Environmental Statement

Dounreay Trì Floating Wind Demonstration Project

Dounreay Trì Limited
16th September 2016

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Checked	RES
Approved	Hexicon
Doc. Ref.	03363-001010
Ver. no.	7

Document history

Version	Date	Person	Comment
1	04/03/2016	Alison Duncan & Carla Houghton	First draft
2	09/03/2016	Jack Farnham	Review
3	10/03/2016	Jack Farnham	Changes to onshore cable route for re-assessment
4	16/03/2016	Jack Farnham	Project description better defined to ensure assessment is remains realistic
5	29/03/2016	Jack Farnham	Checked
6	31/03/2016	Marcus Thor	Approved for Gate Check
7	16/09/2016	Jack Farnham	Final Application

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Acronyms and Abbreviations

AB	Aktiebolag, the Swedish term for a limited company
AC	Alternating Current
ADR	Air Defence Radar
ADTF	Average Daily Traffic Flow
AfL	Agreement for Lease
AHTS	Anchor Handling Tug Supply vessel
AIS	Automatic Identification System
ALARP	As Low as Reasonably Practicable
AOC	Aircraft Operator Certificate
ARC	Amphibian and Reptile Conservation Trust
ASFB	Association of Salmon Fishery Boards
ATBA	Area to be Avoided
ATC	Air Traffic Control
AtoN	Aids to Navigation
BEIS	Department for Business, Energy and Industrial Strategy
BGS	British Geological Survey
BODC	British Oceanographic Data Centre
BOWL	Beatrice Offshore Wind Ltd
BP	Before Present
BSBI	Botanical Society of the British Isles
BTO	British Trust of Ornithology
CAA	Civil Aviation Authority
CBC	Common Bird Census
CCS	Carbon Capture and Storage
CCW	Countryside Council for Wales
CIA	Cumulative Impact Assessment

CJB	Cable Joint Bays
CNS	Communication and Navigation System
COWRIE	Collaborative Offshore Wind Research in the Environment
CP	Count Point
cSAC	Candidate Special Area of Conservation
CSIP	Cetacean Strandings Investigation Programme
DAFOR	Dominant, Abundant, Frequent, Occasional, Rare
DC	Direct Current
DDC	Dounreay Demonstration Centre
DECC	Department of Energy and Climate Change
DEM	Digital Elevation Model
DFOWDC	Dounreay Floating Offshore Wind Development Centre
DGC	Defence Geographic Centre
dSPA	draft Special Protection Area
DSRL	Dounreay Site Restoration Ltd
DTi	Department of Trade and Industry
EC	European Commission
EHWS	Extreme High Water Springs
EIA	Environmental Impact Assessment
ELWS	Extreme Low Water Springs
EMF	Electromagnetic Force
EMF	Electromagnetic Force
EMP	Environmental Management Plan
EPC	Engineering, Procurement and Construction
EPR	Ethylene Propylene Rubber
ES	Environmental Statement
EU	European Union

EUNIS	European Union Nature Information System
FAD	Fish Aggregation Device
FCS	Favourable Conservation Status
FGL	Finished ground level
FL	Fly Level
FLOWW	Fishing Liaison with Offshore Wind and Wet Renewables Group
FSS	Food Standards Scotland
GEN	General Planning Principle
GPS	Global Positioning System
GWDTE	Groundwater Dependant Terrestrial Ecosystems
GWfGS	Greenland White-fronted Goose Study
HBRG	Highland Biological Recording Group
HDD	Horizontal Directional Drilling
HER	Historic Environment Record
HGV	Heavy Goods Vehicles
HIAL	Highlands and islands Airports Limited
HIE	Highlands and Islands Enterprise
HMPA	Historic Marine Protected Area
HRA	Habitats Regulations Assessment
HS	Historic Scotland
HSE	Health, Safety and Environment
IAMMWG	Inter-Agency Marine Mammal Working Group
IAQM	Institute of Air Quality Management
ICNIRP	International Commission on Non-Ionizing Radiation Protection
IEA	Institute of Environmental and Assessment
IEEM	Institute of Ecology and Environmental Management
IEMA	Institute of Environmental Management and Assessment

INSPIRE	Impulse Noise Sound Propagation and Impact Range Estimator
IoA	Institute of Acoustics
ISO	International Standards Organisation
JNAPC	Joint Nautical Archaeology Policy Committee
JNCC	Joint Nature Conservation Committee
JTB	Joint Transmission Bay
km	Kilometre
kV	Kilo Volt
LAT	Lowest Astronomical Tide
LBAP	Local Biodiversity Action Plan
LCA	Landscape Character Areas
LCT	Landscape Characteristic Type
LFA	Low Fly Area
LGV	Light Goods Vehicle
LI	Land Institute
LOS	Loss of Signal
LVIA	Landscape and Visual Impact Assessment
MAIB	Marine Accident Investigation Branch
MBES	Multi-Beam Echo Sound
MCA	Maritime Coastguard Agency
MDA	Managed Danger Area
MESH	Mapping European Seabed Habitat
MGN	Marine Guidance Note
MHR	Main Helicopter Routes
MHWS	Mean High Water Springs
MLWS	Mean Low Water Springs
mm	Millimetre

MMO	Marine Management Organisation
MoD	Ministry of Defence
MOU	Memorandum of Understanding
MPA	Marine Protected Areas
mph	Miles per Hour
MRE	Marine Renewable Energy
MRV	Marine Research Vehicle
MS	Marine Scotland
MSA	Minimum Sector Altitude
MSFD	Marine Strategy Framework Directive
MSI	Marine Scotland Interactive
MS-LOT	Marine Scotland - Licencing and Operations Team
MSS	Marine Scotland - Science
MW	Megawatts
NAS	Nautical Archaeology Society
NATS	National Air Traffic Services
NBN	National Biodiversity Network
NCMPA	Nature Conservation Marine Protected Area
NDA	Nuclear Decommissioning Authority
NFU	National Farmers Union
NHZ	Natural Heritage Zone
NLB	Northern Lighthouse Board
nm	Nautical miles
NMP	National Marine Plan
NNR	National Nature Reserve
NRA	Navigational Risk Assessment
NSAs	National Scenic Areas

NUC	Not Under Command
NVC	National Vegetation Classification
O&M	Operations and Maintenance
OFA	Orkney Fishermans Association
OIC	Orkney Islands Council
OREI	Offshore Renewable Energy Installations
PAN	Planning Advice Note
PAR	Precision Approach Radar
PEXA	Practice and Exercise Area
PFOW	Pentland Firth and Orkney Waters
PHA	Preliminary Hazard Assessment
PMF	Priority Marine Feature
PRAG-D	Particles Retrieval Advisory Group (Dounreay)
pSPA	potential Special Protected Area
PSR	Primary Surveillance Radar
RAF	Royal Air Force
RES	Renewable Energy Systems
RIFE	Radioactivity in Food and the Environment
RLG	Regional Locational Guidance
RNLI	Royal National Lifeboat Institution
ROC	Renewables Obligation Certificate
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
RYA	Royal Yachting Association
SAC	Special Area of Conservation
SAR	Search and Rescue
SB	Scottish Badgers

SCADA	Supervisory Control And Data Acquisition
SCANS	Small Cetacean Abundance in the North Sea and Adjacent waters
SCOS	Special Committee on Seals
SDI	Scottish Development International
SEA	Strategic Environmental Assessment
SEPA	Scottish Environmental Protection Agency
SFF	Scottish Fishermen's Federation
SHEP	Scottish Historic Environment Policy
SHE-T	Scottish Hydro Electric Transmission
SLA	Special Landscape Areas
SLVIA	Seascape, Landscape and Visual Impact Assessment
SMRU	Sea Mammal Research Unit
SNH	Scottish Natural Heritage
SNIFFER	Scotland & Northern Ireland Forum for Environmental Research
SPA	Special Protection Area
SPD	Scottish Planning Policy
SPEAR	Simple Propagation Estimator and Ranking
SPP	Scottish Planning Policy
SPV	Special Purpose Vehicle
SSE	Scottish and Southern Energy
SSEPD	Scottish and Southern Energy Power Distribution
SSR	Secondary Surveillance Radar
SSSI	Special Site of Scientific Interest
THC	The Highland Council
TRA	Temporary Reserve Area
UK	United Kingdom
UKBAP	UK Biodiversity Action Plan

UKCS	UK Continental Shelf
UKHO	United Kingdom Hydrographic Office
UKTAG	United Kingdom Technical Advisory Group
UKTI	United Kingdom Trade & Investment
UNESCO	United Nations Educational, Scientific and Cultural Organization
UXO	Unexploded Ordnance
VMS	Vessel Monitoring System
VP	View Point
VTS	Vessel Traffic Services
WeBS	Wetland Bird Survey
WHO	World Health Organization
WLA	Wild Land Areas
WSI	Written Scheme of Investigation
WTG	Wind Turbine Generator
WWT	Waterfowl and Wetlands Trust
ZTV	Zone of Theoretical Visibility

VOLUME 1: Introduction and Background

1 Introduction

1.1 Hexicon AB is a Swedish design and engineering company that has developed a floating foundation for offshore wind power that hosts two Wind Turbine Generators (WTGs). Hexicon wishes to demonstrate this technology in Scottish waters.

1.2 In order to be eligible for 3.5 Renewable Obligation Certificates (ROCs) the Project must be commissioned and connected to the grid before the 1st of October 2018. Accordingly, Hexicon has created a Special Purpose Vehicle (SPV) called "Dounreay Trì Limited" for the sole purpose of developing, financing, constructing and demonstrating this technology within a site approximately 6km off Dounreay, Caithness ("the Site") (Figure 1-1).

1.3 Dounreay Trì Limited ("the Applicant") is proposing to demonstrate a floating offshore wind farm called Dounreay Trì ("the Project") which shall consist of:

- A two turbine offshore wind farm with an installed capacity of between 8 to 12 megawatts (MW), subject to final approval of The Crown Estate, approximately 6 km off Dounreay, Caithness;
- A single export cable to bring the power to shore immediately to the west of the Dounreay Restoration Site fence line; and
- Subject to a Connection Offer from Scottish and Southern Energy Power Distribution (SSEPD), the associated onshore electrical infrastructure to connect the Project at, or near, the existing Dounreay 132/33/11kV substation.

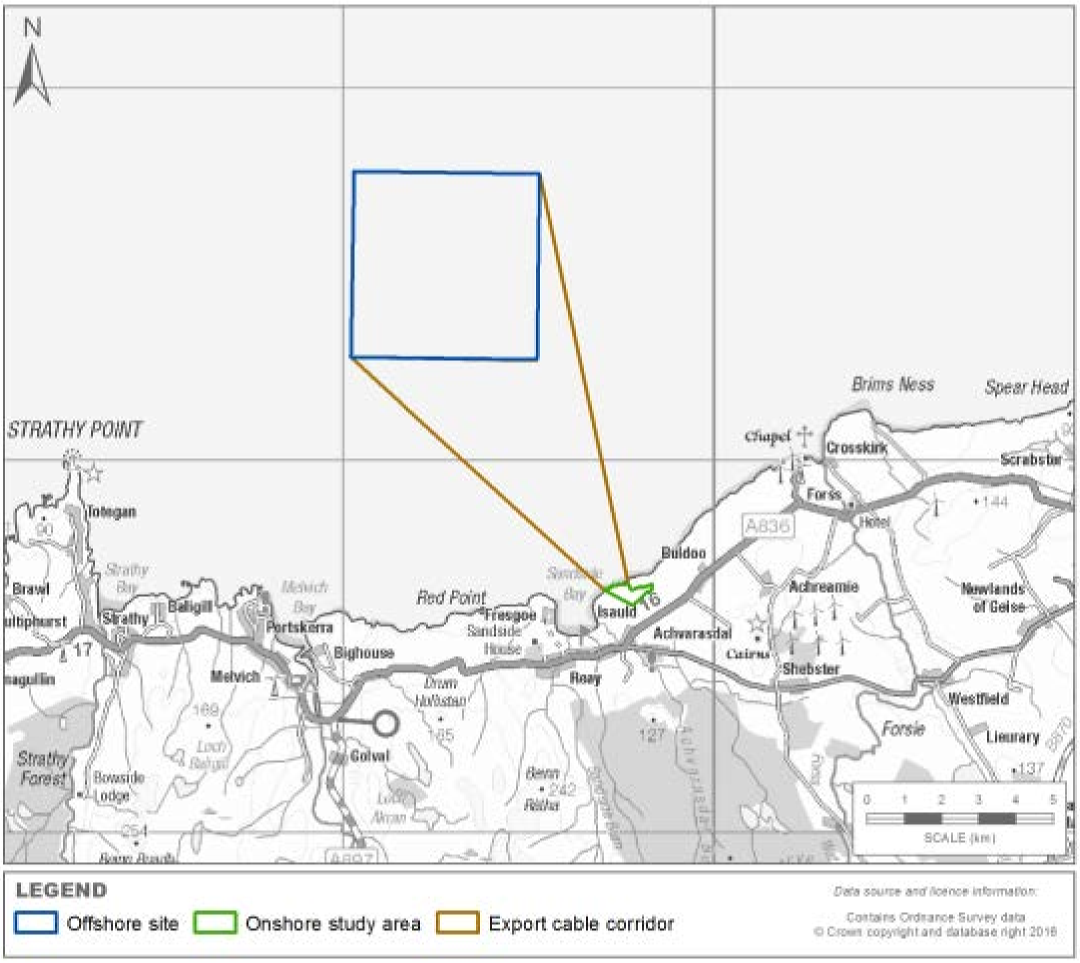

Figure 1-1 Offshore site, export cable corridor and onshore study area

1.4 Figure 1-1 depicts the offshore Site, the export cable corridor and the onshore study area. Coordinates for the four corners of the Offshore Site are provided in Table 1-1.

Table 1-1 Offshore Site Coordinates

Corner	Latitude	Longitude
NW	58°40’25.6”	3°53’36.0”
NE	58°40’27.7”	3°48’25.7”
SE	58°37’46.0”	3°48’22.0”
SW	58°37’44.0”	3°53’31.9”

1.5 Figure 1-2 depicts the onshore study area which includes two cable landfall options, two potential locations for the onshore substation and indicative onshore cable corridors to connect the landfall and substation options. The exact location of the onshore infrastructure will be agreed with Scottish Ministers, in consultation with The Highland Council, once an onshore construction contractor is appointed. The onshore construction contractor would not be appointed until, and unless, deemed planning is grated by Scottish Minsters. Nevertheless is it possible to identify suitable cable landfall options and substation options for the purpose of this Environmental Impact Assessment.

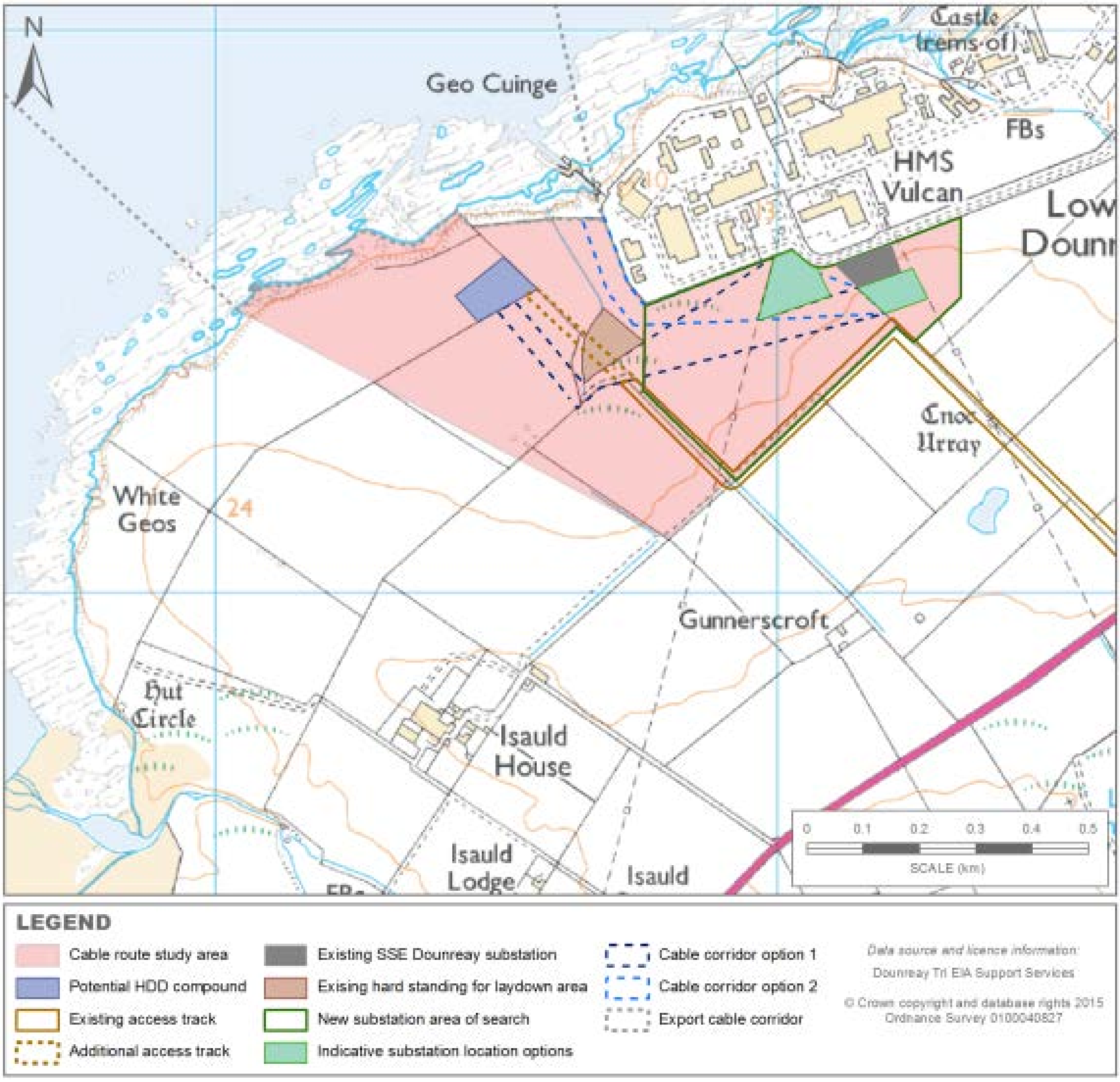

Figure 1-2 Onshore study area - including indicative landfall options, substation options and cable corridors

1.1 Structure of this document

1.6 This Environmental Statement (ES) has been carefully structured.

1.7 This ES is one document made up of three volumes so readers can navigate to the information and issues which are relevant to them:

- Volume 1 sets out the introduction and background for the entire Project and this ES;
- Volume 2 addresses the offshore environment; and
- Volume 3 addresses the onshore environment.

1.8 There are a total of 29 Chapters spanning all three volumes. Chapters are numbered sequentially from 1 to 29.

1.9 Each chapter contains sub-sections which correspond to the Chapter number, for example this sub-section, 1.1, lies within Chapter 1.

1.10 Paragraphs, tables and figures correspond only to the chapter number e.g. this paragraph, 1.10, lies within Chapter 1.

1.2 Translation

1.11 The Applicant is prepared to offer full or partial (i.e. Non-Technical Summary only) translation in Gaelic to meet a specific request. Please email: Dounreay@hexicon.eu

2 Legislative Context and Regulatory Requirements

2.1 Introduction

2.1 This section provides a summary and overview of the international, UK, Scottish, regional and local planning policies and guidance (and associated legislation) which are directly relevant to the Project and this Environmental Impact Assessment.

2.2 Summary of consents applied for

2.2 Dounreay Trì Limited (the Applicant) requests:

- Two Marine Licences pursuant to Section 20 of the Marine (Scotland) Act (the "2010 Act") for the deposit of substances and objects and the construction, alteration or improvements of works within the Scottish Marine Area in relation to the Windfarm; and
- Consent under Section 36 of the Electricity Act 1989 (the "1989 Act") for the construction and operation of a Generating Station ("Section 36 Consent"); and
- A Direction Under Section 57 Of The Town And Country Planning (Scotland) Act 1997 (As Amended) That Planning Permission For The Ancillary Onshore Development Be Deemed To Be Granted; and
- A declaration, pursuant to Section 36A of the Electricity Act to extinguish public rights of navigation so far as they pass through those places within the Scottish Marine Area where the single structure forming part of the offshore Windfarm is to be.

2.3 International policy context

2.3 At the Paris climate conference (COP21) in December 2015, 195 countries adopted the first-ever universal, legally binding global climate deal. The Paris Agreement sets out a global action plan to put the world on track to avoid dangerous climate change by limiting global warming to well below 2°C. The Paris Agreement is due to enter into force in 2020. The EU and its Member States are committed to a binding target of an at least 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. Article 10 of the Paris Agreement specifically states:

> "*Accelerating, encouraging and enabling innovation is critical for an effective, long-term global response to climate change and promoting economic growth and sustainable development*." (UNFCCC, 2015)

2.4 Domestic energy policy and the need for renewable energy

2.4 The UK has committed to sourcing 15% of its total energy needs from renewable sources by 2020 under the 2009 Directive on Renewable Energy (2009/28/EC) including electricity, heat and transport. The UK and Scottish Governments have also made legally binding commitments through the Climate Change Act 2008 and the Climate Change (Scotland) Act 2009.

2.5 There are four key drivers for the shift in energy production to low carbon sources, including renewable energy, in the UK and Scotland which are:

- The need to tackle climate change;
- The need to secure energy supply;

- The need for new energy infrastructure; and
- The need to maximise economic opportunities.

2.6 The challenges of climate change, energy security and affordability are driving renewable energy policy. There are now a significant number of national and international policies, strategies, action plans and regulations relating to climate change and the development of renewable energy in Europe, the UK and Scotland.

2.7 The Dounreay Trì Project intends to demonstrate an innovative multi-turbine floating wind demonstration project. Accelerating, encouraging and demonstrating innovative technology is relevant to curbing global emissions. This demonstration project shall allow Hexicon to test and refine their technology, including fabrication methods and design of the moorings and anchors. The Project will contribute up to 12MW installed capacity from wind energy and will make a contribution to achieving Scotland's policy aims and aligns with the Paris Agreement. The lessons learned in developing this demonstration project can then be applied to developing the technology further to contribute to achieving relevant International, European, UK and Scottish policy aims including for example:

- Kyoto protocol;
- EU Renewable Energy Directive (2009/28/EC);
- UK Climate Change Act 2008;
- The Climate Change (Scotland) Act 2009;
- The Scottish Government's 2020 Routemap for Renewable Energy in Scotland; and
- Scotland's Offshore Wind Route Map 2013.

2.5 Scottish Planning Policy

2.8 On 23rd June 2014, the Scottish Government published the new Scottish Planning Policy (SPP). SPP sets out Scottish Government policy on how nationally important land use matters should be addressed and outlines Governmental priorities for land use planning. SPP should therefore be afforded significant weight in the determination process for planning applications, however SPP acknowledges that "it is for the decision-maker to determine the appropriate weight in each case".

2.9 SPP 2014 sits alongside other key Scottish Government documents including the National Planning Framework 3 and Circulars. The following sections summarise the key principles and recommendations contained within SPP 2014 with regards to sustainable development and development management, in particular to renewable energy development.

2.10 The SPP (paragraphs 152 to 192) details how the Scottish Government expects the planning system to facilitate the delivery of a low carbon economy, specifically through the development of electricity generation technologies which will help contribute to reducing greenhouse gas emissions. It is clear from SPP that the Scottish Government is committed to developing further renewable energy projects, SPP paragraph 153 advises:

> "Efficient supply of low carbon and low cost heat and generation of heat and electricity from renewable energy sources are vital to reducing greenhouse gas emissions and can create significant opportunities for communities. Renewable energy also presents a significant opportunity for associated development, investment and growth of the supply chain".

2.11 Paragraph 154 of SPP 2014 details the policy principles that the planning system is expected to adhere to in order to contribute towards achieving a low carbon economy.

2.12 In relation to energy infrastructure development, SPP paragraph 169 lists potentially important considerations for both developers and local planning authorities in the context of development management decisions. It is acknowledged that these will vary depending on the scale of development and its surrounding environment. SPP highlights that considerations include:

- "net economic impact, including local and community socio-economic benefits such as employment, associated business and supply chain opportunities;
- the scale of contribution to renewable energy generation targets;
- effect on greenhouse gas emissions;
- cumulative impacts – planning authorities should be clear about likely cumulative impacts arising from all of the considerations below, recognising that in some areas the cumulative impact of existing and consented energy development may limit the capacity for further development;
- impacts on communities and individual dwellings, including visual impact, residential amenity, noise and shadow flicker;
- landscape and visual impacts, including effects on wild land;
- effects on the natural heritage, including birds;
- impacts on carbon rich soils, using the carbon calculator;
- public access, including impact on long distance walking and cycling routes and scenic routes identified in the NPF;
- impacts on the historic environment, including scheduled monuments, listed buildings and their settings;
- impacts on tourism and recreation;
- impacts on aviation and defence interests and seismological recording;
- impacts on telecommunications and broadcasting installations, particularly ensuring that transmission links are not compromised;
- impacts on road traffic;
- impacts on adjacent trunk roads;
- effects on hydrology, the water environment and flood risk;
- the need for conditions relating to the decommissioning of developments, including ancillary infrastructure, and site restoration;
- opportunities for energy storage; and
- The need for a robust planning obligation to ensure that operators achieve site restoration." (Pages 40-41).

2.13 This section of the SPP (paragraphs 24-35) identifies the Scottish Government's commitment to the concept of sustainable development which should be a key principle when considering future development proposals. Paragraph 25 of the SPP outlines that the Scottish Government, and the UK as a whole, continues to support the five guiding principles considered necessary to encourage sustainable development.

2.14 Paragraph 27 states the following with regards to achieving sustainable development:

> "The Government Economic Strategy indicates that sustainable economic growth is the key to unlocking Scotland's potential and outlines the multiple benefits of delivering the Government's purpose, including creating a supportive business environment, achieving a low carbon economy, tackling health and social problems, maintaining a high-quality environment and passing on a sustainable legacy for future generations".

2.15 SPP sets out the key policy principle for sustainable development, specifically:

> "This SPP introduces a presumption in favour of development which contributes to sustainable development." (Paragraph 27).

2.6 National Planning Framework 3

2.16 Published in June 2014, National Planning Framework 3 (NPF3) provides a statutory framework for Scotland's long-term spatial development priorities for the next 20 to 30 years. Statutory development plans must have regard to the NPF, and Scottish Ministers expect planning decisions to support its delivery.

2.17 Orkney, Pentland Firth and North Caithness is identified as an area of coordinated action in NPF3; a location of particular significance to the delivery of the Scottish Government's low carbon strategy. NPF3 states that the area is an internationally renowned historic and natural environment, with significant future prospects for growth and innovation. There are unparalleled opportunities for marine renewable energy development, generating significant new business and employment opportunities for the surrounding coastal and island communities.

2.7 Scotland's National Marine Plan

2.18 Scotland's National Marine Plan was published on 25th March 2015. The Plan sets out a single statutory planning framework for all marine activity in Scottish inshore and offshore waters, including sectoral plans for offshore wind energy. The framework covers all of Scotland's seas out to 200 nautical miles and applies to existing and emerging activities as well as devolved and reserved functions.

2.19 A key objective of the Marine Plan is the "Sustainable development and expansion of test and demonstration facilities for offshore wind and marine renewable energy devices" and there is a clear support for maximising the economic benefits of offshore wind and other renewable energy development (Page 78).

2.20 The Marine Plan notes that as the global wind industry expands further offshore, Scotland is well placed to become a key hub for the design, development and deployment of the next generation of offshore wind technologies. In addition to planned development sites, it is noted that Scotland is becoming a key location for demonstration and test sites. In relation to these, Marine Plan policy "RENEWABLES 3" states:

> "Marine planners and decision makers should consider proposals for sustainable development of test and demonstration for offshore wind and marine renewable energy development on a case-by-case basis where sites are identified. This preference should be taken into account by marine planners and decision makers if alternative development or use of these areas is being considered. Regional Locational Guidance should be taken into account and proposals are subject to licensing and consenting processes." (Page 79)

2.21 The Marine Plan identifies the Development as being within an area designated under the National Marine Plan for Wave Energy. After consideration of the number of wave sites and the slow progress of the wave industry, MS-LOT was willing for the current application to proceed (MS-LOT, 2016).

2.22 Further Marine Plan polices of relevance include "RENEWABLES 5" which states that proposals must demonstrate compliance with EIA and HRA legislative requirements. Policies "RENEWABLES 6" and "RENEWABLES 7" relate to provision of grid connections and infrastructure stating the need to ensure the installation of these elements aligns with relevant sectoral and marine spatial planning processes to ensure minimised impacts, as well as securing fit for purpose design.

2.23 Policies "RENEWABLES 8", "RENEWABLES 9" and "RENEWABLES 10" require active early engagement by developers with the general public and interested stakeholders, support joint research and monitoring programme, as well as adherence to good practice guidance for community benefit from offshore wind renewable energy development, where appropriate.

2.8 The Highland-wide Local Development Plan

2.24 The Highland-wide Local Development Plan (HwLDP) (2012) sets out the general policies for the Highland Council area. The key policies relating to this proposal include:

Policy 67 Renewable Energy Developments: This policy notes the Council's support in principle for renewable energy development. This support, however, is subject to clearly addressing important issues and criteria.

Policy 49 – Coastal Development: This policy sets a framework for ensuring the sustainable use and development of the coastal areas. The siting and design of development proposals for the coast or nearshore waters should consider existing interests and ensure best use of resources. It should also take into account existing and planned marine activities in the area. Proposals will be assessed against the requirements of the Highland Coastal Development Strategy which at present is non-statutory advice but may be adopted as Supplementary Guidance to the HwLDP.

The Highland Coastal Development Strategy: identifies the development of the marine renewables industry as a key opportunity for the North Coast due to the potential energy generation. The vision identified in the Strategy includes a diverse range of renewable energy developments and businesses to 'develop a truly mixed renewable energy economy' including offshore windfarms. This is also considered important for retaining a coastal population.

Policy 57 Natural, Built and Cultural Heritage: This policy considers impacts on natural, built and cultural heritage designations and features. These are split into three categories including local/regional importance (e.g. North Cliffs Special Protection Area (SPA) and Sites of Special Scientific Interest (SSSI) at Red Point Coast, Sandside Bay, and Strathy Coast).

Policy 61 Landscape: The policy sets out specific requirements for new developments to reflect the landscape characteristics and the special qualities identified by SNH in the Landscape Character Assessments which are relevant to this Project.

2.25 Other key HwLDP policies include:

- Policy 28 – Sustainable Design;
- Policy 30 – Physical Constraints;
- Policy 31 – Developer Contributions;
- Policy 36 – Development in the Wider Countryside;
- Policy 56 – Travel;
- Policy 58 – Protected Species;
- Policy 59 – Other Important Species;
- Policy 60 – Other Important Habitats;
- Policy 63 – Water Environment;
- Policy 69 – Electricity Transmission Infrastructure; and
- Policy 72 – Pollution.

2.9 Pilot Pentland Firth and Orkney Waters Marine Spatial Plan

2.26 The Pilot Pentland Firth and Orkney Waters Marine Spatial Plan (PPFOW) identifies much of the north coast, including the Project location, as being a potential offshore renewable energy generation activity area.

2.10 Local planning policies

2.27 The site lies close to both the boundaries of the Sutherland Local Plan (2010) and the Caithness Local Plan (2002). Following adoption of the HwLDP, only certain parts of these local plans continue in force as part of the HwLDP.

2.28 Consultation regarding the proposed Caithness and Sutherland Local Development Plan (CaSPlan) closed in March 2016. The proposed CaSPlan shall now be revised, in light of the consultation responses received, before the proposed CaSPlan is submitted to Scottish Minsters in 2016 and adopted in the summer of 2017. The proposed CaSPlan recognises the potential for marine renewable energy generation, particularly in the north-east of the Plan area which is identified in the Spatial Strategy for energy business expansion. This reflects the National Planning Framework 3 (NPF3) which designates the Orkney, Pentland Firth and North Caithness as an Area of Coordinated Action of marine renewables. The proposed CaSPlan aims to maximise the benefits to the local economy by adopting a more targeted, but still flexible, approach to identifying business and industrial land. It builds on the work carried out as part of the North Highland Onshore Vision (NHOV) which identified land use planning actions to support the growth of marine renewables.

2.29 The extent and options for the onshore works have been amended, since the finalisation of the Scoping Report (December, 2015), consequently the onshore works are now sited immediately to the west of the Dounreay restoration site. This change places the onshore works approximately 1km away from the settlement of Reay which is identified as a Growing Settlement in the proposed CaSPlan whereby guiding principles will be used to manage development in and around Reay The proposed CaSPlan has identified marine renewables as a key growth sector and supports such developments, in principle.

2.11 Environmental Impact Assessment

2.30 The EIA Directive (85/337/EEC) as amended by Directives 97/11/EC, 2003/35/EC, 2009/31/EC and 2014/52/EU, introduced a procedure across Europe in order to ensure that the environmental consequences of projects are identified and assessed before consent for the project is given. It ensures that the consenting authorities have all the necessary environmental information on which they can base their decision. The requirements of the EIA Directive are transposed into law in Scotland through the Regulations applied under specific consenting frameworks, as set out below.

2.12 Section 36 of the Electricity Act 1989

2.31 To construct and operate an electricity generating station, such as a wind farm, with a capacity greater than 1MW in Scottish waters, consent is required under Section 36 of the Electricity Act 1989 (as amended). An application for consent under Section 36 in Scottish waters is made to the Marine Scotland - Licensing Operations Team (MS-LOT) on behalf of the Scottish Ministers. Under the Electricity Act, you can also apply to remove the public rights of navigation that pass through the generating station, a Section 36A declaration. Dounreay Trì Limited intend to apply to Scottish Ministers for this declaration at the same time as an application for Section 36 consent.

2.32 The Application is for the construction and operation of two offshore demonstration turbines on a single floating platform, within Scottish waters, with the capacity to generate up to 12MW of electricity. The consent is required for 25 years. The application is supported by a single Environmental Statement (ES) which has been prepared in accordance with the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended.

2.13 Marine Licences

2.33 The Marine (Scotland) Act 2010 states that a Marine Licence is required to construct, alter or improve any works, or deposit any object in or over the sea, or on or under the seabed. A Marine Licence is required where the works are seaward of the mean high water springs (MHWS). As the Development is seaward of the MHWS a Marine Licence is required to construct (install) the two turbines, the platforms, deposit the anchors, mooring system and install the export cable.

2.34 As with the Section 36 application above, two Marine Licence applications have been made to MS-LOT. One Marine Licence for the construction (installation) of the two turbines, platform, anchors and mooring system and One Marine Licence for the construction (installation) of export cable. This ES covers all aspects of the project and been prepared in accordance with the Marine Works (Environmental Impact Assessment) Regulations 2007, as amended.

2.35 The design life of the turbines and other major components of the Project shall be 25 years so the duration of each Marine Licence is 25 years.

2.36 Dredging may be required beneath the platform to rest the clump weight on a level surface prior to suspending the weight beneath the platform. Dounreay Trì Limited may require a separate Marine Licence to dredge an area beneath the platform, in order to level it. The need for dredging shall not be confirmed until the detailed design of the platform is complete. If dredging is required then Dounreay Trì Limited understands that sediment samples must be collected, analysed and provided to MS-LOT prior to support another

Marine Licence application for dredging. Any dredging licence application would be made separately to this application and subject to additional consultation. Dounreay Trì Limited has considered the environmental effects associated with dredging in this Environmental Statement to the extent that is possible but Dounreay Trì Limited accepts that further environmental assessment would be necessary to support and further Marine Licence for Dredging.

2.14 Town and Country Planning

2.37 The Growth and Infrastructure Act (2013) allows for the Scottish Ministers to 'deem' planning permission for onshore elements of offshore electricity generation schemes granted consent under Section 36 of the Electricity Act, which is the intention for this Project. As such, a separate planning application shall not be submitted to the Highland Council, rather deemed consent for the associated onshore infrastructure shall be sought from the Scottish Ministers as part of the Section 36 application. The Highland Council will remain a statutory consultee to MS-LOT.

2.15 Habitats Regulations

2.38 There is a network of protected sites that aim to conserve natural habitats and species that are rare, endangered, vulnerable or endemic within the EU. This network, known as 'Natura 2000', includes Special Areas of Conservation (SAC) designated under the Habitats Directive for their habitats and/or species of European importance and Special Protection Areas (SPA) classified under the Birds Directive for rare, vulnerable and regularly occurring migratory bird species and internationally important wetlands.

2.39 The requirements of the Habitats Directive are transposed in Scotland and its territorial seas, by means of the (Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). These regulations apply in the terrestrial environment and the territorial waters out to 12 nm. The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) transpose the Habitats Directive beyond 12 nm. These are collectively referred to as the "Habitats Regulations" hereafter.

2.40 Candidate SACs (cSACs), potential SPAs (pSPAs) and Sites of Community Importance (SCIs) should be subject to the same considerations as SACs and SPAs. In addition, sites designated under the 1971 Ramsar Convention for their internationally important wetlands shall also be addressed. While Ramsar sites are not European sites for the purposes of the Habitats Directive, they have been considered as such in any material produced by or on behalf of Dounreay Trì Limited.

2.41 Under the Habitats Regulations, development that is considered by the Competent Authority to have the potential to have a likely significant effect on a European site cannot be consented until an Appropriate Assessment, undertaken by the Competent Authority, has ascertained that the Project will have no adverse effect on the integrity of those European sites.

2.42 In accordance with Regulation 48 of the Habitats Regulations, anyone applying for development consent should provide the Competent Authority with such information as may reasonably be required to enable it to determine whether an Appropriate Assessment is required. For the purposes of this application there is one competent authority, MS-LOT. This ES is to inform the HRA and is accompanied by a shadow HRA Report (Appendix 2.1).

2.43

3 Site selection, consideration of alternatives and stakeholder engagement

3.1 Consideration of alternatives

Site selection – consideration of alternatives

3.1 In August 2014, Hexicon sought a site in Scottish waters to demonstrate their multi-turbine platform. Marine Scotland (2014) had published the Potential Scottish Test Sites for Deep Water Floating Wind Technologies - Regional Locational Guidance (RLG). This RLG identified eleven sites which were considered suitable for floating wind. Accordingly, each site was reviewed according to Hexicon's criteria. Only three sites identified in the RLG met Hexicon's criteria:

- Southern Moray Firth;
- North East Aberdeen; and
- North Coast (Dounreay).

3.2 These three sites were examined in greater detail using publically available information and the results presented at a Site Selection Workshop, hosted by Marine Scotland and attended by Scottish marine stakeholders, in Edinburgh on the 10th of October 2014.

3.3 On the basis of the information available and feedback from the workshop, the Southern Moray Firth Site appeared to be unsuitable for development. A deep trench lay landward of this site so it would be difficult to install the marine cable successfully. The Southern Moray Firth Site is also intensively fished and is within an area which is designated for the protection of marine mammals.

3.4 The North East Aberdeen Site lay approximately 23km from shore, significantly increasing the length and cost of the export cable. Furthermore, the site and export cable corridor lay within ground that is fished by a range of gear types, including scallop dredgers. Scallop dredging could damage subsea cables, so presented a significant risk for a project which is reliant on only one export cable.

3.5 Hexicon chose the Dounreay site which lies south of the shipping traffic. The Dounreay site was selected for the following reasons:

- The Dounreay site has suitable water depths, close to shore thus reducing the export cable length and costs compared with other sites;
- The substrate is gravelly sand and thus better suited to drag embedment anchors;
- The average wind speed is good and has been calibrated with data from the Forss Wind Farm, thus negating the need for an offshore anemometer mast;
- On the basis of discussions with Scottish Fishermen's Federation (2014), the Dounreay site appeared to lie out-with intensively fished areas; and
- Marine Scotland completed a detailed geophysical survey, including drop down video and grab samples, during the summer of 2014, which provided a clear, up-to-date understanding of the water depths and seabed conditions. This information is publically available.

Landfall – consideration of alternatives

3.6 The Scoping Report (2015) identified a potential landfall option which would have involved trenching across the east of Sandside Bay. This alternative has since been excluded because:

- A cable landfall at on the eastern flank of Sandside Bay would be complicated by the orientation of the proposed landfall site (facing across as opposed to straight out the bay) and presence of exposed rock in the foreshore area;
- Storm events are known to periodically expose the bedrock at Sandside Bay and could therefor expose/damage the export cable (*pers comm.* 2016);
- Access to beach is limited (narrow access track at far western end of the bay) and thus it is likely that a temporary access track would need to be established to allow vehicle access;
- There appear to be features of archaeological interest immediately to the east of Sandside Bay;
- Sandside Bay and the land to the east above MHWS is a Site of Special Scientific Interest (SSSI). Part of the SSSI includes the foreshore and the banks of the Burn of Isauld – i.e. the land immediately to the east of Sandside Bay. Consequently, SNH (2016) stated a preference for either the HDD or pinning options rather than trenching; and
- Historic radioactive particles have been found on the beach at Sandside Bay. Works within this area could unearth additional particles. Whilst the probability of coming into contact with a relevant particle at Sandside Bay is one in 80 million (DSRL, 2016). It seemed unnecessary to continue with an option which was already technically and environmentally unfavourable (see points above).

3.2 Stakeholder engagement

3.7 Table 3-1 sets out the key meetings and dialogue the Applicant has had to date.

Table 3-1 Meetings and engagement to date

Meeting	Date	Purpose
2014		
Marine Scotland (Policy)	22nd September	To discuss the selection of a demonstration site for a multi-turbine, floating wind project, in Scottish Waters. A key attraction is remaining eligible for 3.5 ROCs.
The Crown Estate	22nd September	
Site Selection Workshop (a number of key stakeholders representing the human, physical and biological environment)	10th October	To discuss: The selection of a demonstration site for a multi-turbine, floating wind project, in Scottish Waters. The data available/survey requirements for each site. Potential environmental impacts.
Marine Scotland (Science)	23rd October	To discuss the survey data available and future survey plans for the NE Aberdeen

Meeting	Date	Purpose
		site and the North Coast.
Scottish Fishermen's Federation	23rd October	To discuss the fishing activity at both the NE Aberdeen site and the North Coast site, with a view to avoiding high value fisheries, where possible.
The Crown Estate	27th November	To confirm Hexicon had selected the Dounreay site and to enquire about the leasing process and likely timescales.
SSEPD	19th December	To discuss connecting at, or near, Dounreay substation.
2015		
HIE	14th January	To confirm that Hexicon had selected the Dounreay site and to discuss HIEs ambition for a floating wind demonstration centre.
The Crown Estate	20th January	To discuss the technology plan.
The Crown Estate	2nd April	To discuss the development, technology and financing plans. To discuss leasing timescales and content.
SSEPD	7th April	Call to discuss connection options and voltages at, or near, Dounreay Substation.
Landowners	16th April	To introduce the Project and discuss access for onshore surveys.
NDA	16th April	To confirm that Hexicon had selected the Dounreay site and to enquire about radiological contamination, existing offshore data sets and the NDA's work with local stakeholder groups.
The Highland Council	17th April	To introduce the Project and discuss the development programme.
SSEPD	6th May	To discuss grid connection application routes and timescales for Dounreay.
HIE	6th May	To discuss an MOU, grid capacity and sharing survey data.
Marine Scotland (MS-LOT) and SNH	12th May	To introduce the Project and discuss the development programme. To set out the aerial and onshore ecological survey methods.
The Highland Council, SNH, SEPA, MS-LOT	10th June	Highland Council Pre-Application Committee which discussed the proposal, consenting strategy and key

Meeting	Date	Purpose
		environmental sensitivities.
Scottish Development International (SDI)	24th June	Call with SDI to discuss the Scottish supply chain.
Landowners	14th July	Meeting to discuss construction access.
HIE	15th July	Meeting to discuss grid, MOU contents and highland ports.
Marine Scotland (MS-LOT)	17th July	Review of complete development programme, consent determination period and consenting strategy.
SDI	4th August	Call to arrange meetings with both Global Energy Group (Nigg) and the Port of Ardersier.
Harland & Wolff	17th August	Call to discuss availability and potential constraints both with the dry dock and Belfast Harbour.
Port of Ardersier	21st August	Call with SDI, HIE and others to discuss potentially fabricating the platform at the Port of Ardersier, Nairn.
Global Energy Group	24th August	Call with SDI, HIE and Global Energy Group to discuss potentially fabricating the platform at Nigg Energy Park.
UK Trade & Investment (UKTI)	10th September	Call to discuss supply chain contacts.
UKTI	11th September	Call to discuss project financing.
HIE	15th September	Meeting to discuss progress with MOU.
The Crown Estate	13th November	To discuss a new leasing route.
2016		
Marine Scotland (MS-LOT)	29th January	To discuss the aerial survey results and outline the approach to Habitats Regulations Assessment.
Stakeholder drop-in session	2nd February	Key stakeholders were invited to a drop-in session at Thurso to ensure that the proposals took account of the importance of the area for tourism and recreation, commercial fisheries and local industry and community interests.
Global Energy Group	12th February	Tour of Nigg Energy Park.
NDA	2nd March	Call to discuss land ownership and access at Dounreay.
The Highland Council	3rd March	To discuss programme and potential

Meeting	Date	Purpose
		planning conditions.
RSPB	9th March	To discuss the aerial survey results and outline the approach to Habitats Regulations Assessment.
The Highland Council	8th March	To introduce the Project to local councillors.
HIE	24th March	Call to discuss decision to not take forward the Dounreay Demonstration Centre
The Highland Council	6th April	Onshore site walkover with THC case officer
Pre-Application Event	9th April	Public consultation event in Thurso.

3.3 Scoping

3.8 Dounreay Trì Ltd requested a Scoping Opinion from Marine Scotland on the 3rd of December 2015. On receipt of the Scoping Opinion request, the Scottish Ministers initiated a consultation on the contents of the Scoping Report. This commenced on 18th January 2016 and requests for consultations were sent to Scottish Natural Heritage ("SNH"), Scottish Environment Protection Agency ("SEPA"), the Northern Lighthouse Board ("NLB"), the Maritime and Coastguard Agency ("MCA"), The Highland Council ("THC"), the Orkney Islands Council ("OIC") and various other bodies whom the Scottish Ministers considered likely to have an interest in the proposed application. Not including individual departments within bodies whom were consulted, 57 consultees were contacted and total of 26 responses were received. The scoping responses are outlined and addressed at the start of each chapter within this Environmental Statement.

3.4 Stakeholder drop-in session

3.9 A stakeholder drop-in session was held on the 2nd of February 2016 between 10am and 8pm at Caithness Horizons, Thurso (Figure 3-1).

3.10 57 stakeholders representing tourism and recreation, commercial fisheries, local industry and community interests were invited to the drop-in session. Seven stakeholders attended the event and one responded afterwards, via email.

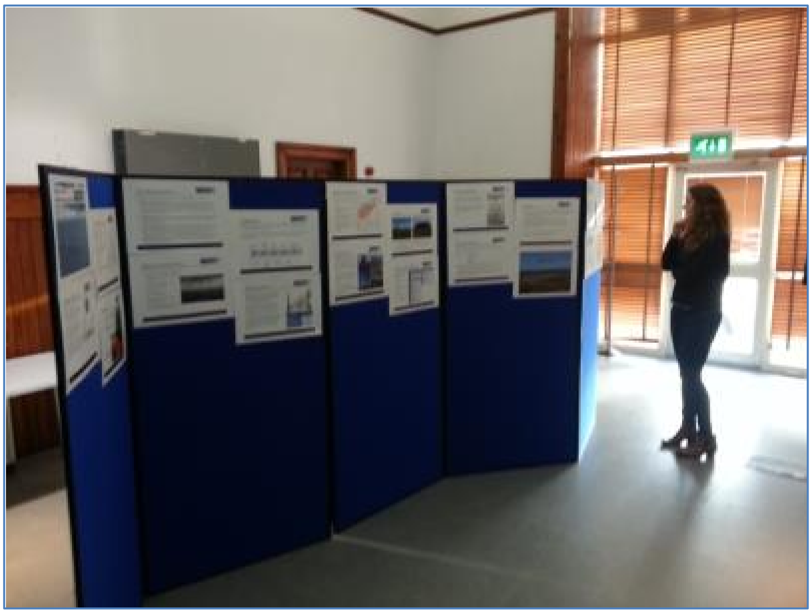

Figure 3-1 Stakeholder drop-in session, Thurso. February 2016

(RES, 2016)

3.11 Those whom attended or responded noted:

- The monitoring and clean-up of particles at Sandside Bay and offshore;
- The “no take” fishing zone around the Dounreay cooling water outfall;
- Project timescales, including the selection of any operations and maintenance facilities;
- Possible sites of archaeological interest on the eastern flank of Sandside Bay;
- Sea kayaking routes, which tend to hug the coast, start at Sandside Bay and head west; and
- Yachting routes, which presented no concern but cautioned that vessels used during construction might want to avoid the waters just off Dounreay during large swell and at low tide as the seabed is saw toothed and larger vessels could become trapped.

3.5 Pre-Application Consultation

3.12 A pre-application, public consultation event was held on the 9th April 2016 between 10am and 5pm at Caithness Horizons, Thurso. The event was advertised in both the John O’Groats Journal and the Caithness Courier.

3.13 The public event displayed details of the proposed development through a series of display boards throughout the room, including projections of the visual aspects of the offshore and onshore infrastructure from key vantage points (Figure 3-2).

Figure 3-2 Pre-Application Consultation Event, Thurso. April 2016

(RES, 2016)

3.14 Three representatives from Dounreay Trì Limited were present to answer specific questions about the development.

3.15 There were only two attendees and there have been no subsequent emails to the Dounreay Trì inbox (as of 31st August 2016).The first attendee was a student from Toronto who asked how the platform is tethered and how it operates. The second attendee was from Caithness and noted that another demonstration project would fit in with the local heritage given the first fast breeder reactor was demonstrated at Dounreay in the 1950s. Locating the onshore electrical infrastructure adjacent to the existing industrial landscape at the Dounreay Restoration Site, as opposed to a “green field” site was considered positive.

4 Project Description

4.1 Dounreay Trì Limited is proposing to demonstrate a floating offshore wind farm called Dounreay Trì which shall consist of:

- A two turbine offshore wind farm with an installed capacity of between 8 to 12 megawatts (MW), subject to final approval of The Crown Estate, at least 6km off Dounreay, Caithness;
- A single, 33kV, export cable to bring the power to shore immediately to the west of the Dounreay Restoration Site fence line; and
- Subject to a Connection Offer from Scottish and Southern Energy Power Distribution (SSEPD), the associated onshore electrical infrastructure to connect the Project at, or near, the existing 132/33/11kV substation at Dounreay.

4.1 Project Objectives

4.2 The Dounreay Trì Floating Wind Demonstration Project has two key objectives:

- **Technical:** To test the performance of a multi-turbine floating wind platform in a real offshore environment; e.g. fatigue loading, power output, controls etc. and use these results to refine the platform for larger scale projects overseas; and
- **Economic:** Verification of the economic return through this demonstration project shall provide a base for more reliable estimations for utility scale projects overseas. This full scale demonstration project is an important step towards developing a commercially competitive product.

4.2 Design Envelope

4.3 As set out further in Chapter 5, the ES will include a clearly defined "Design Envelope". The Design Envelope is also known in UK legal nomenclature as the Rochdale Envelope[1].

4.4 Key components of the Design Envelope are outlined below and will be refined following detailed design and in consultation with contractors, The Highland Council and other stakeholders.

4.3 Construction and operation programme

4.5 Figure 4-1 provides the indicative timeframe over which the Project will be constructed and operated.

[1] Case law (for example Rochdale MBC Ex. Parte C Tew 1999) has affirmed the legal principle that the content of any consent for development requiring EIA cannot exceed the scope of EIA. However, an enduring difficulty for the promoters of complex infrastructure projects such as offshore wind farms is that it is not possible to be precise about each element of a development at the time of the submission of a consent application. A valid approach to this issue is to define a design envelope (known as a Rochdale envelope) comprising a series of realistic worst-case scenarios for individual environmental or technical disciplines, which will define the scope of the EIA and in turn the scope of any consent or licence.

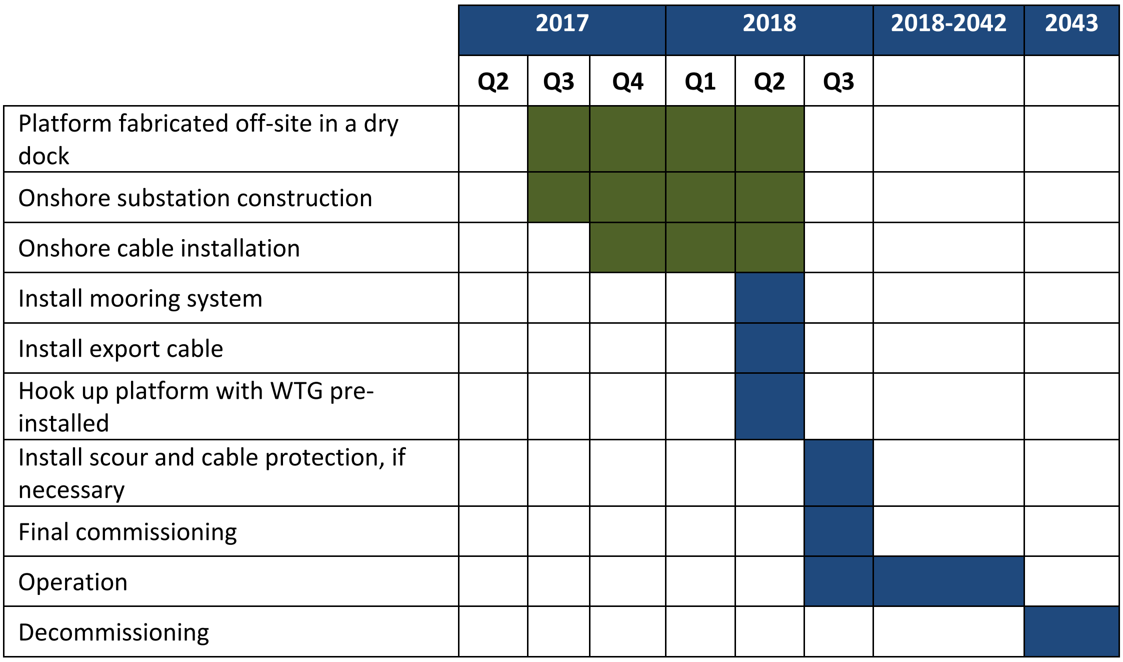

Figure 4-1 Indicative construction and operation programme

4.4 Offshore Infrastructure

4.6 The main offshore components will include:

- Two offshore wind turbines;
- A floating foundation;
- Mooring clump weight;
- Mooring chain and/or steel lines
- Drag embedment anchors;
- One cable to bring the renewable electricity ashore; and
- Scour protection for the anchors and the export cable, where necessary.

Turbine Envelope

4.7 The turbine envelope sets maximum and minimum turbine dimensions against which the environmental impacts of this Project have been assessed (Table 4-1). These minimum and maximum dimensions used to define the turbine envelope are based on current offshore wind turbine technology.

Table 4-1 Turbine Envelope

Nominal rating	Maximum rotor tip height (above LAT)	Maximum number of turbines	Maximum rotor diameter	Maximum hub height (above LAT)	Minimum air draft (above MHWS)
4 MW	185m	2	130m	120m	22m
5 MW	186m	2	132m	120m	22m
6 MW	201m	2	154m	124m	22m

4.8 Each wind turbine operates automatically. Each turbine can yaw – the nacelle rotates to face the rotor blades into the wind. The rotor blades can also pitch – the blades can rotate into or out of the wind depending on the wind speed. Each turbine is self-starting when the wind speed reaches an average of about 3 to 5m/s (about 10mph). The output increases with the wind speed until the wind speed reaches typically 10 to 13m/s (about 25mph). At this point, the power is regulated at rated (maximum) power. When the maximum operational wind speed is reached, typically 25 to 30m/s (about 60mph), the wind turbine will cut-out, either fully or gradually, in order to limit loading. If the high wind speed cut out is gradual, the wind turbine will continue to generate some power through to higher wind speeds, the maximum being dependent on the wind turbine design. A SCADA (Supervisory Control and Data Acquisition) computer system monitors and controls the output from each wind turbine. An integrated alarm system will be triggered automatically in the event of a turbine fault.

Turbine Installation

4.9 The wind turbines will be installed on the platform and commissioned at the fabrication port, prior to being towed to the offshore Site.

Safety Requirements

4.10 The Project will be designed and constructed to satisfy the safety requirements of the Maritime and Coastguard Agency (MCA) as well as the marking, lighting and fog-horn specifications of the Civil Aviation Authority (CAA) and the Northern Lighthouse Board (NLB). At present, requirements specify that the turbines must be marked with lights that are visible from 2 nm. The project shall be marked on navigational charts.

4.11 When in operation, the platform shall be marked with clearly visible unique identification characters, which will be visible from all sides and comply with applicable requirements in Maritime and Coastguard Agency Marine Guidance Notice MGN 371. Currently these recommend that they should be visible from at least 150m from the structure and permanently lit by down lights to minimise light pollution. The colour scheme of the turbine tower, nacelle and blades is likely to be light grey RAL 7035, white RAL 9010 or equivalent.

4.12 The turbines shall be lit at night. The exact lighting requirements shall be agreed with the CAA. However, it is expected that both turbines (as they are over 60m) will require a medium intensity red light mounted on the top of each turbine nacelle in accordance with Air Navigation Order (ANO) Article 220. However, as per standard marine practice and in accordance with previous Northern Lighthouse Board (NLB) advice for other offshore wind projects that Dounreay Tri Ltd shall request a deviation from the steady red light detailed within the ANO in order to prevent confusion with marine lights and therefore the red aviation lights will flash Morse "W". In terms of charting, there is an international civil aviation requirement for all structures of 300 feet (91.4 metres) or more to be charted on aeronautical charts. Accordingly such structures should be reported to the Defence Geographic Centre (DGC) which maintains the UK's database of tall structures (the Digital Vertical Obstruction File) at least 10 weeks prior to the start of construction. In order to ensure that aviation stakeholders are aware of the turbines and / or meteorological masts while aviation charts are in the process of being updated, developments should be notified through the means of a Notice to Airmen (NOTAM) at least 14 days prior to the start of construction

The Platform

4.13 The platform is a large, floating, column-stabilised platform that supports two WTGs. The semi-submersible platform has buoyancy columns that are interconnected in a steel lattice truss framework.

4.14 The exact size of the platform shall be determined by the rotor diameter of the turbines used. Table 4.2 sets out the indicative platform length and other dimensions in relation to the turbine envelope. The total weight of iron and steel, for both the platform and turbines, is expected to be in the order of 7,972 tonnes. The platform shall weigh approximately 6,010 tonnes. The turbines shall weigh a total of 1,962 tonnes. There shall not be a substation on the platform.

Table 4-2 Indicative platform dimensions

	Turbine options		
Aspect	**4 MW**	**5 MW**	**6 MW**
Length	195m	200m	230m
Width	105m	115m	135m
Height above water surface	15m	15m	15m
Draft (transit)	10m	10m	10m
Draft (operational)	15m	15m	15m
Total displacement	14,100Te	15,200Te	23,000Te

4.15 The topside of the platform would be painted yellow to improve visibility and provide corrosion protection. Offshore man-made structures are typically painted yellow above the waterline in accordance with the recommendation of the International Association of Marine Aids to Navigation and Lighthouse Authorities. Figure 4-2 provides further illustration of the platform. Figure 4-3 provides indicative details of the maximum platform dimensions and parameters when utilizing 6MW turbines with a rotor diameter of 154m.

4.16 The platform is expected to be lit to aid navigation. The exact navigational lighting requirements shall be agreed with the NLB and the Marine and Coastguard Agency (MCA). However, the expectation is that there shall be three flashing white lights– one on each corner of the triangular foundation. The white lights are expected to flash Morse code “U” with a range of not less than 5 nm. The three navigational lights shall be synchronised.

4.17 The platform including the 360^{o} turn radius and allowing for some lateral movement, would occupy a sea surface area of up to approximately 0.17km^2.

Figure 4-2 Floating platform concept

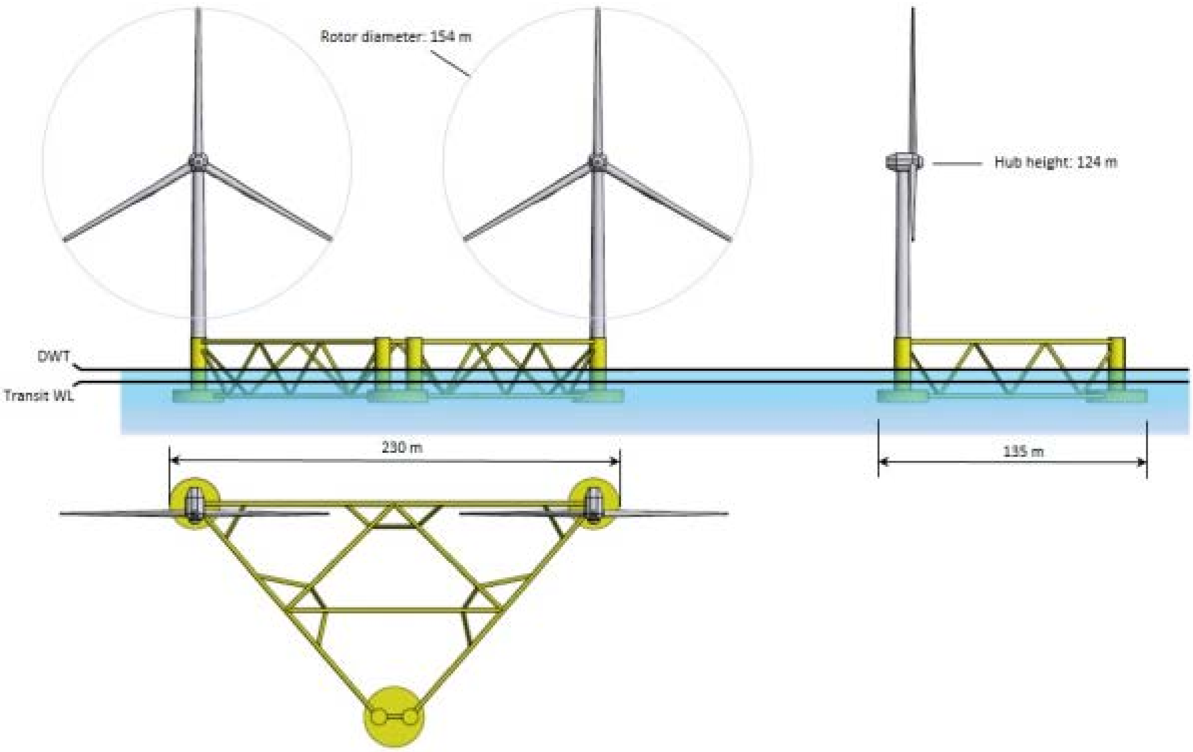

Figure 4-3 Indicative platform parameters (assuming 6 MW turbines are used)

4.18 The method for the platform construction, tow-out and installation are anticipated to be as follows:

Fabrication

- The steel is rolled at a steel yard;
- The buoyancy columns are fabricated at a steel yard or construction yard;

- The steel components are shipped to a dry dock facility for fabrication;
- The turbines are shipped to the dry dock, hoisted onto the platform whilst in the dry dock;

Float-out from Dry Dock

- The platform and turbines (fully assembled and partially commissioned) will be floated out from the dry dock;
- Trimming and ballasting of the structure to the transit draft outside of the dry dock;
- Completion of turbine commissioning and inspection while moored at the quayside;

Tow to Site

- A Notice to Mariners would be promulgated to local ports and marine users prior to transit;
- Platform towing will be performed with all the equipment needed to ensure safe marine transportation including the whole platform, workers and vessels. Note no personnel will be on the floating platform during transportation;
- Once the platform is ready to sail, it will be towed to site by using up to four Anchor Handling Tug Supply vessels with the adequate bollard pull. This operation shall be subject to weather;
- A support vessel, as assistance in line connections tasks will be used for manoeuvre control, and additionally with enough crane capacity for mooring and anchoring lines operations;

Installation

- Notice to Mariners would be promulgated to local ports and marine users prior to work offshore. Local vessels may be employed as guard vessels;
- Prior to the platform arriving on site, the export cable, drag embedment anchors, mooring lines and clumped weight are installed on the seabed using tugs and barge. The clump weight will be installed temporarily on the seabed, directly under the platform;
- Solid ballast will be installed in the clumped weight at the site. Optionally, the solid ballast can be installed at the base port;
- When the platform arrives on site, the entire platform will be trimmed and ballasted down to increase the draft of the turret column allowing the vertical catenary lines to be connected to the clumped weight and the turret. The export cable would be attached. ROV and suitable winching equipment will be utilised as required;
- The platform is then trimmed and ballasted back to the operational draft to suspend the clump weight beneath the platform; and
- The Project undergoes final checks before exporting power.

Table 4-3 Platform tow out and installation vessels

Installation details	Requirement	Value
Tow out and positioning	Description	Up to 4 Anchor Handling Tug Supply (AHTS) vessels.
Installation	Description	Up to 8 support vessels. This will include up to 2 crew transfer boats, 1 dive/ROV support, 1 barge for the clump weight, 1 cable installation barge/boat, 1 dredger and up to 2 guard vessels

Safety zone

4.19 A declaration shall be sought from the Department of Business, Energy and Industrial Strategy (BEIS) for a 500m safety zone around construction works within the offshore Site.

Mooring system

4.20 The platform shall rotate 360^{o} in order to reduce wake effects (i.e. turbulence) between the turbines. Wakes effects can occur when one turbine is down wind of the other.

4.21 The platform shall use a passive mooring system which aligns with the prevailing tidal, wind and wave conditions similar to the way a boat swings at anchor.

4.22 The mooring system shall consist of up to 8 mooring lines which are anchored to the seabed. The mooring lines shall pass through a 600 tonne clump weight (approximately 50m by 50 m) which shall be suspended in the water beneath the platform. The mooring lines between the platform and the clump weight shall be taught. The lines between the clump weight and the anchors shall be semi-taught. The clump weight shall act like a pendulum which dampens lateral movement. The mooring system is shown in plan view in Figure 4-4 and in profile in Figure 4-5.

4.23 The mooring lines maybe made of either steel chain with a diameter of approximately 0.4m or steel rope sheathed in plastic with an overall diameter of approximately 0.9m or a combination thereof.

4.24 The anchors would have a maximum radius of 800m from the platform centre and occupy an area of approximately 2km^2 on the seabed.

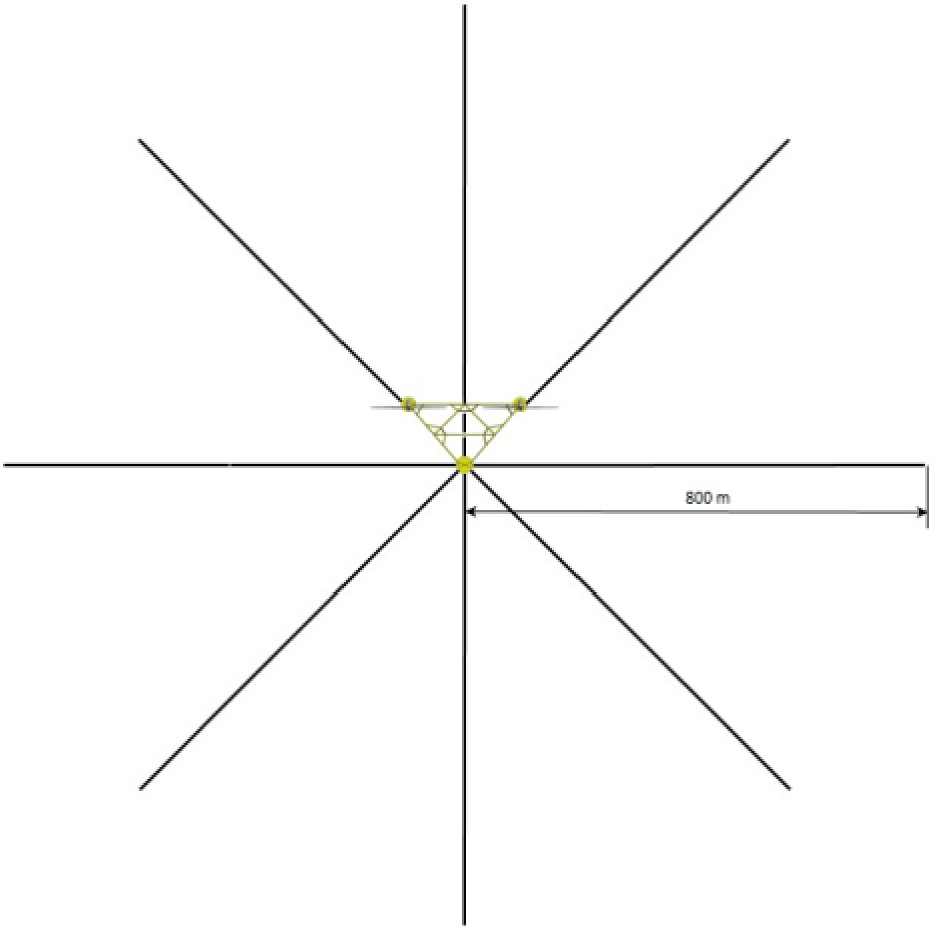

Figure 4-4 Mooring layout (plan view)

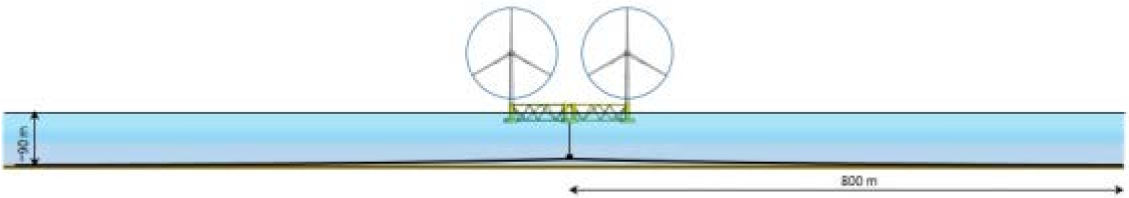

Figure 4-5 Mooring system (profile)

Dredging

4.25 The plinth for the clump weight may require dredging to level the seabed. Dounreay Trì Limited are currently (September 2016) conducting a geophysical survey within the site to determine the sediment depth and firmness within the Site. The plinth would measure approximately 70m by 70m and may need to be dredged to a maximum depth of 5m. The approximate volume of dredge material would be 24,500m^3. The dredged material would be replaced by clean, crushed stone. The dredged material has not yet been characterised so a proper assessment cannot be made of its potential impacts on human health and the environment, consequently it shall not be disposed of at sea. The dredged material shall be disposed of at a licenced site onshore.

4.26 Dounreay Trì Limited shall require a separate Marine Licence to dredge an area beneath the platform, in order to level it. The need for dredging shall not be confirmed until the detailed design of the platform is complete. If dredging is required then Dounreay Trì Limited understands that sediment samples must be collected, analysed and provided to MS-LOT prior to support another Marine Licence application for dredging. Any dredging licence application would be made separately to this application and subject to additional consultation. Dounreay Trì Limited has considered the environmental effects associated with dredging in this Environmental Statement to the extent that is possible but Dounreay Trì Limited accepts that further environmental assessment would be necessary to support any additional Marine Licence for dredging.

Mooring lines

4.27 The mooring lines are most likely to be chain, steel wire or a combination thereof. Offshore grade mooring chains of 100mm to 160mm diameter may be used.

4.28 The 8 mooring lines are each approximately 800m long and may be slack. For the purposes of the assessment it is assumed that up to 75% of each mooring line could come into contact with the seabed.

Anchors

4.29 Drag embedment anchors shall be used. The holding capacity of a drag embedment anchor is generated by the resistance of the soil between the anchor and the platform. It is possible to add more than one anchor to each mooring line in order to increase the holding capacity. The platform may require up to two anchors on each mooring line so up to 16 drag embedment anchors in total.

4.30 Each anchor shall be approximately 9m wide and 9m long, assuming 30 ton Stevpris Mk 5 anchors are used (Figure 4-6). These drag embedment anchors are designed to penetrate approximately 10-15m into the seabed, subject to seabed conditions. The anchors would be installed by an Anchor Handling Tug Supply vessel.

Figure 4-6 Stevpris Mk 5 Drag Embedment Anchor

(Image: www.vryhof.com, 2016)

Scour protection

4.31 Scour protection is designed to prevent structures being undermined by sediment processes and seabed erosion. The impacts of scour can be managed by protecting the seabed around the base of the anchors and the export cable. Several types of scour protection exist, including mattress protection, sand bags, grout-filled bags, stone bags and artificial seaweeds. However, the placement of crushed rock around the anchors and cable is the most common solution. The base case is that no scour protection is required; however if scour protection were to be used, then the foot print would extend no more than 20m out from the centre of the anchor and to a height of 2m above the seabed (Table 4-4).

Table 4-4 Scour protection for anchors

Scour Protection	Unit	Measurement
Type of scour protection	-	Crushed rock
Indicative diameter of rocks used	m	0.06-0.65
Height of scour protection above original seabed	m	2
Extent of scour protection (from centre of anchor)	m	20
Seabed area take (per anchor)	m^2	1,260
Anticipated number of vessels required including support vessels	-	2
Vessel Type	-	Dynamically Positioned Fall-pipe Vessel Crew transfer vessel

Intra-array cables

4.32 Intra-array cables shall connect the two wind turbines. These cables shall be integrated into the top-side of the platform.

Export cable

4.33 The export cable shall be buried in the seabed between the Site and the landfall. The export cable will make landfall in an area immediately to the west of the Dounreay restoration site (Figure 1-1). The export cable would be between 6 to 13.8km in length, depending on the final position of the platform within the Site.

4.34 The marine cable shall include conductor cores and a fibre optic cable encased in one cable which is armoured. The copper or aluminium conductors are covered by an insulation of polyethylene (cross linked XLPE) or EPR (Ethylene Propylene Rubber). The insulation is contained within an insulation screen, a lead alloy sheath (to ensure no ingress of water into the insulation). The diameter of the cable would be approximately 0.5m.

4.35 The portion of the cable closest to the platform shall be dynamic so the platform can rise and fall without stretching or snapping the cable. A dynamic cable would typically be suspended in a "lazy-wave" (s-shape) acting like a flexible riser would on an oil and gas platform. Buoyancy elements lift the cable from the seabed and suspend it in the water column, well below the sea surface. The cable shall touchdown on the seabed approximately 250m beyond the platform. Approximately 20% (50m) of the dynamic cable may come into contact with the seabed as the platform moves. A small drag embedment anchor or clump weight shall stabilise the export cable touchdown. Thereafter the export cable will be buried under the seabed with a target burial depth of 2m.

4.36 Ploughing is the preferred cable installation method. Although jetting or vertical injection may be used where local sediments require. The export cable will be buried within a trench up to maximum 8m wide and up to 2m deep. Depending on seabed conditions along the export cable corridor it may not be possible to bury the full length of cable to the desired depth. Where it is not possible to bury the cable, rock may be required to protect the cable. As a worst case it is assumed that a maximum of (20%) 2.8km of cable may require protection.

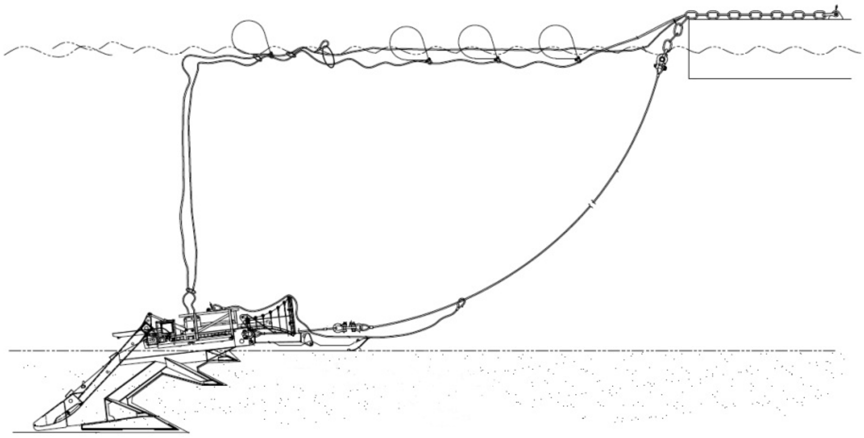

Figure 4-7 Typical cable plough towing arrangement

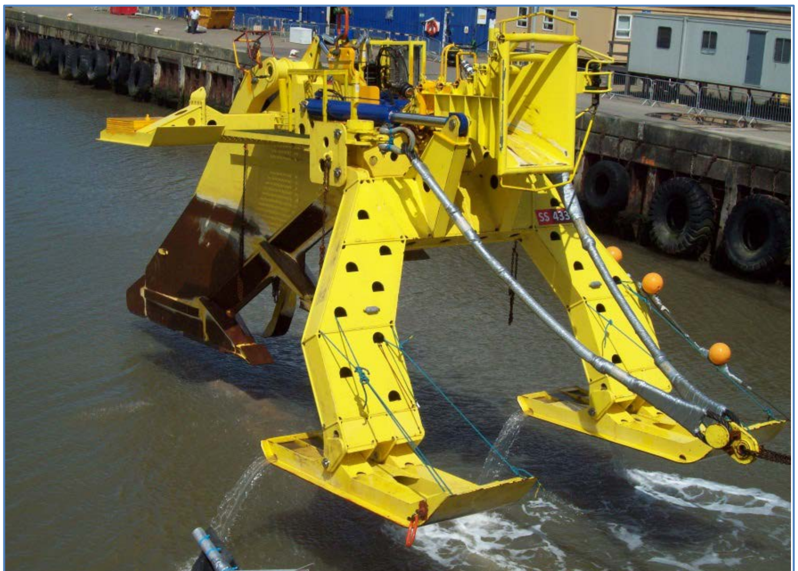

Figure 4-8 Typical offshore cable plough

4.37 The installation of the export cable is most likely to be carried out in one operation where the cable is laid and buried from the same vessel simultaneously.

4.38 The general procedure for the installation of the array cables is as follows:

- **Pre Laying Grapnel Run**: Not long before the cables are laid, a Pre-Laying Grapnel Run (PLGR) will be carried out along the cable route. The main purpose of this is to ensure the cable routes are clear from shallow buried linear obstructions to burial such as old fishing gear or rope; and
- **Cable laying and pull through:** consisting of laying the cable from the shore to the platform and pulling the seaward end through the clump weight.

Table 4-5 Indicative export cable burial values

Cable Parameter	Requirement	Value
Specification	Range	AC Cable Diameter (including armour and insulation) – up to 0.5m
Length	Range	6 – 13.8km
Weight	Max	3.2 tonnes per km 44 tonnes
Burial Depth	Range	Generally the cable will be buried at 2m. Sections of the cables will be surface laid if soil conditions are hard and/or the risk of cable damage is very low.
Width of seabed affected per cable during burial	Max	1-8m depending on soil conditions and burial method
Burial Spoil	Jetting	Jetting may cause sediment suspension. This volume of sediment suspension depends on the soil conditions. For the calculation of the maximum volume of the sediment suspension, it can be assumed that there is 100% sediment suspension along 95 % of the total cable length from a trench up to 3m deep and 0.6m wide. It should be noted that this is based on burial with a jet and does not represent the actual shape of the trench which in reality could be wider and v-shaped. For the remaining 5%, it can be assumed that there is 100% sediment suspension from a trench up to 10m deep and 1m wide with straight sides. It should be noted that this is based on burial with a vertical injector and does not represent the actual shape of the trench which in reality could be wider and v-shaped.

Cable Parameter	Requirement	Value
	Ploughing	Ploughing will not result in substantive sediment suspension. Spoil will be pushed up out of the trench to lay in a berm on either side. A multi-pass plough will dig a V-shaped trench up to 2m deep and 3m wide. Spoil can be backfilled if required.
Type of cable protection	-	Rock
Diameter of rocks used	m	0.06-0.65
Height of cable protection above original seabed	m	2
Width of cable protection	m	8
Length of cable protection	m	2,800
Seabed area take	m^2	22,400
Anticipated number of vessels required including support vessels	-	2
Vessel Type	-	Cable installation barge or boat Dynamically Positioned Fall-pipe Vessel Crew transfer vessel

Cable crossings

4.39 There are no known active or inactive cables within either the offshore Site or export cable corridor.

Offshore substation

4.40 This Project shall not require an offshore substation.

Offshore anemometer mast

4.41 This Project shall not require an offshore anemometer mast.

Fabrication and installation activities

4.42 The platform is a steel truss structure with welded steel joints. The basic premise of the fabrication and installation methodology is as follows:

- Rolling of steel and fabrication of sections of the platform, Scottish fabrication options are being explored;
- Joining of the sections of the platform in a dry dock;
- Turbine installation and commissioning in the dry dock;
- While the fabrication is taking place, the subsea cable, anchors, mooring lines and clump weight will be installed at the Dounreay site. The lines will be buoyed and marked as required, ready for installation of the platform. Anchor handling and installation can be carried out from a local port using local support vessels, where possible. Cable laying and particularly anchor installation will be done as late as possible prior to platform installation to minimise risks to the components and shipping. Scour protection for the anchors and cable may be required depending on the seabed conditions and the metocean conditions experienced at the Site;
- Tow the platform to Site and then hook up to the export cable and the anchor lines; and
- Final testing and export power.

4.43 The environmental management of construction activities will be carried out under the provisions of an Environmental Management Plan (EMP), which will be agreed with key stakeholders prior to construction. The provisions of an EMP typically include issues such as fuel and chemical handling, pollution prevention and control and storage of waste and effluent.

Programme of works (offshore)

4.44 Approximate durations for typical construction activities associated with individual components are provided below:

- Fabrication and turbine installation may take approximately 12 - 18 months. The platform shall be fabricated in a dry dock, offsite; and
- Subsea cable, anchors and mooring lines would be installed at the Dounreay site, as will the anchors and mooring lines. This would take 2 - 3 months, subject to weather.

4.45 The overall programme of works would likely remain 12 - 18 months as the fabrication of the platform and installation of the cable, anchors and moorings would occur in parallel.

Operations and Maintenance

4.46 Once operational, the Project will require regular inspections, servicing and maintenance throughout its lifetime. This will require technicians and support staff. Given the distance of the Project from shore and project size, it is assumed that an Operations and Maintenance (O&M) hub at an existing port may be required. The O&M hub would be selected during the consent determination period. O&M vessels would steam between the port and the Project.

4.47 Turbine maintenance falls into two categories: Preventative maintenance and corrective maintenance. Preventive maintenance will be mostly undertaken using crew vessels (although helicopters could be used in certain circumstances) to access the turbine and includes tasks such as the replacement of consumables (filters and oil) as well as a general inspection of the turbine. Crew transfers from vessels are expected to be via boat landing whereas helicopter access will be via heli-hoist. Corrective maintenance includes minor repairs/restarts and major component replacements (such as generator, blades, etc.). This is required if the results of condition monitoring or preventive maintenance suggest it is necessary, or if monitoring alarms are triggered (some of which may result in the wind turbines being remotely shutdown). It is expected that on average up to eight visits per turbine, per year will be required for fault rectification and up to three per turbine, per year for major component replacement (these figures may vary significantly from year to year). Corrective maintenance will be carried out using crew boats, helicopter or specialised vessels depending on weather conditions and the details of the breakdown. Major component replacements (nacelle, blades etc.) may mean that the platform is towed to a deep water port or dry dock.

4.48 Foundation maintenance will be mostly undertaken using vessels to access the foundations and divers or ROVs for subsea inspections. Preventive maintenance operations will include routine inspections of the subsea and topside structures, along with confined space operations which may require specialised technicians. The structural integrity of the foundation structure and ancillary structure (access ladders, walkways etc.) will be assessed along with the level of corrosion and marine growth. Marine growth will be removed if it is causing excessive loading on the foundation structure or restricting access. Pressure washers (using high- pressure sea water with no additives) will most likely be used for general cleaning and removing marine growth on key areas such as access ladders and walkways.

4.49 Additionally, separate inspections (such as side-scan sonar or ROVs) will inspect the condition of the seabed and scour protection (if utilised) around the anchors and the export cable.

Decommissioning

4.50 The design life of the turbines and other major components of the Project shall be 25 years.

4.51 The Energy Act 2004 requires Dounreay Trì Limited to provide a decommissioning plan, supported by appropriate financial security, prior to constructing the Project. Decommissioning activities will comply with all relevant legislation at that time.

4.52 At the end of the operational lifetime of the Project, it is anticipated that there will be a requirement for all structures above the seabed to be completely removed. For the purposes of the EIA, the decommissioning of the wind farm is likely to be the reverse of the construction process. Decommissioning best practice and legislation will be applied at that time.

Decommissioning the Platform

4.53 The removal and dismantling of the platform will largely be a reversal of the installation process and subject to the same constraints. Even though decommissioning may not require the same level of precision as installation, it will be undertaken in the same controlled manner and in accordance with a risk management plan to ensure the same level of safety and pollution control measures. Components will be reused or recycled, where possible.

Decommissioning the export cable

4.54 Relevant stakeholders and regulators will be consulted to determine which sections of the offshore cable will need to be removed. If there are no issues with stakeholders/regulators and the risk of the cable becoming exposed is minimal, then the cable may be left in situ to avoid disturbing the seabed unnecessarily. In this instance, the ends of the cables will be cut as close to the seabed as possible. The ends will be weighted down and buried (probably using an ROV) to ensure they do not interfere with trawling etc.

4.55 If removal is deemed necessary, the removal sequence of the cable is anticipated to be:

- Locate the cable using a grapnel and lift it from the seabed. Alternatively, or in addition, it may be necessary to use an ROV to cut and/or attach a lifting attachment to the cable so that it can be recovered to the vessel;
- Seabed material may need to be removed to locate the cable. This is likely to be carried out using a water jetting tool similar to that used during cable installation;
- The recovery vessel will either 'peel out' the cable as it moves backwards along the cable route whilst picking it up on the winch or cable engines, or, if the seabed is very stiff/hard it may first under-run the cable with a suspended sheave block to lift the cable from the seabed. The use of a suspended sheave block could be carried out before by a separate vessel such as a tug prior to the recovery vessel 'peeling out' the cable;
- The recovery vessel will either spool the recovered cable into a carousel or cut into lengths as it is brought aboard before transport to shore; and
- The cables will be recycled onshore.

Removal of scour protection

4.56 It may be preferable to leave the scour protection in-situ to preserve the marine habitat that may have developed over 25 years. Relevant stakeholders and regulators will be consulted to establish what the best approach is. If removal is deemed necessary, the removal sequence is anticipated to be:

- For rock armour, the individual boulders are likely to be recovered using a grab vessel, and transferred to a suitable barge for transport to an approved onshore site for appropriate re-use or disposal; or
- The filter layer is likely to be dredged and transported to be reused or disposed of at a licensed disposal area (this could be offshore or onshore).

4.5 Onshore Infrastructure

4.57 The onshore infrastructure shall comprise of:

- A cable landfall immediately to the west of the Dounreay Restoration Site fence line;
- A cable joint transition bay, where the offshore and onshore cables are spliced together;
- The onshore cable, buried to a depth of approximately 1m, subject to ground conditions; and
- A substation or switchgear to transfer power to the grid, to comply with requirements of the Grid operator, to contain equipment and provide control functions. A grid connection has been requested at, or near, the existing Dounreay 132/33/11KV Substation.

4.58 Figure 4-9 outlines the onshore infrastructure which includes two cable land fall options to the west of Dounreay and Sandside Bay. Figure 4-9 also depicts two potential substation locations which lie immediately south of Dounreay, adjacent to the existing 132/33/11kV Dounreay substation. The Project shall make use of an existing access track which was installed during the upgrade of the Dounreay - Mybster line in 2015. This existing access track joins the A836. The Project would also utilise an existing area of hardstanding as a lay down area. This hardstanding was used during the construction of the 132/33/11kV Dounreay substation in 2013.

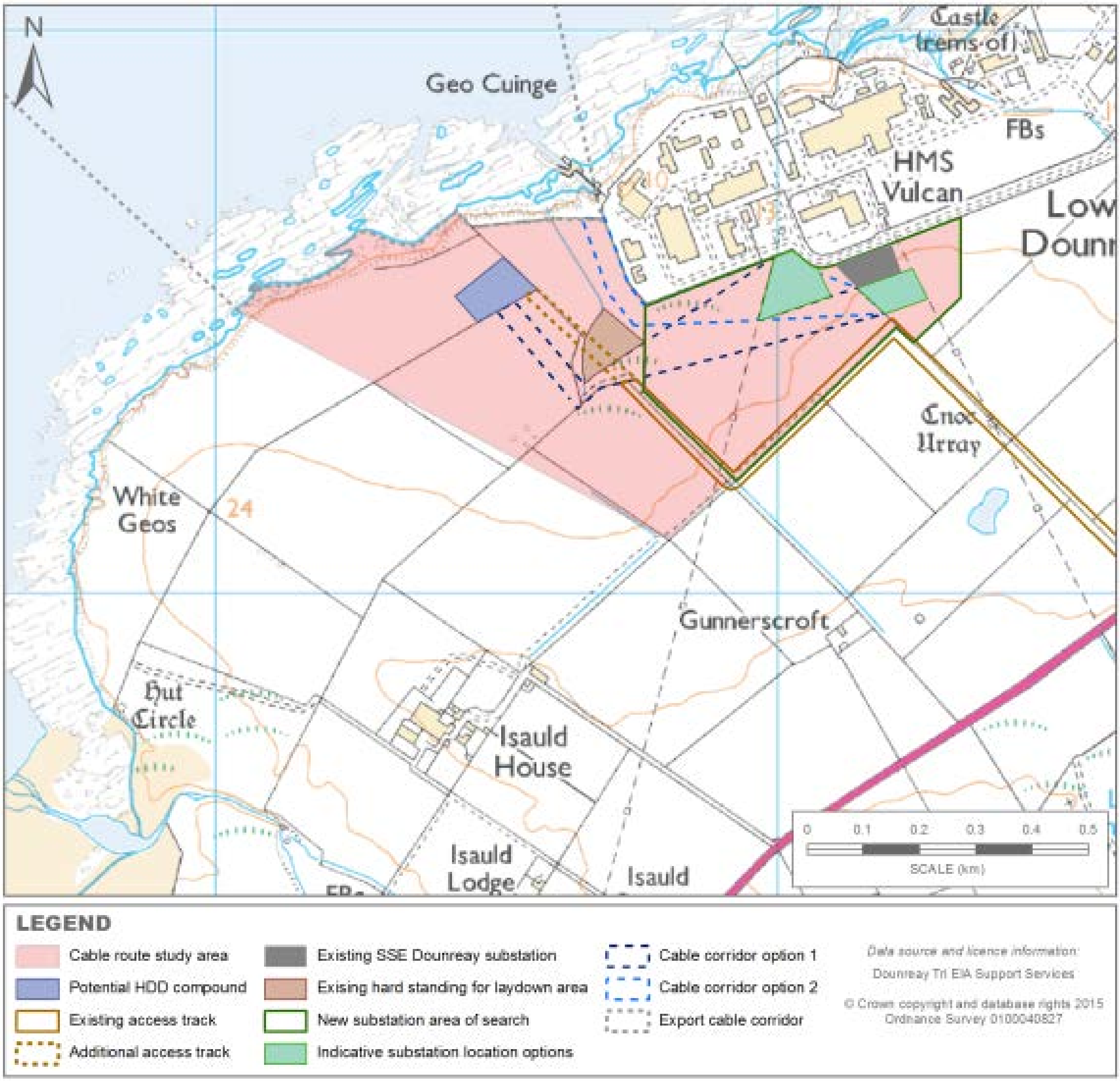

Figure 4-9 Indicative onshore infrastructure

Cable landfall

4.59 The landfall shall be located immediately to the west of the Dounreay restoration site, within the export cable corridor (Figure 4-9). This stretch of coastline is dominated by slabbing rocks as illustrated in Figure 4-10. This makes a conventional, trenched cable landfall very challenging. Two trenchless landfall options are proposed, HDD or pinning. It is important to retain two cable landfall options into the application because both options present different risks. Both options would be located immediately to the west of the Dounreay Restoration Site fence line.

Figure 4-10 Rocky coastline between Sandside Bay and Dounreay Restoration Site

(RES, 2015)

Option 1 **Horizontal Directional Drilling (HDD)** – to the west of the Dounreay restoration site fence line. This is currently the base case. HDD involves drilling a small pilot hole from the landward side to a point below MLWS. The hole is widened to accommodate a conduit pipe or duct through which the cable is pulled. Once installed the HDD compound would be removed and the site restored to pre-construction conditions; or

Option 2 **Pinning -** the cable to the existing cooling water intake channel for the Dounreay Nuclear power station. This cooling water intake was cut through the rock circa. 1968. A cable duct could be pinned or screwed to the rock wall at low tide and the cable pulled through the duct.

HDD

4.60 An existing access track from the A836 could be upgraded, if necessary, and temporarily extended by approximately 300m to serve the proposed HDD compound (Figure 4-9). The drilling compound would be set back approximately 150m from the edge of the cliffs which should provide sufficient space for the arced drill profile to pass beneath the cliffs and exit onto the seabed below MLWS. The field at this location is relatively flat and provides ample space to establish the HDD compound. HDD requires a temporary landward working area of up to 1000m^2 to accommodate the drilling equipment and ancillary plant (Figure 4-9). The existing area of hardstanding would be used for storage, welfare facilities and laydown (Figure 4-9).

4.61 HDD is achieved using the following general procedure:

- The existing access track is temporarily extended by 300m;
- The HDD compound is established to accommodate the drilling equipment and ancillary plant;
- An onshore drill rig begins drilling a small diameter pilot hole from the HDD compound, beneath the intertidal area, to a point offshore (below MLWS) where the offshore cable laying vessel can gain safe access;

- As this hole is drilled, a 'drilling mud' (typically Bentonite) will be injected into the hole behind the drilling head to ensure it is kept stable and to flush out drill arisings. Bentonite is an inert material consisting of a mixture of water and natural clays;
- A steel reamer is then pulled back from an offshore vessel (AHTS vessel or similar) through the pilot hole enlarging the diameter of the hole as it progresses. Several reaming operations may be necessary to achieve a size suitable for accommodating the cable duct;
- The exact depth of the drilling depends on the soil profile and geology, however a drill depth of between 5-20m below ground level is typical;
- The cable duct (usually formed from high density polyethylene – HDPE) is attached to the seaward end of the reamer and pulled through the drilled hole toward the HDD compound onshore (although in some instances it may be possible to push the duct through the tunnel from the land side). Approximately 5m of the offshore duct end may be plugged and temporarily weighted by a concrete mattress (to counter any buoyancy), to await the arrival of the cable installation vessel;
- Shortly before the cable installation vessel commences installation, the concrete mattress will be lifted aboard, the offshore duct end will be exposed and unplugged. The export cable is then pulled through the duct from a winch located onshore. To ensure a smooth pull of the cable the inner diameter of the duct is typically twice the outer diameter of the cable;
- Once the offshore cable has been installed, the duct may be injected with a thermal dissipation medium (typically a thermal grout) to ensure that the cable does not overheat, although the need for any thermal grout will be confirmed once the geology is known;
- The HDD compound is removed and the site restored in accordance with any consent conditions and to the Landowner's satisfaction; and
- The temporary 300m access track is removed in accordance with any consent conditions and to the Landowner's satisfaction.

4.62 The entire HDD operation would be expected to take 1-2 months, subject to weather and ground conditions.

Figure 4-11 Typical HDD working area

(Photograph supplied by O'Connor Utilities, 2016)

HDD - bentonite break out

4.63 During drilling there is a very low risk of bentonite breakout. Bentonite is naturally occurring, inert clay.

- Pressure sensors will be attached to the drill rig to monitor sudden drops that indicate a break out. This will allow rapid response to any incident;
- The bentonite system will be inspected on a daily basis;
- The site will be manned 24hrs a day to discourage vandalism; and
- If break out does occur, the bentonite (a naturally occurring clay) will be cleared from the site by hand and minor cultivation and reseeding if required.

HDD - technical risks

4.64 One area of potential concern relates to the angle of the sandstone/siltstone strata. As visible in Figure 4-10 the bedding angle is relatively flat which can cause problems during the drilling operation. It is preferable to drill perpendicular rather than parallel to bedding planes. Another potential concern relates to the offshore ground and met-ocean conditions at the punch out point. The northern Scottish coastline is exposed to adverse weather systems generated in the north Atlantic. If consented, an HDD specialist contractor would be employed to explore the practicalities of HDD in more detail. For this reason, the Applicant wishes to retain a second cable landfall option, pinning.

Pinning

4.65 At the western edge of the Dounreay restoration site is an existing man-made channel which passes out to sea (Figure 4-12). This cooling water intake channel could provide a potential landfall, if the cable duct was pinned to the channel.

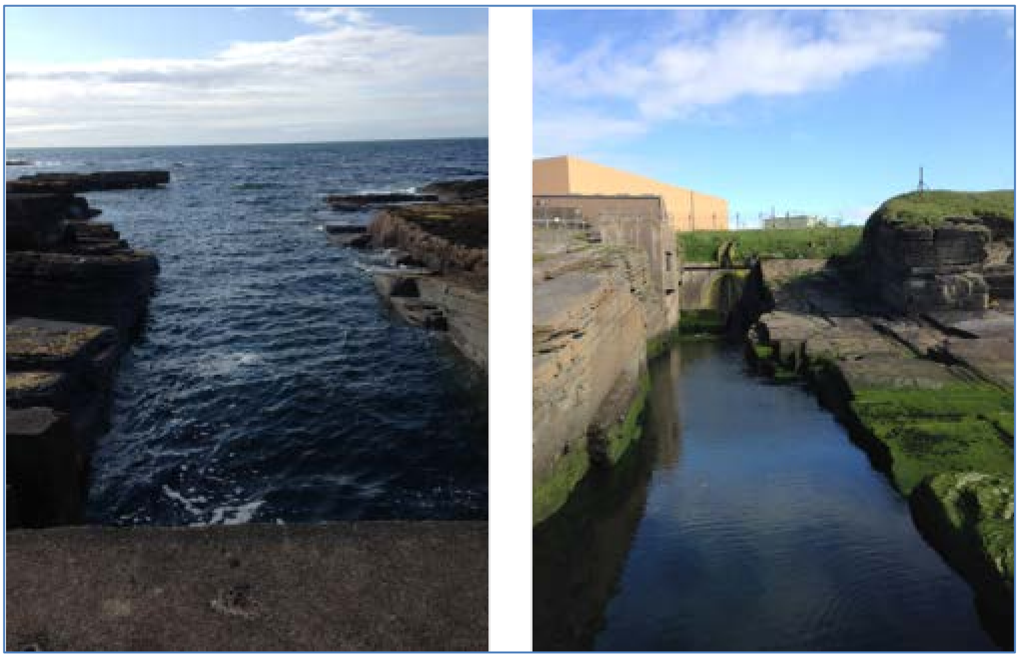

Figure 4-12 Cooling water intake channel at Dounreay (looking seaward and landward)

(RES, 2015)

4.66 A single duct (plastic or metal) would be mechanically restrained (e.g. by rock bolts, screws and/or studs) to the existing concrete structure and would run from below MLWS up the existing channel to a Joint Transition Bay set back from the coast.

4.67 The entire installation of the duct would take approximately 1-2 months, subject to weather and tidal conditions. Pinning would be expected to take place over the course of 1-2 weeks. Noise would be intermittent and would be controlled by the noise restrictions to be agreed with The Highland Council.

Pinning - technical risks

4.68 The cable duct would be exposed to significant wave action. This coastline is exposed to weather systems generated in the north Atlantic. Furthermore, the duct profile would need to be carefully designed to ensure a smooth profile to facilitate subsequent cable pulling. If consented, a specialist contractor would be employed to explore the practicalities of pinning a cable within this channel in more detail. For this reason, the Applicant wishes to also retain a HDD cable landfall option.

Joint Transition Bay

4.69 At the cable landfall point, regardless of whether HDD or pinning, a concrete Joint Transmission Bay (JTB) may be required to house the joint between the multi-core offshore export cable, and the single core onshore cable.

4.70 The JTB would be located above MHWS and comprise an area approximately 2m wide, 5m long and 1m deep with a level concrete floor and walls. The JTB would be buried at approximately 1.5m below ground level.

4.71 The purpose of the JTB is to allow a firm, solid base for cable jointing which can be covered by a tent or container to allow the necessary environmental conditions. Following connection of the cables, the JTB may be backfilled to protect the joint. The soil will be replaced, the area reinstated and the stock fencing removed once the vegetation is re-established (Figure 4-13).

Figure 4-13 Example of a cable joint transition bay – once installed

Onshore cable

4.72 The onshore cable will be installed in a trench along the cable route over a distance of up to 800m. Cable will be delivered to site on drums by Heavy Goods Vehicles (HGVs).

4.73 Once the onshore cable route is finalised the appropriate installation method will be decided. However, it is anticipated that open-cut trenching will be the primary installation method. A trench will be dug using backed-hoe excavators to a depth of 1 – 2m. The turf, top soil and sub-soils will be separated and placed beside the trench. A plastic duct would then be laid on top of sand and then the excavated material would be backfilled and restored. The cable would then be drawn through the buried duct.

4.74 The working width includes the corridor in which the access road, cable trench, excavated material, turf and any other equipment/machinery is placed. The access track would be temporarily fenced off to keep livestock out. It is expected that one cable will be installed in a single trench up to 3m wide with an associated working corridor width of up to 20m. This working width would encompass the cable trench, an access track and turf storage and fencing.

4.75 The onshore cable corridor can be reinstated and re-cultivated after installation is complete. However, construction above the cable is not permitted.

4.76 The trenching and installation process for the onshore cable is as follows:

- Initially trial holes will be dug (usually by hand) at certain points along the cable route, normally near existing utilities and at the anticipated positions of the joint bay. This process clarifies the resistivity of the soil allowing the correct backfill material to be chosen and ensures there are no unexpected underground obstacles to burial;
- Prior to construction starting, the existing access track will be surveyed to ensure the track is fit for purpose;
- The onshore cable route will then be trenched using tracked or wheeled back-hoe excavators (one to excavate and one to handle trench support). The trench walls will be angled to prevent them from collapsing;

- The trench will be dug to a sufficient depth to avoid damage to the cable during construction works or cultivation. Generally this will be between 1-2m although deeper burial may be required where services or obstructions need to be crossed;
- The top and sub soil will be separated and placed beside the trench, where possible, for back filling later;
- The bottom of the trench will be lined with a selected sand with a specific thermal resistivity to ensure the correct ambient conditions and to protect the duct from sharp stones;
- The duct will be placed at the bottom of each trenched section and jointed to previously buried ducts. The cable pull-in can then occur at a later date;
- The cable will be sheath tested before and after cable pull-in to ensure it was not damaged during transportation or installation;
- The duct is then lined with sand to control the ambient conditions of the cable system;
- Finally the sub soil and top soil will be back filled. Any surplus soil will be distributed on site or disposed of depending on the agreement with the Landowner; and
- After installation, the land will be reinstated including fences, gates, vegetation, tracks, roads or hard standings in accordance to planning consent, licences and to the Landowner's satisfaction.

4.77 Onshore trenching would take 1-2 months, subject to weather.

Cable Joint Bay

4.78 A Cable Joint Bay (CJB) may be required at approximately 400 - 500m along the onshore cable corridor to join together the onshore cable sections. The cable joints will occur within the CJB. A CJB is typically slightly smaller than the JTBs (5m long and 1.5m wide) but ostensibly the same design.

4.79 The CJBs will be installed approximately 1.5m below ground level. This can take place prior to the trenching operation as long as the bay is temporarily covered until the jointing operation. During the jointing operation the bay will be covered by a tent or a container to ensure the correct environmental conditions for the jointing work. A working area of approximately 20m x 20m is required adjacent the CJBs to provide space for the cable drums at one end, and the pulling equipment and auxiliary supply for the jointing work at the other end. This can be contained within the cable route working corridor. Following the cable jointing operation, the CJB will be backfilled and the ground restored.

4.80 A manhole cover will be the only surface level structure visible following full reinstatement of the cable corridor. This provides access for maintenance. The precise positioning will be agreed with landowners.

Switchgear or Substation

4.81 The turbines will export power at 33kv. The Project will require either a:

- Switchgear to connect to the distribution network at 33KV; or
- Substation to connect to the transmission network at 132KV.

4.82 The onshore substation or switchgear will include the electrical equipment required to connect the Project to the grid. This may include switchgear, transformers, filtering and harmonic equipment, reactive compensation devices, protection equipment and other auxiliary equipment.

4.83 The entire footprint to the edge of the fence line is likely to be an area of approximately 50m x 50m (0.25 hectares). The majority of electrical plant should be indoors owing to the coastal location. The substation building itself shall be approximately 30m long, 17.5m wide and up to 8m above finished ground level (FGL). Figure 4-14 provides the context in which a proposed new substation would be set and shows the existing 132/33/11kV substation. A new substation is unlikely to be larger than the existing 132/33/11Kv substation.

Figure 4-14 Substation context and existing 132/33/11kv Dounreay Substation

(RES, 2015)

4.84 External lighting will be used to illuminate the building but this will be intermittent and only when people are on site.

Onshore construction method

4.85 Onshore construction activities will fall into the following generalised categories, noting that some activities may occur in parallel:

Cable landfall and onshore cable corridor

- Erect site fencing;
- Excavation or Horizontal Directional Drilling (HDD);
- Possible laying of ducts for later installation of cables;
- Backfilling and compaction of soil; and
- Reinstatement, where necessary.

Onshore switchgear or substation

4.86 Construction of the onshore switch gear or substation would comprise the following stages:

- Construction of temporary access roads from the existing road network;
- Site preparation including site clearance, fencing off of the construction area, provision of services to the site and creation of a construction compound with welfare facilities;
- Civil works to prepare the site for the heavy duty equipment required for the installation of the foundations and buildings. This will comprise earthworks to create a firm and level platform across the site;

- Foundation works for the main electrical components and buildings which may comprise piled and/or shallow foundations;
- Provision of the main utilities to services the site including electrics, water and telecommunications;
- Construction of the main buildings housing the switchgear and controls;
- Installation and testing of electrical equipment;
- Landscaping works including earthworks and vegetation planting; and
- Commissioning activities.

Onshore operations and maintenance

4.87 Following commissioning, it is assumed that the onshore substation will operate continuously (24 hours a day, 7 days a week) except during planned shutdowns for maintenance. The onshore substation will be designed to remain in situ during the life of the wind farm, which is envisaged to be up to 25 years.

4.88 There will be a limited amount of traffic to and from the substation for general operation and maintenance purposes. This is estimated to be around four vehicles per month carrying up to three persons per vehicle. Beside this, there will be no day to day personnel on site in normal operation. Unexpected faults may lead to increasing traffic volumes depending on the type of fault.

4.89 Routine activities on the underground cable system during the operational phase will be regular and ad-hoc visits to the manholes as required for inspection/maintenance purposes. Non-routine activities could include repair of damage to cable or replacement of a failed cable joint.

Decommissioning

4.90 The onshore switchgear or substation will first be disconnected from the high voltage transmission system, de-energised and all equipment earthed. Potential hazards and pollutants to the environment will be identified and a plan put in place to ensure removal is carried out with minimal risk of damage to surrounding environment. All electrical equipment/plant items will be dismantled and removed. Parts will be re-used, recycled or disposed of.

4.91 Usually, due to the disruption of their removal, it is preferable to leave decommissioned cables in situ. The ends of the cables will be cut and any over ground installations (link boxes) removed. If required by regulators or if it is economic to recover the cable for scrap without causing significant disruption, the decommissioned cable may be removed. HDD ducts will remain buried unless it is absolutely essential for the re-purposing of the site.

Programme of Works (onshore)

4.92 The construction of the onshore infrastructure is likely to take 12 - 18 months to complete:

- **Cable landfall installation** – the total duration of drilling and installing a duct may take approximately 1 - 2 months. However, the exact timing is site specific and depends on the installation strategy;
- **Cable trenching** – Trenching, cable pull-in and re-establishment will last approximately 1 - 2 months. This assumes a single excavation team;

- **Onshore substation** – a typical construction period for switch gear or substation is 12 - 18 months; and
- **Total onshore programme of works** would likely to be 12 - 18 months as the cable landfall, trenching and substation construction can occur in parallel.

Waste

4.93 The ECoW will make arrangements for the safe and legal disposal of waste from the onshore site. Waste will be managed during the construction, installation, operation and installation of the Project. Temporary site office and welfare areas will be provided with closed skips for the segregation and disposal of paper, cardboard and mixed municipal waste. All waste containers will be stored away from drainage runs. They will be kept clean and closed to prevent odour, wind-blown litter and to avoid attracting vermin. Effluent from 'portaloos' will be collected by the toilet hire company. Disposal will be to a sewage treatment works. Waste wood, metals and ceramics (cement) will be segregated into skips for off-site recycling. Mixed construction and demolition waste will be collected for offsite disposal by a licenced waste contractor. Facilities for the disposal of hazardous solid waste will be provided for items such as oil filters, batteries, paint tins, resins sealants and adhesives. Liquid hazardous wastes such as hydraulic oils will be stored in a suitable tank or drum within a bunded area. Fly tipping will be prevented by effective security measures. Horizontal Directional Drilling (HDD) is unlikely to give rise to significant amounts of waste as drilling mud is typically captured and reused during the process however any excess waste will be disposed of by a licensed waste operator at a licenced facility.

Health and Safety

4.94 Development, construction, operation, repowering and decommissioning will be undertaken in accordance with the requirements of the Health and Safety at Work etc. Act (1974) and subordinate legislation. Health, safety and environmental risks will be identified and arrangements implemented throughout the Project's lifecycle to ensure all potential health, safety and environmental issues are managed, as required by legislation and in accordance with the principle of ALARP (as low as reasonably practicable).

4.95 A construction stage health and safety plan shall be put in place under the requirements of the Construction (Design and Management) Regulations, 2015 (CDM Regulations). The CDM regulations are aimed at improving the management and coordination of heal, safety and welfare throughout all stages of construction projects to reduce the potential for serious accidents.

4.96 Dounreay Trì Limited has appointed a CDM principle designer with the responsibility for overseeing the safe design, construction and installation of the project.

4.97 Dounreay Trì Limited will make clear their health, safety and environmental expectations to contractors via their health and safety policy, procedure and the general mitigation measures set out in Table 4-6.

4.6 Embedded mitigation

4.98 The Applicant recognises that the development control process continues through the lifecycle of the Project. Consequently, the following measures have been incorporated into the Project Design to best manage (prevent, reduce or offset) environmental impacts as the project progresses through fabrication, installation, operation and finally to decommissioning.

4.99 Table 4-6 sets out the mitigation measures which are considered generic so could apply to the offshore and onshore aspects of the projects. Tables 4-7 and 4-8 set out mitigation measures which are to be applied to the onshore and offshore parts of the project, respectively.

General Mitigation

Table 4-6 General mitigation measures

General Mitigation Measures		
Ref	**Title**	**Description**
GM1	Sub-Contractor Management	The developer will develop a Supplier Evaluation procedure which will be implemented prior to tender / contracting potential sub-contractors, which will include an health, safety and environmental performance evaluation as part of the selection process. Contractors will be contractually required to take account of and implement the relevant committed mitigation measures as well as other recognised construction best practice measures including those adopted by the developer.
GM2	Construction Environmental Management Document	The developer will prepare a Construction Environmental Management Document (CEMD) which will describe the: • Construction method statements (including scope, frequency and hours) and construction processes; • Site lighting, marking and designation strategy during construction; • Detailed site layout, and micro-siting options; • Description of vessel routes; • Safety and emergency response procedures; • Construction team and management; and • Project schedule, duration and phasing. The CEMD will also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the construction period. The CEMD will be agreed with statutory consultees and periodically revised to account for emerging best practice and standard procedures.
GM3	Operational Environmental Management Plan	The developer will collate an Operational Environmental Management Plan (OEMP) to guide on-going operations and maintenance activities during the lifetime of the project. The OEMP will

General Mitigation Measures		
Ref	**Title**	**Description**
		also set out the procedures for managing and delivering the specific environmental commitments for each receptor made in the ES over the operational period. The operational monitoring will include observations of all hardware during the operational phase of the development. This will monitor colonisation of scour protection material, changes in sediment distribution and changes in biota.
GM4	Engineering Change Notification	The construction and operation of the development will be undertaken in line with the description of ES, however over the duration of detailed technical design an engineering change notification system will be implemented to ensure coherence with ES technical description. If any part of the detailed design is assessed by the developer to potentially result in technical differences to those reported in the ES, a process of consultation will be initiated with relevant statutory consultees to determine level of material changes and appropriate actions.
GM5	Pollution Control Plan (PCP)	The Pollution Control Plan will form part of the wider OEMD to manage the potential for accidental pollution, management of materials on site and response for any pollution events. The PCP will include a Waste Management Plan.
GM6	Decommissioning Programme and Plan	Must be submitted to the Secretary of State prior to installation offshore.
GM7	Construction Programme (CP)	A Construction Programme will be developed allowing stakeholders to see when key Project activities will be taking place, which could potentially enable conflicts to be avoided or offset
GM8	Construction Method Statement (CMS)	A Construction Method Statement will be developed detailing how project activities will be carried out, highlighting any possible dangers/risks associated with particular Project activities
GM9	Development Specification and Layout Plan (DSLP)	A Development Specification and Layout Plan will be generated allowing stakeholders to see the specifics of the Project, e.g. platform position and mooring arrangement position

General Mitigation Measures		
Ref	**Title**	**Description**
GM10	Operation and Maintenance Programme (OMP)	An Operation and Maintenance Programme will be developed detailing O&M procedures and timescales allowing any potential conflicts to be avoided or offset
GM11	Industry best practice and safety measures for pollution control (SEPA, 2009)	Scottish Environment Protection Agency, 2009. Control of priority and dangerous substances and specific pollutants in the water environment.
GM12	General liaison	General liaison with community during construction, any public road improvements and disruption to the road network etc.

Onshore

Table 4-7 Onshore mitigation measures

Onshore Mitigation Measures		
Ref	**Title**	**Description**
GM13	Controlling of noise from construction sites	The contractor will adopt Best Practicable Means, as defined in Section 72 of the Control of Pollution Act 1974 as a means of controlling noise from construction sites
GM14	Environmental Clerk of Works	An ECoW will be appointed to audit site activities and will advise on implementation of mitigation.
GM15	Transport Statement	Prepared in accordance with the current Transport Scotland document, Highland Council Transport Assessment Guidance, relevant Transport Scotland guidance and other guidance as necessary.
GM16	Construction Traffic Management Plan	Part of the Onshore construction method statement

Offshore

Table 4-8 Offshore mitigation measures

Offshore Mitigation Measures		
Ref	**Title**	**Description**
GM17	Sub-Contractor Management	The developer will develop a Supplier Evaluation procedure which will be implemented prior to tender

Offshore Mitigation Measures		
Ref	Title	Description
		/ contracting potential sub-contractors, which will include an environmental performance evaluation as part of the selection process. Contractors will be contractually required to take account of and implement the relevant committed mitigation measures as well as other recognised construction best practice measures including those adopted by the developer.
GM18	Cable Laying Strategy and Method Statement	The developer will submit a Cable Laying Strategy and method statement to Marine Scotland with details of: • Geophysical survey outputs; • Planned deployment corridor and micrositing options; and • Method Statement including minimum depths and protection.
GM19	Project Environmental Monitoring Programme (PEMP)	Will be submitted in writing to the Licensing Authority for written approval. Will cover: • Pre-construction, construction (if considered appropriate by the Licensing Authority) and post-construction monitoring surveys as relevant in terms of the Application and any subsequent surveys for: o birds; o marine mammals; o non-native species; o diadromous fish; o benthic communities; and o seabed scour and local sediment deposition
GM20	International Marine Contractors Association (IMCA) Guidance	IMCA Guidance will be followed by all vessels exceeding identified thresholds, to ensure correct protocol for ballast water management and discharge.
GM21	Notices to Mariners	The location and nature of Project activities and potential obstructions to mariners will be provided in Notices to Mariners In order to avoid disruption to other harbour users. These will be issued prior to the start of installation and, where necessary, during work

Offshore Mitigation Measures		
Ref	**Title**	**Description**
		at the site.
GM22	Vessel Management Plan	A vessel management plan will be developed to ensure the safe passage of vessels throughout the construction phase
GM23	Construction Safety Zone	500m around the offshore site during the installation of the mooring system and platform. Local guard vessels may be employed to manage this zone.
GM24	Operational Advisory Zone	50m around the mooring system – i.e. a radius around the anchors and platform. Fishing vessels shall not be excluded from the Advisory Zone but they shall be aware of the high risk of snagging gear.
GM25	Equipment and Training for Site Personnel	Site personnel will be suitably equipped and trained for work offshore including in firefighting, first aid and offshore survival
GM26	Marine Standard Fluids and Substances	Only recognised marine standard fluids and substances will be used in the turbine hydraulic systems
GM27	Hydraulic Fluids	Hydraulic fluids will be mostly water based, biodegradable and be of low aquatic toxicity
GM27	Turbine Sensors	Turbine sensors will detect loss of fluid and leaks, enabling maintenance operatives to reduce the risk of further leaks
GM28	Adverse weather	There will be adverse weather working policies and procedures for periods of construction and maintenance
GM29	Vessel Equipment	Vessels associated with all Project operations will carry onboard oil and chemical spill mop up kits
GM30	Vessel Activities	Vessel activities associated with installation, operation and, routine maintenance and decommissioning will occur in suitable conditions to reduce the chance of an oil spill resulting from the influence of unfavourable weather conditions
GM31	Navigational Aids	Navigational aids such as marking, lighting and an AIS transmitter shall be employed
GM32	A written scheme of investigation	To include cross-referencing with construction an environmental management plans, and inductions on

Offshore Mitigation Measures		
Ref	Title	Description
		any marine historic environment assets to avoid
GM33	Protocol for accidental discovery of cultural remains	An agreed reporting protocol for the accidental discovery of cultural remains in line with The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore Renewables Projects, http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects. pdf
GM34	Environmental Clerk of Works	An ECoW will be appointed to audit offshore activities and will advise on implementation of mitigation.

5 Environmental Impact Assessment Methodology

5.1 Introduction

5.1 Under European legislation transposed into Scottish law (Chapter 2: Legislative Context and Regulatory Requirements), certain projects are required to undertake an Environmental Impact Assessment (EIA) to determine and quantify potential impacts arising as a result of the development.

5.2 This chapter describes the general process and methodology in which such potential impacts are evaluated. Where topic specific terminology or methods are applicable, this is described in the individual chapter.

The Environmental Impact Assessment Process

5.3 EIA is an iterative process, carried out in parallel with project design, where the emphasis is on identifying and preventing potential impacts where possible and suggesting adequate mitigation measures if not.

5.2 The Design Envelope

5.4 The EIA process makes use of the Design Envelope, an approach to assessment applied where the final design cannot be confirmed ahead of the assessment. This approach is permitted in law and has been adopted in connection with other offshore and marine renewable consent applications where a level of flexibility is required in the Project Description (Chapter 4).

5.5 The Design Envelope describes the limits of design proposed for the development, providing both minimum and maximum parameters within which the realistic worst case scenario will be assessed.

5.6 The adoption of the Design Envelope approach allows a meaningful EIA to take place by defining a realistic worst case scenario that decision makers can consider in determining the acceptability, or otherwise, of the environmental impacts of a project. As long as a project's technical and engineering parameters fall within the limits of the envelope and the EIA process has considered the impacts of that envelope and provides robust and justifiable conclusions, then flexibility within those parameters is deemed to be permissible within the terms of any consent granted, i.e., if consent is granted on the assessed maximum parameters of a development, any parameters equal to or less than those assessed is permitted to be constructed.

5.7 The full project description is described in Chapter 4: Project Description.

5.3 Approach to Assessment

5.8 Broadly, the IEEM Guidelines for Ecological Impact Assessment (IEEM 2010) have been followed. To add clarity, the terms impact and effect are not used interchangeably as seen in the Guidance but rather hold clear and consistent meaning in this EIA process and ES.

Defining impacts and effects

5.9 In this Environmental Statement (ES), an ***effect*** is defined as a physical change in the environment as a result of an action or activity related to the development and an ***impact*** is defined as the consequence of that change. For example, dredging the seabed resulting in increased suspended sediment locally would be considered an effect, the impact of this would depend on the particular receptor but may include smothering of sessile benthic organisms.

5.10 The following impacts are considered and are described in Table 5-1:

- Direct;
- Indirect; and
- Cumulative.

Table 5-2: Quantification of impact

Impact	Description	Example
Direct impacts	Those caused by physical changes to the environment caused by the Project.	Localised changes to sediment movement or habitat loss due to the placement of the foundations may be considered as direct impacts.
Indirect impacts	Those caused as a result of a direct impact.	Habitat loss caused by the placement of foundations may cause the displacement of a species from the area and have an impact on commercial fishing.
Cumulative impacts	Impacts arising as a result of the interaction between this and similar projects.	Habitat loss in the project site may combine with habitat loss from other projects resulting in an impact to specific protected benthic species.

Pathway approach

5.11 In order for there to be an impact, there must be a pathway between the ***effect*** and the ***receptor*** i.e. a route along which the effect can be transmitted. Where there is no pathway, the potential impact is "scoped out", this process is described and undertaken in the Scoping Report and subsequent Scoping Opinion, both are available to download from the Marine Scotland website (http://www.gov.scot/Topics/marine/Licensing/marine/scoping).

Methods of prediction

5.12 For each receptor, potential ***effects*** are identified and the significance of ***impact*** is assessed for each stage of the project lifecycle and significance attributed relative to the existing or baseline conditions.

5.13 Significance is attributed by considering the magnitude of effect and the vulnerability of the receptor as follows:

Defining magnitude of effect

5.14 Magnitude of effect is based on the following four criteria and is described in Table 5-2:

- Spatial extent (geographic range);
- Duration (how long the effect lasts);
- Frequency (how often the effect occurs); and
- Severity (the degree of change).

5.15 The parameters will be specific to each receptor.

Table 5-3: Magnitude of effect

Characteristic	Categories	Description
Spatial extent	Negligible Low Medium High	The geographic area of influence where the effect is noticeable against background variability where negligible corresponds to the smallest possible spatial extent and high corresponds to the most significant spatial extent i.e. the furthest
Duration	Negligible Low Medium High	The temporal extent of the effect is noticeable against background variability
Frequency	Negligible Low Medium High	How often the effect occurs
Severity	Negligible Low Medium High	The degree of change – toxicity, mass, volume, concentration

Vulnerability of receptor

5.16 Vulnerability is defined as the susceptibility of a given receptor to a change in baseline conditions and is quantified using the following four factors (Table 5-3):

- Adaptability (how well a receptor can avoid or adapt to an effect). High adaptability results in low vulnerability;
- Tolerance (the ability of a receptor to be either affected or unaffected). High tolerance results in low vulnerability;
- Recoverability (how well a receptor recovers following exposure to an effect). High recoverability results in low vulnerability; and
- Value (the scale of importance). High value results in high vulnerability.

5.17 The parameters will be specific to each receptor and are allocated in reverse to those associated with magnitude of effect; high adaptability is better (i.e. less vulnerable) than negligible adaptability.

Table 5-4: Vulnerability of receptor

Characteristic	Categories	Description
Adaptability	Negligible Low Medium High	How well a receptor can avoid or adapt to an effect. Negligible adaptability represents an organism which cannot adapt at all, or does so very slowly to the potential environmental change whereas high adaptability represents an organism which can adapt rapidly.
Tolerance	Negligible Low Medium High	The ability of a receptor to be either affected or unaffected (temporarily and/or permanently) by an effect.
Recoverability	Negligible Low Medium High	A temporal measure of how well a receptor recovers following exposure to an effect.
Value	Negligible Low Medium High	The scale of importance (for example; level of conservation status and keystone species), rarity (for example; how much of it exists relative to the potential area impacted) and worth (for example, it's socioeconomic, cultural and amenity value).

Significance of impact

5.18 Following identification of sources, effects, receptors and impacts, an assessment of the significance of the impact can be undertaken, relevant to specific receptors. Significance is determined through consideration of both the magnitude of effect and the vulnerability of the receptor (Table 5-4). The assessed level of magnitude and vulnerability are put into a matrix to determine the overall level of significance of the impact on a given receptor.

5.19 All impacts will be measured to identify a degree of "significance". The classifications for magnitude and vulnerability will be defined on a topic by topic basis, i.e., the level or limit that is considered to be 'high', 'moderate', 'low' or 'negligible'. Through this, significance can be defined through expert judgement for specific topics.

5.20 Those impacts assessed as 'moderate' or 'major' significance are considered to require mitigation measures to be applied.

Table 5-5: Significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

5.21 Overall significance can be further qualified by attributing uncertainty. For example, the use of potentially unreliable or incomplete data sets could skew the assessment. The overall significance however, does not change; rather a note of caution is applied to the conclusions. In all assessments, professional judgement is applied to follow the process to produce the overall assessment outcome.

Receptor specific impact assessment

5.22 Some receptors are subject to specific assessment methodologies as defined by government or regulatory bodies, where this is applicable, detailed methodologies will be described in the relevant chapter. Specific chapters include Chapter 15: Seascape, Landscape and Visual Amenity, Chapter 16: Archaeology and Cultural Heritage, Chapter 18: Socio-economics, Recreation and Tourism, Chapters 25: Onshore Archaeology and Cultural Heritage and Chapter 27: Landscape and Visual Amenity.

5.4 Cumulative Impact Assessment

5.23 Cumulative Impact Assessment (CIA) is necessary to understand the potential impact arising as a result of interaction between this Project and others. This interaction may occur between projects at great distances if the receptor considered is migratory or wide ranging, or receptors originate from multiple sites.

5.24 CIA will follow the above approach but, due to the different timescales, availability of data and potential lack of information share, the assessment will be more qualitative in nature and subject to greater uncertainty. Where timelines are unconfirmed, the worst case approach has been adopted.

5.25 The ES intends to consider projects which are "reasonably foreseeable" such as:

- Existing development either built or in construction;
- Approved development, awaiting implementation; and
- Proposals awaiting determination within the planning process with design information in the public domain.

5.26 The projects considered in each cumulative assessment are described in the specific chapter as the potential for interaction is specific to each given receptor. The projects which may be considered in this assessment are detailed below and shown on Figure 5-1:

- Orkney-Caithness interconnector cable;
- HIE Dounreay Demonstration Centre (DDC);
- Brims Tidal Array, Brims Ness;
- MeyGen, Inner Sound;
- DP Energy, Westray South;
- Scotrenewables, Lashy Sound;
- The decommissioning of Dounreay and HMS Vulcan; and
- Onshore wind farms on Caithness (not shown on this figure, see Chapters 15 and 27).

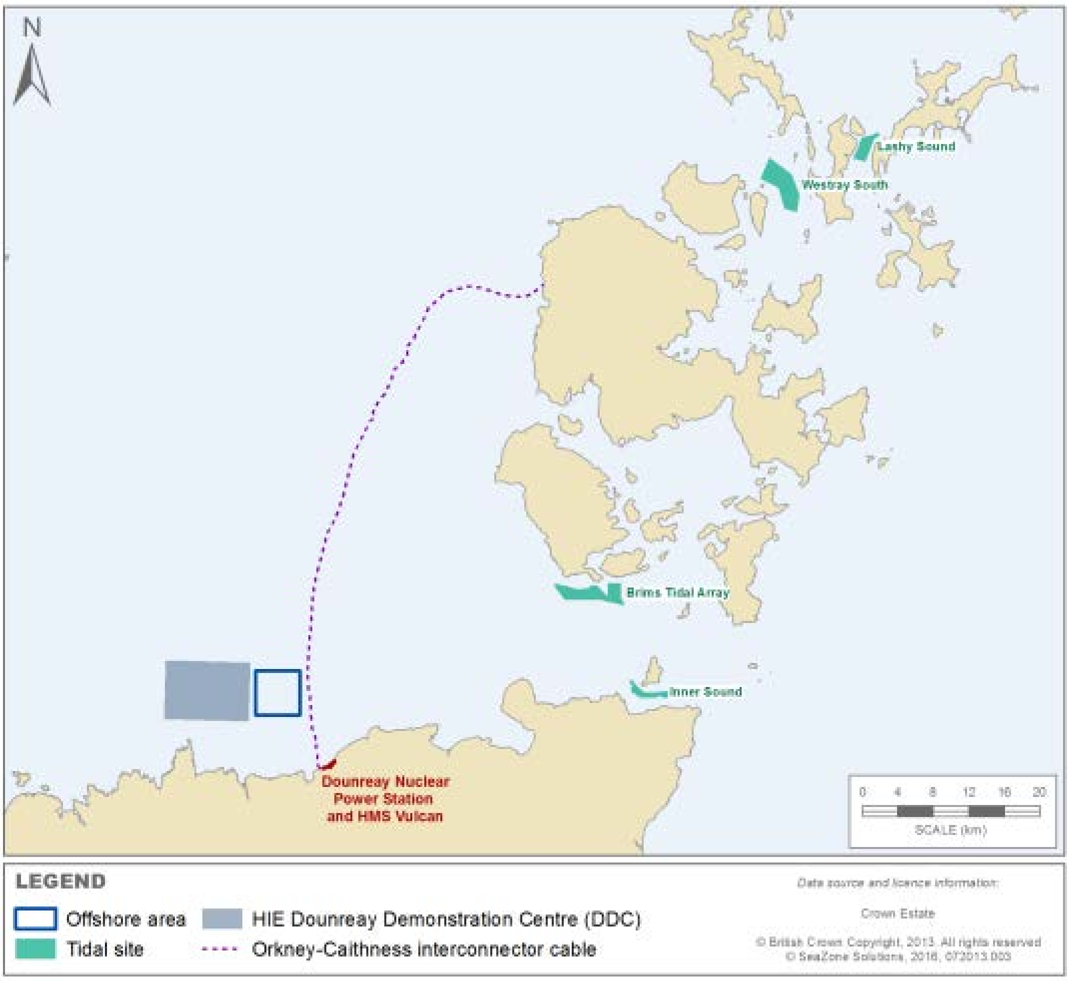

Figure 5-2 Cumulative projects

5.5 Transboundary Impacts

5.27 Due to the location of the Dounreay Trì Project, there are no transboundary impacts foreseen and this was scoped out of the assessment in the Scoping Phase.

5.6 Mitigation

5.28 Mitigation can be applied project wide by way of defined control measures designed to reduce the potential for risk or impact arising from overall site operations or can be applied specifically to reduce the impact arising from a single event. For example, the adoption and implementation of a Pollution Control Plan will reduce the risk of project wide events which may give rise to pollution; such a measure would be considered a project mitigation.

5.29 Mitigation is applied following the initial impact assessment, impacts are identified and measures are found to reduce the potential impact. Mitigation measures will be applied to potential impacts until they are either reduced to tolerable levels i.e. not significant, or they have been reduced as far as practicable. The residual impact is that which remains after all mitigation has been applied. Should an impact post mitigation still be assessed as significant then an alternative should be explored.

5.30 A summary of impacts is presented in each chapter and collectively in Chapters 19 and 28.

5.7 Authors and expertise

5.31 This Environmental Statement was compiled by drawing upon the expertise and input from the following experienced contractors (Table 5-5).

Table 5-5: EIA authors and expertise

Chapters	Title	Author(s)
1-4	Front end of ES	RES, Hexicon and Atkins
5	EIA methodology	Aquatera
6	Physical and Coastal Processes	Aquatera
7	Intertidal Ecology	Aquatera
8	Benthic and Shellfish Ecology	Aquatera
9	Fish Ecology	Aquatera
10	Marine Mammals	SMRU
11	Marine Ornithological	HiDef
12	Commercial Fisheries	Aquatera
13	Shipping and Navigation	Aquatera
14	Aviation and Radar	Osprey
15	Seascape, Landscape and Visual Amenity	Horner + Maclennan
16	Offshore Archaeology and Cultural Heritage	ORCA
17	Other Users Of The Marine Environment	Aquatera
18	Socio-Economic, Recreation and Tourism	Aquatera
21	Geology and Hydrology	Energised Environments

Chapters	Title	Author(s)
22	Land Use, Agriculture and Soils	Energised Environments
23	Terrestrial Ornithology	Caledonian Conservation
24	Terrestrial Ecology	Caledonian Conservation
25	Onshore Archaeology and Cultural Heritage	ORCA
26	Air Quality	Affric
27	Landscape and Visual Effects	Horner + Maclennan
Annex 2.1	Habitats Regulations Assessment	Pelagica

VOLUME 2: Offshore Environment

6 Physical and Coastal Processes

6.1 Introduction

6.1 This chapter provides an overview of the offshore physical environment within the offshore Study Area and export cable corridor. This chapter describes the key aspects of the physical environment including bathymetry, geology, sediment characteristics and coastal water quality and assesses the potential impacts arising from the development of the proposed Dounreay Trì Project – the 'Project' - during the construction, operation and maintenance and decommissioning phases has been carried out and the findings are presented in this chapter.

6.2 This chapter describes the potential impacts that the Project may have on the offshore physical environment in the offshore site and export cable corridor (Figure 1-1). These potential impacts are identified and assessed and, where required, the mitigation measures which will be implemented to prevent, reduce or offset any potential adverse effects.

6.3 The onshore physical environment is not considered in this chapter, being instead addressed in Chapter 21: Geology and Hydrology, and Chapter 22: Agriculture, Soils and Land Use.

6.2 Study Area

6.4 The offshore site (the 'Site') comprises a 5km by 5km offshore area which is located approximately 6 km from the north coast of Scotland, at its closest point, and an export cable corridor running from the offshore site to the coast immediately to the west of the Dounreay Restoration fence line (Figure 1-1). The 'Study Area' comprises the offshore site and export cable corridor only as impacts are considered to act in the immediate vicinity of the proposed development only.

6.3 Legislation and Guidance

6.5 There is no specific legislation which is applicable to this chapter.

6.6 The Scottish Environment Protection Agency (SEPA) Marine development and marine aquaculture planning guidance (SEPA 2014) advises that water quality and potential pollution risks should be taken into account in the Environmental Statement (ES) and that the principles included in the CIRIA C584 "Coastal and marine environmental site guide" should be considered. Sensitive water uses, such as bathing waters and shellfish growing waters, and associated potential impacts should be assessed as should proximity to existing discharges and designated areas i.e. estuarine abstractions and cooling water discharges.

6.7 The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) has developed guidance detailing the effect of wind farms on the physical environment (CEFAS 2004). This guidance, referenced in Chapter 5: Environmental Impact Assessment Methodology of the document, is applicable to this development and draws attention to potential changes in scour, sediment mobility and wave regime as a result of the Project.

6.4 Sources of Information

6.8 A review was undertaken of the existing literature and data relating to the physical environment in the Study Area and was used to give an overview of the existing environment. The major data sources used in the preparation of this chapter are listed below in Table 6-1.

Table 6-6 Data sources used in the preparation of this chapter

Source	Content
British Geological Survey. Area Maps and Reports (BGS, 2015a)	Geological charts
British Geological Survey. Geology of Britain viewer (BGS, 2015b)	Geological charts
British Geological Survey. Nirex Geological Archive - Browsing (BGS, 2015c)	Geological charts
British Oceanographic Data Centre. Oceanographic and Marine Data (BODC, 2015)	Oceanographic charts and information
United Kingdom Hydrographic Office (UKHO) Admiralty Chart data and UKHO INSPIRE bathymetric data	Bathymetric data
Soil Survey of Scotland, Staff. (1981). Soil maps of Scotland at a scale of 1:250 000. Macaulay Institute for Soil Research, Aberdeen. Scotland's Soils. 2015. Soil maps - Scotland's Soils. [ONLINE] Available at: http://www.soils-scotland.gov.uk/data/soil-survey	Soil data and classification
Seazone. HydroSpatial One data (Seazone, 2015)	Bathymetric data

6.5 Surveys and Studies Carried out to Date

6.9 A multibeam survey of the north coast of Scotland between the Kyle of Tongue and 8 miles west of Thurso was surveyed by the Marine Scotland Science vessel, the MRV Scotia in 2014. Video-based monitoring of the benthic environment located in the same area was also conducted in 2014.

- MSS (2014). Marine Scotland Science Farr Point Bathymetry Survey http://www.gov.scot/Topics/marine/science/MSInteractive/datatype/Bathymetry/data/farr-point; and
- Moore, C.G. 2015. Biological analyses of underwater video from research cruises in marine protected areas and renewable energy locations around Scotland in 2014. Scottish Natural Heritage Commissioned Report No. 819.

6.6 Consultation

Pre-application consultation

6.10 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2nd February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date and included the following relevant information:

6.11 DSRL Senior Environmental Specialist:

- Confirmed that beach surveys for historic radioactive particles are carried out approximately every two weeks per month, throughout the year with surface driven detectors but no ploughing is undertaken;
- Seabed monitoring has ceased; and

- The Dounreay foreshore is monitored with sediment sampling and water sampling carried out several times per month.

Scoping feedback

6.12 The following stakeholder responses have been received specifically relating to this chapter (Table 6-2).

Table 6-7 Summary of scoping responses

Consultee	Comment	Relevance / Cross Reference
SEPA	We are generally content with the proposed scope for historic radioactive contamination, the only issues we previously gave specific marine advice on, however we do not agree that monitoring can automatically be ruled out at this stage; it will be dependent on the results of the initial assessment.	See Section 6.12 potential cable landfall in Sandside Bay removed from options under consideration.
SEPA	As outlined previously we ask that the application includes: (1) an assessment outlining the risk of disturbance of particles currently within the sediment and methods to minimise this risk,	See Section 6.9 and 6.10
	(2) detailed information on the route of the cables within the marine environment,	Cable corridor detailed on Figure 6-1
	(3) information on the methods of laying cables, including information on the depth of laying within the sediment, with a justification as to why the method chosen is acceptable,	See Chapter 4: Project Description
	(4) information on any monitoring proposals.	See Chapter 19 and Section 6.14
Scottish Government Planning	The potential for alteration of sediment dynamics and tidal flows/fluxes from the presence of anchors on the seabed and presence of mooring lines in the water column is noted. The potential for impacts such as scouring, abrasion and deposition from the presence of anchors and mooring lines on the seabed may also occur and should be addressed in the ES, alongside proposals to implement appropriate monitoring, and where necessary, mitigation. It is also noted that the Eurosion 2000 survey identifies accretion in Melvich Bay located to the west of the proposed landfall site.	See Section 6.9 and 6.10
Scottish Government	Disturbance of contaminants in soils and seabed sediments during pin piling, cable	See Section 6.9 and 6.10

Consultee	Comment	Relevance / Cross Reference
Planning	burial, landfall excavation works and onshore excavation works should be considered in the EIA. Given the proximity of the offshore site to the Dounreay Nuclear Power Plant, the potential disturbance of seabed sediments containing radioactive particles in the construction and decommissioning stages should be factored into the EIA. The ES should explore the potential for secondary or indirect effects associated with the disturbance of contaminated sediments; particularly on benthic ecology.	See Chapter 8: Benthic and Shellfish Ecology
SNH	Analysis and potential impacts There is some uncertainty about the usefulness of the Marine Scotland's 2014 bathymetry survey. Since it is "insufficient to micro-locate the project" (section 6.18), it may be insufficient to inform assessment of effects such as seabed scour, changes to currents, and removal / creation of seabed features. This undermines the proposed assessment method "careful examination of the MS data" (section 6.41 [of the NSH response]). If the MS data is not of sufficient quality to inform the impact assessment, we advise that further bathymetry survey may be required.	See Section 6.8
SNH	Potential disruption to intertidal beach dynamics by landfall trenching is not mentioned in Table 6-1 [of the NSH response]. This could affect the notified coastal habitats of Sandside Bay SSSI, and although the effects may be temporary, this should be assessed in the ES. We advise, therefore, that this potential impact should be scoped in.	Potential cable landfall in Sandside Bay removed from options under consideration.
SNH	Potential cumulative impacts with the HIE Dounreay Demonstration Centre should be scoped in.	See Section 6.16

6.7 Assessment Methodology

6.13 The overarching approach to the environmental assessment is described in Chapter 5: Environmental Impact Assessment Methodology. This section sets out the specific criteria which have been used to evaluate the impacts of the proposals on the offshore physical environment. The assessment is based on an understanding of the vulnerability of the current baseline to changes resulting from project construction and operation and the magnitude of the effects from these activities.

6.14 The scoping process (Dounreay Trì Limited, 2015) identified that any potentially significant impacts would be primarily associated with the installation and physical presence of the project infrastructure modifying water currents and altering sediment dynamics potentially leading to areas of seabed scour and changes in water and sediment quality. Due to the fact that this is a single demonstration platform (i.e. small scale) the following potential large-scale impacts were scoped out of the assessment:

- Impacts on geology;
- Impacts on coastal processes;
- Impacts on bathymetry; and
- Impacts on the wind and wave regime in the area.

Design envelope considerations

6.15 As described in Chapter 5: Environmental Impact Assessment Methodology, the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst-case scenario for that specific receptor.

6.16 The project description is set out in Chapter 4: Project Description. Design assumptions about the project envelope (the Design Envelope) are summarised in

6.17 Table 6-3. Specific assumptions relevant to the assessment in this chapter are:

- Foundation/anchor type;
- Platform footprint;
- Scour protection;
- Export cable burial depth; and
- Volume of dredged material.

6.18 Dredging and cable installation has the potential to cause the greatest impact on the offshore physical environment. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

Table 6-8 Design envelope parameters specific to the physical environment offshore

Design Envelope Parameter	Value / Description
Installation of drag anchors	A maximum of 16 embedment anchors (9 m wide) will be deployed. Anchors will be dragged to penetrate 10 m - 15 m into the seabed leading to maximum seabed disturbance area of 100 m by 9 m for each anchor installation (0.014 km^2). Scour protection may need to be installed should anchors not reach their target depth. Protection would consist of crushed rock extending out to a maximum a radius of approximately 20 m from the anchor and to a depth of approximately 5 m (0.020 km^2).
Creation of clump weight gravel bed (Including dredging)	A 70 m x 70 m area of seabed (0.005 km^2) will be dredged to depth of 5 m immediately below the platform and filled with gravel to support platform clump weight that will rest on seabed during installation before being raised. Excavated sediments shall be disposed of at a licenced onshore site.
Export cable installation	The device will be connected to the shore via a 13.8 km long subsea cable (maximum). It is estimated that 80% will be buried to 1 m - 2 m using a ploughing and/or jetting installation technique. The maximum width of the cable trench is estimated as 8 m. The remainder will require protection (up to 2.8 km) in form of concrete mattresses or rock dump. The maximum width of the cable protection is also estimated as 8 m. The maximum depth of cable protection would be 0.5m. The maximum volume of cable protection would therefore be 11.2km^3. The maximum seabed footprint of the cable is therefore estimated as 13.8 km x 8 m (0.11 km^2).

Design Envelope Parameter	Value / Description
Presence of embedment anchors	Scouring from turbulence: The worst case scenario is for each anchor to be protected by 2 m high rock dump extending 20 m from the anchor location. The protection will modify local hydrodynamics and may lead to areas of scouring and increased deposition in the vicinity. Effects are conservatively estimated to be restricted to within 5 m of the rock dump.
Presence of export cable (including dynamic cable)	Physical abrasion: A small anchor or clump weight shall stabilise the export cable touchdown. Up to 50 m of cable may interact with the seabed due to the actions of waves and tidal variations. Assuming a scour width of 5 m, the approximate area of potential seabed scouring is 250 m^2. Scouring from turbulence: The physical presence of the cable and protection (up to 8 m in width) will modify local hydrodynamics and may lead to areas of scouring and increased deposition in the vicinity. Effects are conservatively estimated to be restricted to within a 5 m either side of the protected cable.
Presence of mooring lines	Physical abrasion may occur on the seabed in the vicinity of mooring lines located near the seabed. For the purposes of the assessment it is assumed that up to 75% of each mooring line (800 m in length) could come into contact with the seabed. Assuming a scour area of 5 m either side of the line the total approximate area of scouring for eight mooring lines is 0.048 km^2.
Vessels used during construction, operation, maintenance and decommissioning Equipment carrying lubricant that has potential to leak (platform)	1 medium size cable laying vessel (cable installation) 1 dive support vessel (platform installation) 4 Anchor Handling Tug Supply (AHTS) vessels (platform installation) 1 ocean going tug (anchor installation) 1 barge (scour protection installation) 1 crew boat/ specialised vessel (to be used in the case of maintenance/ repair)

6.19 Impacts in the decommissioning phase will include temporary disturbance from the removal of the export cable and platform anchors will be comparable to those impacts assessed in the construction and operational phases.

Methods of prediction

6.20 Potential effects are identified and the significance of impact is assessed for each stage of the project lifecycle and significance attributed relative to the background conditions.

6.21 A matrix approach has been used as a tool to inform the impact assessment, while expert judgement has also been used following best practice, best available understanding and relevant EIA guidance (SNH, 2013).

6.22 Significance is characterised using the following attributes: Magnitude of Effect and Vulnerability of Receptor which combine to give an overall level of Significance of Impact.

Magnitude of effect

6.23 The magnitude of potential changes in water currents and sediment dynamics (and associated effects on water and sediment quality) is based on the spatial extent and severity of the effect, its duration and predicted frequency. The characteristics of magnitude of effect are defined in Table 6-4:

Table 6-9 Magnitude of effect for offshore physical environment

Magnitude of Effect	Description
High	Total loss of, or alteration to, key features of the baseline resource such that post development characteristics or quality would be fundamentally and irreversibly changed.
Medium	Loss of, or alteration to, key features of the baseline resource such that post development characteristics or quality would be particularly changed.
Low	Small changes to the baseline resource, which are detectable but the underlying characteristics or quality of the baseline situation would be similar to pre-development conditions.
Negligible	A very slight change from baseline conditions, which is barely distinguishable, and approximates to the 'no change' situation.

Vulnerability of receptor

6.24 The vulnerability of the receptor is also taken into account. For offshore physical receptors the sensitivity analyses takes into account the scarcity and the relevance of the physical environment as a habitat for potentially important species (see Chapter 8: Benthic and Shellfish Ecology). The vulnerability of receptors (and effects on them) also takes account of other attributes including their adaptability, tolerance to change and recoverability. A set of guideline criteria for determining vulnerability are set out in Table 6-5.

Table 6-10 Vulnerability of offshore physical receptors

Vulnerability	Description
High	The physical environment is fragile and any additional disturbance is likely to cause a fundamental change in existing characteristics. Physical environment supports species and/or habitats of international/national importance with restricted distribution, limited range or threatened populations.
Medium	The physical environment is reasonably robust and can absorb moderate levels of disturbance without significantly changing the overall characteristics of the area.

Vulnerability	Description
	Physical environment supports species or habitats of regional/local importance.
Low	The physical environment is robust and/or subject to significant disturbances from natural processes. Physical environment supports species or habitats with low importance.

Significance of impact

6.25 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact. The significance of impact is based on best practice and expert judgement. While there is no specific guidance for other marine users, any impacts of 'moderate' or above are considered significant, in accordance with EIA guidance (SNH, 2013). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor. The evaluation of impact significance is informed by the matrix presented in Chapter 5: Environmental Impact Assessment Methodology and by the professional judgement of the assessment team.

6.8 Data Gaps and Uncertainties

6.26 Marine Scotland Science conducted a bathymetric survey in the development area in 2014 (MSS, 2014a). The dataset does not allow accurate interpretation of small-scale seabed features required for micro-siting of seabed infrastructure but is considered sufficient for this assessment as the potential impacts are considered to be observable at a more broad-scale level rather than at a small scale. The Applicant has commissioned a geophysical survey including sub-bottom profiling and an unexploded ordnance survey which is set to commence in September 2016. The results of this survey will assist in identifying a location for the platform, within the offshore site and identifying a cable route, within the cable corridor.

6.9 Description of the Current Environment

Geology

6.27 The offshore site and cable route are typically made up of Pre-Quaternary bedrock covered by varying depths of glacier-derived material deposited during the Pleistocene epoch and sediments laid down during sea transgression during the early Holocene. Present sediment input from the land is small and most seabed sediments are reworked from older deposits (Barne, *et al.* 1996).

6.28 In Caithness and eastern Sutherland the rocks tend to decrease in age from south-west to north-east. The Caledonian metamorphic basement intruded by large igneous intrusions (Strath Halladale granite, Reay diorite and Helmsdale granite) is overlain by Lower Devonian (lower old red sandstone) conglomerates and breccia. These pass up into the Middle Devonian (middle old red sandstone) lower and upper Caithness flagstone groups separated by the Achanarras Fish Bed. The uppermost rock sequence is the fluvial sandstones with occasional aeolian sand of the John O'Groats and Dunnet Head sandstone possibly of upper Devonian age (upper old red sandstone).

6.29 The shore sections are often complicated by many small faults and high cliffs add to the problems. Several major faults have been traced, mainly from the coast into the interior and confirmed by seismic section. Smaller faults undoubtedly exist but are not exposed. These faults include: normal faults, reverse faults and wrench faults. Because of the abundance of these faults simple geometry cannot be used to estimate stratigraphic thicknesses.

6.30 The Reay area lies on the western margin of the Orcadian Basin. The Devonian sedimentary rocks (Flagstones) rest on the crystalline basement rocks. The Reay Landfall also lies south of the margin of the offshore West Orkney Basin of Permo-triassic and younger sedimentary rocks resting on the Devonian and basement rocks. This basin contains oil fields west of Shetland.

6.31 Red Point Coast Special Site of Scientific Interest (SSSI) to the west of Sandside Bay is immediately adjacent to the export cable corridor. This site is listed for (among others) geological interests including Quaternary geology and geomorphology and non-marine Devonian stratigraphy.

Coastal environment

6.32 The offshore cable landing search area extends from the western edge of the Dounreay Nuclear Power Plant site to the eastern side of Sandside Bay. The height of the clifftop at Dounreay on the eastern boundary of the potential cable landing area in the vicinity of Dounreay Burn is approximately 6 m. The cliff height gradually increases to around 9 m at White Geos at the eastern entrance to the Bay then reducing to around 4 m in the sand dunes at the outfall of the Burn of Isauld at the western extent of the cable route.

6.33 Sandside Bay, located immediately to the west of the potential cable landing location is a north-facing pocket beach composed of sandy sediments originating from ancient glacial deposits. The sheltered nature of the beach limits sediment transport within the bay although there is some disturbance during storm events and some wind driven movement of sediments that have led to the formation the extensive dune systems present behind the beach (Ramsay and Brampton, 2000).

Bathymetry

6.34 Bathymetry was assessed from regional nautical charts and multibeam echo sounder data collected in the area (MSS, 2014a). The multibeam data (Figure 6-1) provided higher resolution bathymetric information and it was possible to interpret this data for the purpose of the assessment.

6.35 Water depths in the offshore Site are in the range 60 m – 110 m. Water depth is greatest in the northwest corner of the offshore area, and decreases gradually towards the southeast corner.

6.36 Moving south along the export cable corridor the seabed shelves gently to the north-west at approximately 0.5°. Although not clear from data available for this location, submarine cliffs have been observed in the Orkney/North-east coast area at water depths of approximately 10 m and 45 m related to stillstands occurring at around 7,000 and 9,500 years BP respectively. The high resolution profile of the export cable corridor indicates the presence of the 45 m cliff structure although the steepness of the slope was not able to be accurately determined.

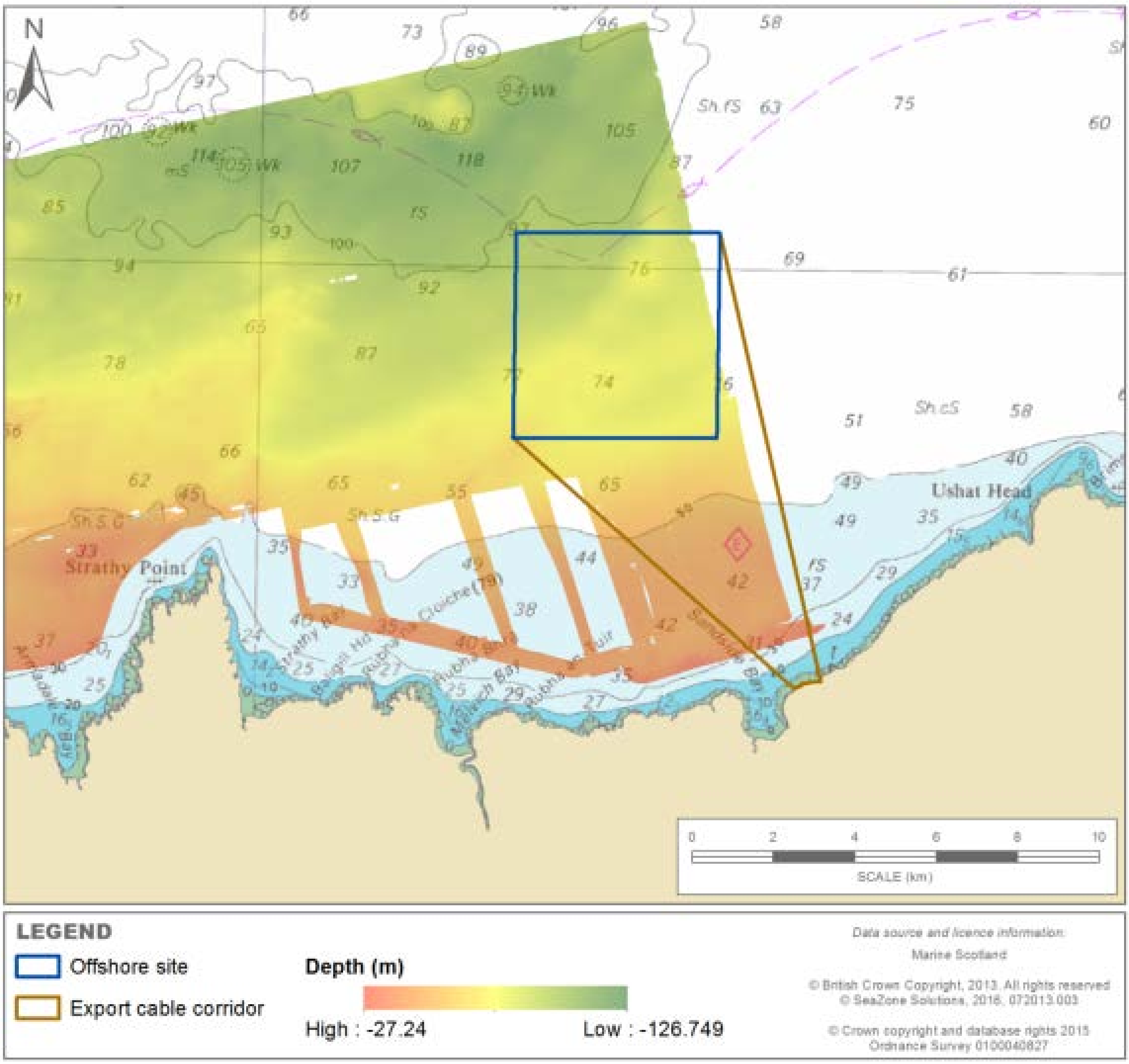

Figure 6-1 Seabed bathymetry

Seabed sediments, sediment thickness and sediment transport

6.37 The National Marine Landscape types present within the offshore site are 'shelf sand plain' in the northern offshore section of the site and 'shallow sand plain' in the south. 'Shallow sand plain' extends inshore to the coast along the potential cable route.

6.38 Geological surveys of the area (BGS, 1989) indicate that the surface sediments are mainly composed of sand and slightly gravelly sand (Figure 6-2). Seabed video survey collected in the offshore area (Moore, C.G. 2015) indicated the presence of a predominantly sandy seabed with areas of slightly gravelly sand. Similar sediments were recorded along the export cable corridor however in shallow water areas (<40 m depth) areas of mixed coarser sediment types and rocky outcrops were also recorded.

6.39 The thickness of sediment across the majority of the Site is greater than 2 m (BGS, 1987). Sediment thickness decreases to approximately 1m in the southernmost part of the offshore site, at its shallowest reaches approximately 0.1m. Sediment thickness decreases to 0m towards the coast. Expert interpretation of ripple marks and dunes apparent on the survey data (MSS, 2014a) indicate that locally considerable variation in the sediment thickness exists. Further review of data covering the project area demonstrates that the sediments below wave base are current rippled sands and silts which have been derived from dynamic weathering of the Boulder clay and in particular the shelly till member. A glacial moraine seabed feature runs diagonally across the offshore area from northwest to southeast.

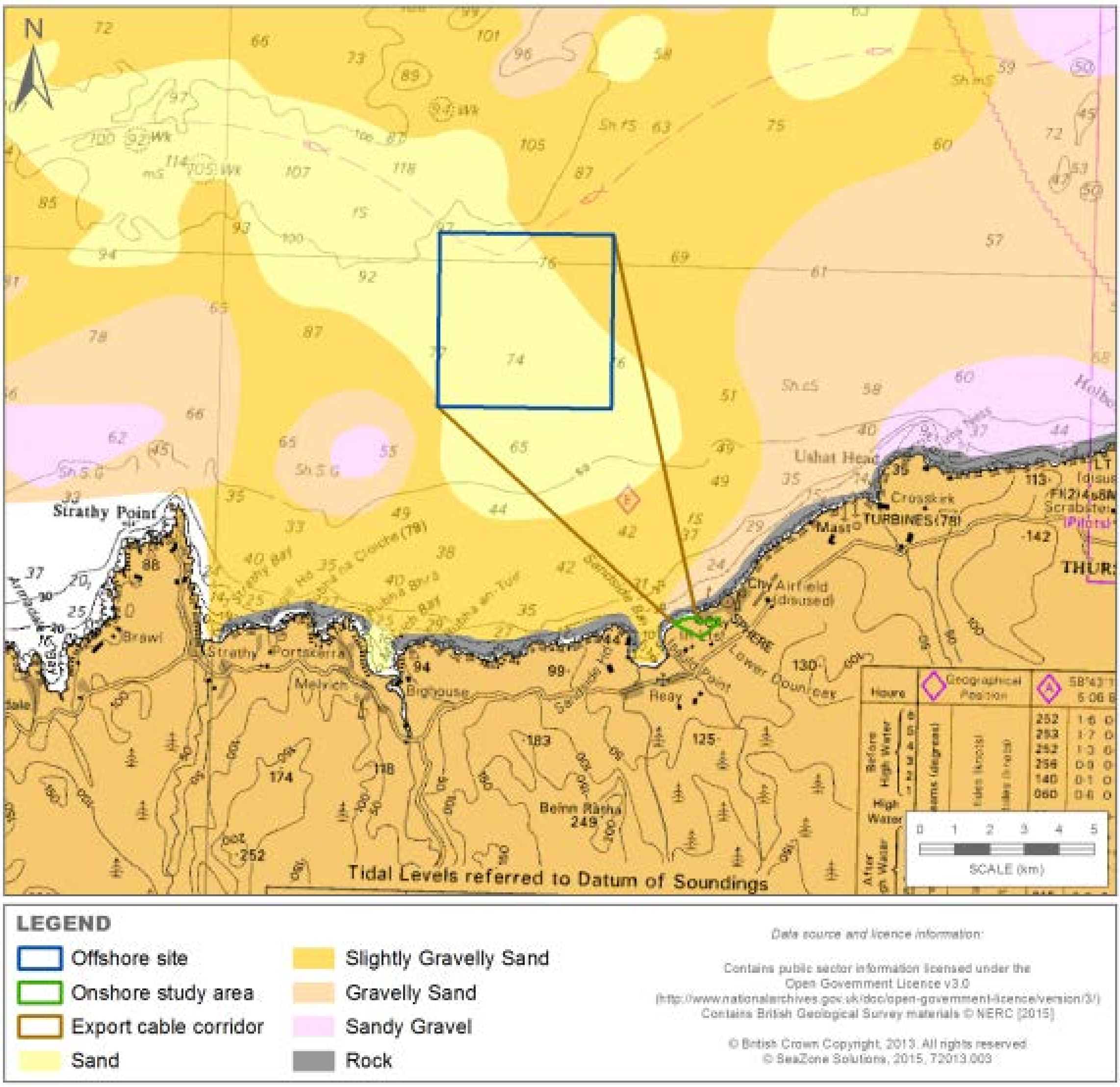

Figure 6-2 Surface sediments in offshore site and export cable corridor

Physical processes

6.40 Summary statistics describing the metrological and hydrodynamic regime for the Project area were obtained from the Atlas of UK Marine Renewable Energy. Average wind speeds at both 80 m and 100 m elevation are greatest at distances furthest offshore and are highest in the western half of the offshore Site (7 m/s - 10 m/s and 8 m/s - 10 m/s at 80 m and 100 m respectively). Lowest wind speeds for both elevations are present in the south east sector of the offshore Site (7 m/s -8 m/s). Similar wind speeds are present in the south west sector of the offshore Site at 80 m, but are greater at 100 m elevation (to 8 m/s - 9 m/s). Wind speeds show seasonal trends with highest speeds recorded in the winter months and the lowest in summer.

6.41 Annual mean significant wave height across the majority of the offshore Site is 1.75 m - 2.0 m (ranging from approximately 1.25 m in the summer months to 2.5 m in winter). To the south of the Dounreay Trì Project Area annual mean significant wave height values are in the range 1.5 m – 1.75 m decreasing further closer to shore.

6.42 A summary of the wave and swell characteristics found off the north coast of Scotland was included in a study of the area between Cape Wrath and Duncansby Head (Ramsay and Brampton, 2000). It is reported that the dominant wave direction in the area is between 240° and 320° which accounts for over two thirds of the offshore wave climate. A similar pattern is observed for the swell direction (50% originating from between 300° and 340°). The expected extreme significant wave heights were also modelled for the area and the values calculated for 1, 10 and 100 year return periods are 10.24 m, 12.39 m and 14.42 m respectively. The actual wave regime within the project area will depend on local bathymetry and will also be influenced by sheltering effects from the coastline and headlands.

6.43 The annual mean spring tidal range across the offshore Site is 3.5 m – 4.0 m, with a corresponding neap range of 1.5 m – 2.0 m. Tidal velocities range from approximately 0.25 m/s – 0.75m/s during spring tides and 0.1 m/s – 0.5 m/s for neap tides.

Water quality

6.44 The north coast of Scotland is influenced by the North Atlantic Drift current, which carries oceanic water north and east through the Faroe - Shetland Channel to the Norwegian coast. This flow exerts a relative warming influence in winter and a cooling influence in summer. Average temperatures along the north coast are 12.5°C – 13.0°C in summer and 6.5°C – 7.0°C in winter. The salinity of the sea in the coastal area between Cape Wrath and the Pentland Firth (34.75 parts per thousand) is slightly below that of normal sea water (35 parts per thousand), owing to the mixing of Atlantic water with low-salinity coastal waters (Barne *et al*., 1996).

6.45 The chemical composition of the water present in the proposed development area would be expected to be similar to that recorded for typical unpolluted coastal/offshore North Sea water. The Scottish Environmental Protection Agency (SEPA) is responsible for producing and implementing River Basin Management Plans (RBMPs) under the Water Environment and Water Services (Scotland) Act, 2003. River basins comprise all surface waters (including transitional (estuaries) and coastal waters) extending to three nautical miles seaward from the Scottish territorial baseline. Any proposed development within these waters must have regard to the requirements of the Water Framework Directive to ensure that all surface water bodies achieve 'Good Ecological Status (GES)' and that there is no deterioration in status. Five classifications of water quality status are defined: High (near natural), Good, Moderate, Poor and Bad; and each classification is accorded a degree of confidence (high, medium or low) in the overall quality assessment. The offshore Site and export cable corridor is located within the Strathy Point to Dunnet Head RBMP area. In 2012 SEPA analysis identified no significant pressures on this water body and classified it as having an overall status of Good with High confidence (SEPA, 2014).

6.46 The closest designated bathing waters are at Dunnet Bay and Thurso, which are about 15 km – 25 km east of offshore Site and export cable corridor. Both sites have consistently passed the mandatory standards set out in the EC Bathing Water Directive and are currently classified as excellent and sufficient respectively (SEPA, 2015).

Sediment quality

6.47 With the exception the presence of historic radioactive seabed particles described below, there are no other known sediment quality issues associated with the offshore Site or within the export cable corridor. A recent review of the status of the marine environment of the northern coastal area of Scotland identified no significant concerns relating to hazardous substances, eutrophication, oil/chemical spills, algal toxins and microbiology of bathing and shellfish waters (Baxter *et al*., 2011).

6.48 An extensive marine programme of remediation activity was undertaken by Dounreay Site Restoration Limited (DSRL) to detect and retrieve hazardous particles from a 60 hectare area of seabed around the outfall using remotely operated vehicles (ROVs), clean-up vehicles and divers. These studies have indicated that the highest numbers of historic radioactive particles were clustered on the seabed within 1 km to the northeast of the discharge point, the independent Dounreay Particle Group estimated some 5,000-6,000 particles may be present in 60 hectares of the seabed near the historic discharge outlet[2]. Figure 6-3 shows the locations of 'significant' particles (with activities greater than 1 million becquerels (Bq) and likely to pose a risk to human health) recorded during the monitoring and retrieval surveys conducted by DSRL. These particles were removed by DSRL in 2012. Figure 6-3 also shows the area where significant particle densities in excess of 1 particle per hectare have been found (PRAG-D, 2011). In the period up to summer 2012, when the last survey of this type was conducted, a total of 2,184 particles were removed from the seabed. Of these 411 were deemed significant in terms of their potential health effects (DSRL, 2014). These particles are believed to have originated from fragments of irradiated nuclear fuel that were discharged to sea as a result reprocessing of nuclear fuels at the Dounreay Nuclear Plant during the 1960s and 1970s and are believed to be the source of smaller, less hazardous particles detected in the wider area. Based on the results of the reported survey results and extensive remediation it is unlikely that any significant particles would be encountered within either the offshore Site or the export cable corridor.

[2] http://www.dounreay.com/particle-cleanup/seabed

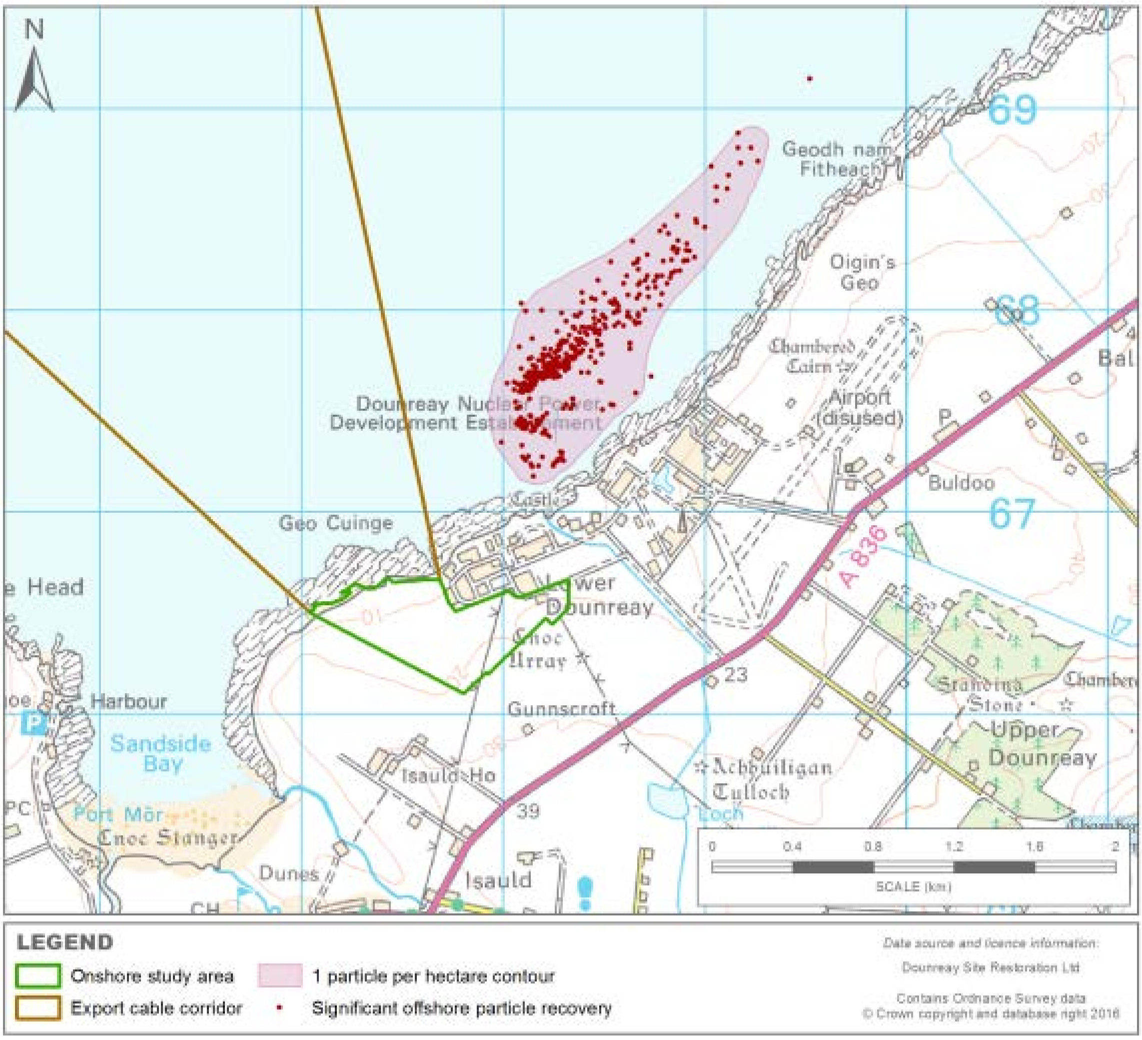

Figure 6-3 Significant radioactive particles detected and removed during DSRL seabed surveys

(Source: DSRL, 2016)

6.10 Summary of baseline

6.49 The offshore site and cable route are made up of Pre-Quaternary bedrock covered by varying depths of glacier-derived material deposited during the Pleistocene epoch and sediments laid down during sea transgression during the early Holocene. The thickness of sediment across the majority of the Site is greater than 2 m (BGS, 1987). Sediment thickness decreases to approximately 1 m in the southernmost part of the offshore site and at its shallowest reaches approximately 0.1 m. Sediment cover reduces to zero in the near-coast parts of the cable corridor.

6.50 The wind and wave regime follows a seasonal pattern with highest wind speeds and wave heights being recorded in the winter months. Average winds speeds are 7 m/s -10 m/s with mean significant wave heights of 1.5 m - 2.0 m. Tidal currents in the area range between 0.10 m/s and 0.75 m/s.

6.51 The potentially significant radioactive particles released by historic activities at the Dounreay Nuclear installation are primarily clustered on the seabed northwest of the outfall which is located approximately 0.5 km west of the cable corridor boundary. However, these particles were removed by divers in 2012. Numerous less-hazardous particles have been recorded in the coastal zone extending between Sandside Bay and Brims Ness to the east. There are no other water or sediment quality concerns in the area.

6.11 Identification of Potential Impacts

6.52 The following impacts have been considered in the assessment. These have been informed through scoping and the consultation process (see Section 6.6).

Potential impacts in the construction phase

- Loss of, and/or alteration of the physical and chemical characteristics of the seabed due to installation of infrastructure (cables, moorings, anchors);
- Changes in water quality related to the installation of subsea infrastructure - primarily increased suspended sediment concentrations;
- Sediment quality impacts due to the dispersal of radioactive particles into wider environment resulting from potential disturbance of contaminated sediments; and
- Changes in water and sediment quality due to pollution from routine and accidental discharges from vessels.

Potential impacts in the operations and maintenance phase

- Changes to local sediment transportation processes and seabed features due to altered hydrodynamics related to interactions between mooring cables, anchors and cables with the action of water currents and waves; and
- Changes in water and sediment quality due to pollution from routine and accidental discharges from vessels.

Potential impacts in the decommissioning phase

- Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase therefore for decommissioning impacts the reader is requested to review the impacts during the construction phase. Following removal of structures opportunities for seabed recovery in the former location of seabed infrastructure may arise.
- If the export cable is left *in situ* any potential impacts will be reduced further.

6.12 Impact Assessment - Construction Phase

Changes in seabed characteristics arising from installation of subsea infrastructure

6.53 The Project construction phase will include the placement of a range of anchors, moorings and cables on the sea floor (see Table 6-3 for details of the worst case scenario values) that will disturb surface seabed sediments. All temporary and permanent changes in seabed characteristics, ranging from minor physical disturbances to the smothering of the existing seabed with deep deposits of gravel and/or rock, will be restricted to the immediate vicinity of the deployed infrastructure. Based on the worst case scenario, the maximum total footprint of potential seabed change is estimated as 0.2 km^2 (approximately 0.4% of the total area of the offshore site [25 km^2] and cable corridor [24 km^2]). The vulnerability of the receptor is considered to be low and the magnitude of effect is considered to be negligible.

The significance of impacts can therefore be considered as having a negligible impact on the overall seabed characteristics of the area.

Water quality impacts due to installation of subsea infrastructure

6.54 The physical disturbance of the seabed surface during installation of Project infrastructure (anchor deployments and export cable trenching) will release sediment particles into the water column causing increased turbidity. The highest quantiles of suspended sediments will likely be generated by cable trenching via jetting (if used). This potential impact will be both localised around the working area and transient due to the rapid re-settlement of the relatively coarse sediment particles present in typical surface sediments. The vulnerability of the receptor is considered to be low and the magnitude of effect is considered to be negligible and has therefore been considered as having negligible significance.

Sediment quality impacts due to the potential disturbance of historic radioactive particles

6.55 It is known that the sediments in the coastal area (within 1 km from the coastline) in the vicinity of the export cable corridor may contain radioactive particles from Dounreay. However, based on the available survey data reported by DSRL (Section 6.9) it is highly unlikely that potentially harmful radioactive particles would be encountered during export cable installation activities (the particle density has been estimated as being less than one per hectare in the cable corridor area) and there is no evidence to suggest particles are present within the offshore site The disturbance of historic radioactive particles during installation operations is therefore considered unlikely. However, any disturbed particles would re-settle rapidly and no overall change in sediment quality within the area would be expected. The vulnerability of the receptor is considered to be low and the magnitude of effect is considered to be negligible and has therefore been considered as having negligible significance.

Water and sediment quality impacts due to pollution from routine and accidental discharges from vessels

6.56 Vessels involved with the installation and construction activities will discharge liquid effluents into the sea during operations (i.e. bilge water and sewage). Procedures will be in place to ensure all discharges are compliant with appropriate anti-pollution regulations (e.g. MARPOL). All routine discharges will be rapidly dispersed by water currents and will have no significant reduction in the sediment or water quality in the development area and surroundings. The vulnerability of the receptor is considered to be low and the magnitude of effect is considered to be negligible and has therefore been considered as having negligible significance.

6.13 Impact Assessment - Operations and Maintenance Phase

Changes to local sediment transportation processes and seabed features due to altered hydrodynamics related to interactions between mooring cables, anchors and cables with action of water currents and waves

6.57 There is no evidence of any major mobile seabed features in the Study Area (Section 6.9) although areas of rippled sediments do indicate some degree of interaction between water currents and the seabed. The sediment transport processes within the offshore Site and the cable corridor are not expected to be modified significantly by the presence of the anchors or cables. Any effects are likely to be limited to localised areas of scouring and accretion (within a few metres) around seabed anchors, mooring lines and export cable protection from either physical abrasion or due to increased water turbulence. The area potentially impacted will remain small (0.20 km^2) in comparison to the total offshore Site and therefore the overall magnitude of changes in sediment transportation can be considered as being negligible.

6.58 The nearshore export cable installation method is either directional drilling or pinning to an existing outfall pipe. The vulnerability of the receptor is considered to be low and the magnitude of effect is considered to be negligible. For both options under consideration any potential impacts to hydrodynamics and sediment transportation processes would be expected to be of negligible significance.

Water and sediment quality impacts due to pollution from routine and accidental discharges from vessels

6.59 See Paragraph 6.56.

6.14 Mitigation Measures

6.60 Project commitments relevant to the Physical Environment are listed below. For full list of project commitments, see Chapter 4: Project Description.

- GM19 Project Environmental Monitoring Programme (PEMP);
- GM2 Construction Environmental Management Document (CEMD);
- GM3 Operational Environmental Management Plan (OEMP);
- GM5 Pollution Control Plan (PCP); and
- GM11 Industry best practice and safety measures for pollution control (SEPA, 2009).

Specific mitigation

6.61 Measures listed below (Table 6-7) will be implemented to minimise impacts on the offshore physical environment.

Table 6-11 Mitigation measures specific to the physical environment

Ref	Title	Description
PCP1	Cable protection management	Should rock placement be used, all contractors will ensure that the volume of any rock used in rock placement activities will be kept to a minimum. The width of rock covering should be minimised to avoid seabed disturbance and minimise waste and cost.
PCP2	Use of clean rock for cable protection	Should rock placement be used, in cable protection and scour protection, all contractors will be required to use clean rock only. The preference would be to source this rock locally, from an existing onshore quarry to reduce transportation costs.
PCP3	Cable route survey	The developer will undertake to survey the final agreed cable route to ensure final positioning is acceptable from both an engineering and ecological position.
PCP4	Particle monitoring strategy	A particle monitoring strategy shall be agreed with SEPA and DSRL. The developer will undertake surveys prior to and post cable

Ref	Title	Description
		installation. The surveys shall identify and remove any nuclear particles which are hazardous to human health. Monitoring may requiredeploying a remotely-operated vehicle (ROV) capable of detecting and retrieving particles buried deep in the sediment. The ROV shall be controlled from a surface vessel where recovered particles are separated from the sediment and packaged for return to DRSL.

6.15 Residual Impacts

6.62 All impacts were assessed as having negligible significance. Dounreay Trì Limited is committed to reducing impacts wherever possible and so the above mitigation has been applied to all assessed impacts, regardless of assessed significance.

6.16 Cumulative Impacts

6.63 There is potential for cumulative impacts to arise from the development of a number of other projects in the nearby area (See Chapter 5: Environmental Impact Assessment Methodology for map of developments in nearby area):

- The SHE-T Orkney-Caithness interconnector cable;
- HIE Dounreay Demonstration Centre (DDC);
- Brims Tidal Array, Brims Ness;
- MeyGen, Inner Sound;
- Scotrenewables, Lashy Sound; and
- DP Energy, Westray South.

6.64 Two of the Projects identified above may require the laying of electrical cables on the seabed in close vicinity/or within the proposed development area (SHE-T Orkney-Caithness interconnector cable and HIE Dounreay Demonstration Centre (DDC)). The magnitudes of potential impacts to the offshore physical environment for these planned projects are not known at present but they are expected to be negligible, both individually, and in-combination with the Dounreay Trì Project.

6.65 Based on current knowledge of the other listed projects, there is no potential for further cumulative impacts.

6.17 Summary and Conclusions

- No significant impacts to the physical environment have been identified in the assessment of potential impacts at any stage of the Project construction, operation, and maintenance or decommissioning.
- Project wide mitigation measures will be implemented to further reduce all assessed impacts as described above.
- Table 6-8 summarises the assessment outcomes.

Table 6-12 Summary of Impacts

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Loss of, and/or alteration of the physical and chemical characteristics of the seabed due to placement of infrastructure (cables, moorings, anchors).	Negligible	Low	Negligible
Changes in water quality related to the installation of subsea infrastructure - primarily increased suspended sediment concentrations.	Negligible	Low	Negligible
Sediment quality impacts due to the dispersal of historic radioactive particles into wider environment resulting from potential disturbance of contaminated sediments.	Negligible	Low	Negligible
Changes in water and sediment quality due to pollution from routine and accidental discharges from vessels.	Negligible	Low	Negligible
Operations and Maintenance			
Changes to local sediment transportation processes and seabed features due to altered hydrodynamics related to interactions between mooring cables, anchors and cables with the action of water currents and waves.	Negligible	Low	Negligible
Changes in water and sediment quality due to pollution from routine and accidental discharges from vessels.	Negligible	Low	Negligible
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	N/A	N/A	N/A

7 Intertidal Ecology

7.1 Introduction

7.1 This chapter describes the intertidal ecology within and around the intertidal area of the export cable corridor associated with the Dounreay Trì Project - the 'Project' as defined in Chapter 4: Project Description and shown in Figure 7-1.

7.2 Within this chapter the potential effects that the Project may have on intertidal ecology in the Study Area (see Section 7.2) are identified and assessed and, where required, the mitigation measures which will be implemented to prevent, reduce or offset any potential adverse effects.

7.3 The intertidal communities (flora and fauna) living between Mean Low Water Springs (MLWS) and Mean High Water Springs (MHWS) in the export cable corridor are characterised. This is the area of search that could be affected by the proposed cable landfall installation activity.

7.4 The geology of the area is described in Chapter 21: Geology and Hydrology.

7.2 Study Area

7.5 The intertidal area within the export cable corridor can be seen in Figure 7-1. The area from MLWS to MHWS within the export cable corridor. This area is referred to as the Study Area for the purposes of this assessment. The Study Area is approximately 0.6 km long and varies in width (up to 100 m) due to variable geomorphology and tidal conditions. The littoral aspect of the area is north facing with the area is exposed to waves from the north and north west.

7.6 The Study Area is entirely a rocky shore area and stretches from the eastern flank of Sandside Bay to the western side of the Dounreay Restoration Site.

7.3 Legislation and Guidance

7.7 The following relevant legislation and guidance relating to intertidal ecology was used in the preparation of this chapter, in addition to that described in Chapter 2: Legislative Context and Regulatory Requirements.

7.8 Conservation importance of intertidal species will be deduced using the following pieces of legislation and guidance:

- European Council Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (EU Habitats Directive 92/43/EEC) 1992;
- The Habitats Regulations 1994 (As amended in Scotland);
- UK Biodiversity Action Plan;
- Priority Marine Features (PMFs); and
- OSPAR Convention.

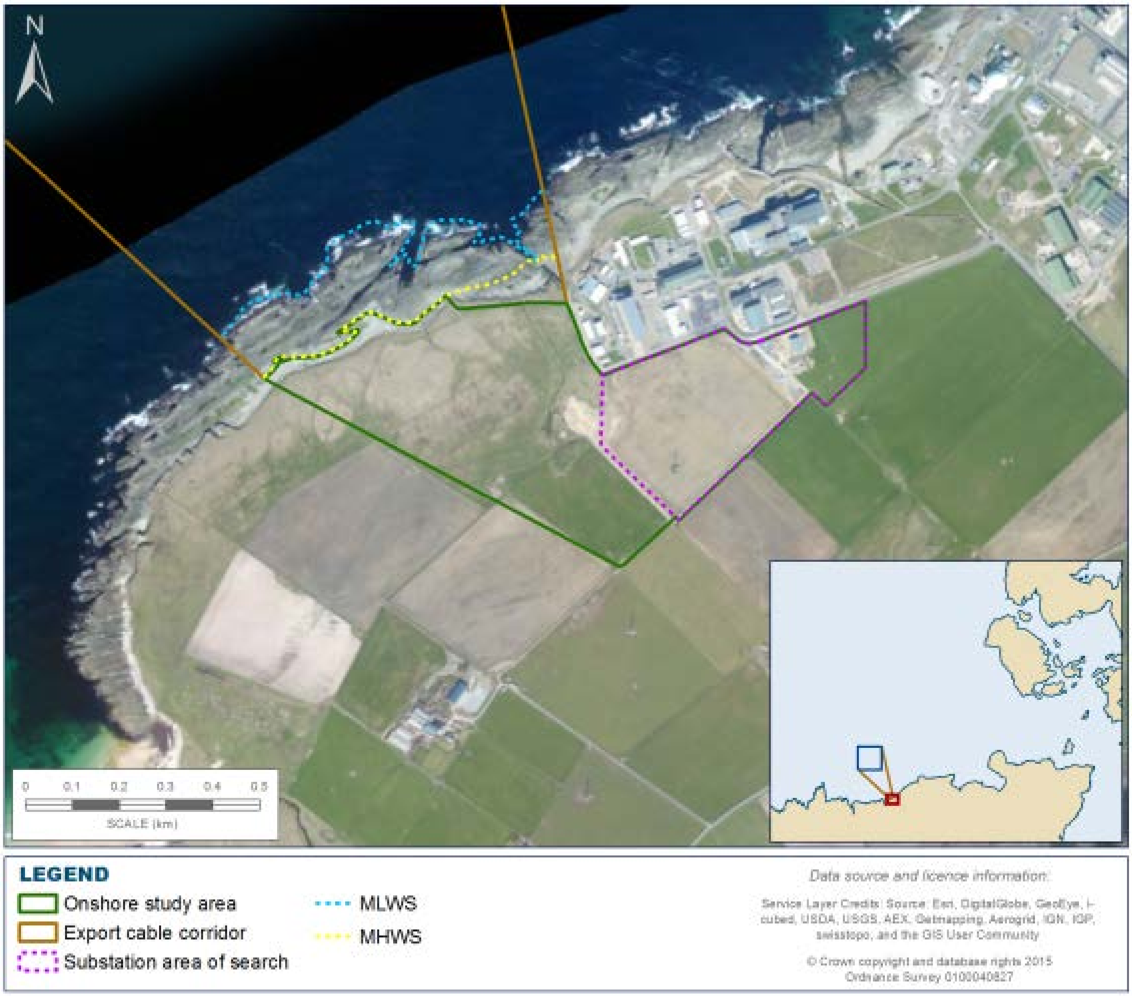

Figure 7-3 Boundaries of intertidal Study Area from Mean Low Water Springs to Mean High Water Springs

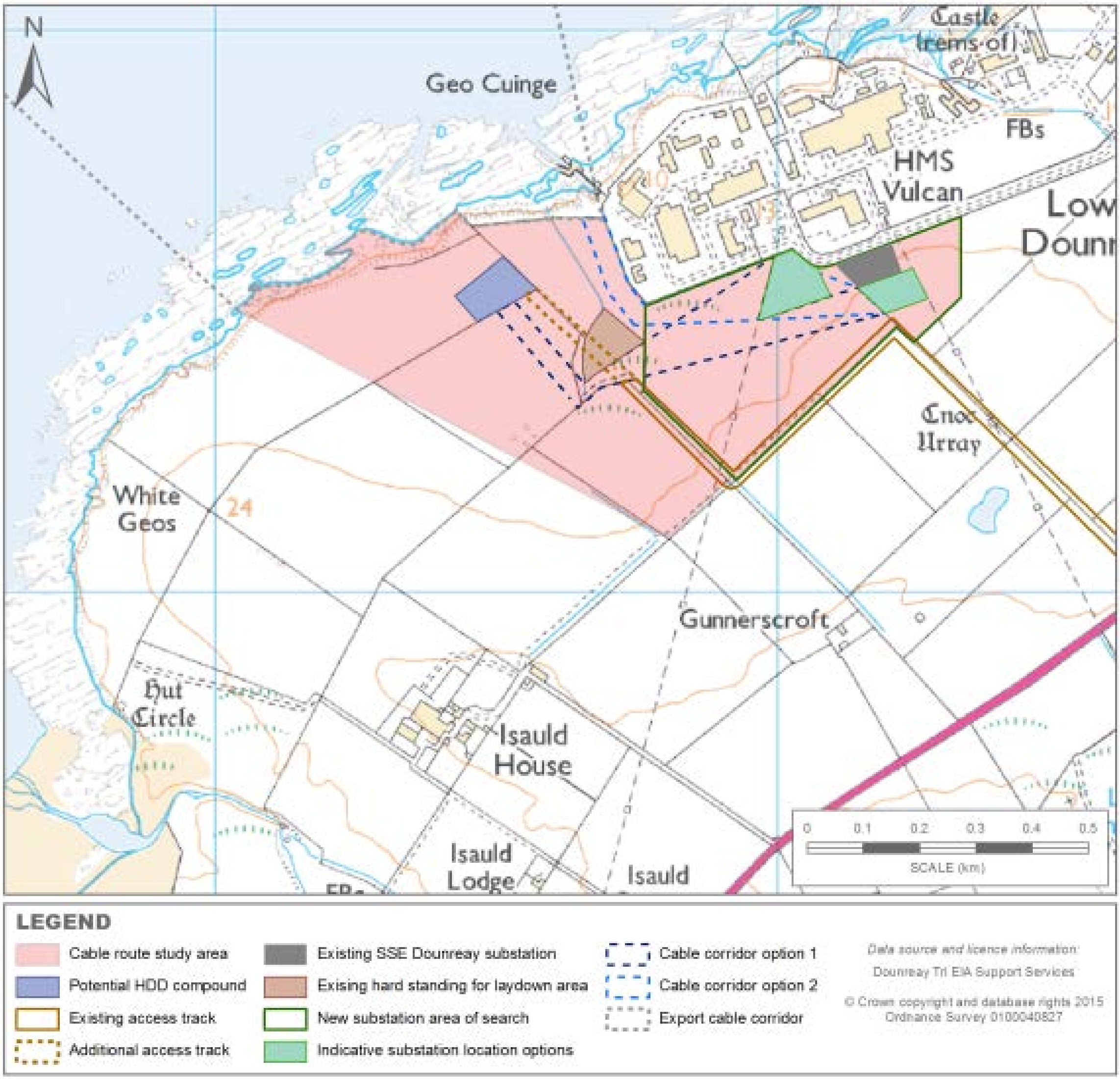

Figure 7-4 Onshore boundaries of Project showing cable corridor options 1 and 2

7.4 Sources of Information

7.9 A review was undertaken of the existing literature and data relating to the intertidal ecology and this was used to give an overview of the existing environment. The key data sources used are listed in Table 7-1. The field surveys that have been undertaken are described in Section 7.4.

Table 7-13 Key data sources

Source	Content
Scottish Natural Heritage (SNH)'s Sitelink (gateway.snh.gov.uk/sitelink) website (SNH, 2015);	Designated sites within and surrounding the Project Site.
National Biodiversity Network (NBN) (http://www.nbn.org.uk/) (National Biodiversity Network, 2011)	Biological records relevant to the site and the assessment.

7.5 Surveys and Studies Carried out to Date

Field surveys

7.10 The following specific surveys have been undertaken and used to inform this assessment (see also:

- Intertidal Ecology Survey (Appendix 7.1: Intertidal Survey Report)

7.11 An intertidal Phase 1 biotope mapping survey took place on 12th October 2015 covering the Dounreay intertidal Study Area. The objectives of the survey were to identify and map biotopes present in the Study Area (see Section 7.2); identify and map the presence of any rare or protected species; and to provide target notes for each biotope and any rare or protected species encountered.

7.6 Consultation

Pre-application consultation

7.12 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2nd of February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date, and included the following relevant information:

7.13 Dounreay Site Restoration Limited (DSRL) Senior Environmental Specialist:

- Confirmed that beach surveys are carried out approximately every two weeks per month, throughout the year with surface driven detectors but no ploughing is undertaken;
- Seabed monitoring has ceased; and
- The Dounreay foreshore is monitored with sediment sampling and water sampling carried out several times per month.

7.14 Additionally, consultation was undertaken with Scottish Natural Heritage in order to discuss the options for the export cable landfall. The Scoping Report discussed three options of cable landfall namely, HDD, Pinning or trenching. Trenching was seen to have the most significant potential environmental impact as a large trench would be dug in the Sandside Bay sandy area crossing the designated Sandside Bay SSSI (Site of Special Scientific Interest). As a result of consultation with SNH on this matter, the option for trenching was removed from the scope of this development and the entire Sandside Bay SSSI was removed from the Study Area.

7.7 Scoping Responses

7.15 The following stakeholder responses have been received specifically relating to this chapter:

Table 7-14 Summary of scoping responses

Consultee	Comment	Relevance / Cross Reference
Scottish Government-Planning	**Loss of or damage to coastal and terrestrial habitats or species** associated with onshore works and installation of cabling at landfall sites. It is recommended that the ES should look at the proximity of the proposed onshore site works to valued or sensitive landscapes/seascapes, national and international environmental designations (e.g. North Caithness Cliffs SPA, Strathy Point SAC, Red Point Coast and Strathy Coast SSSI), and the potential for impacts to protected species that will not be considered within the required and supporting HRA process.	See Section 7.13 – Potential Impacts During Construction Phase
Scottish Government-Planning	There may be potential for the development and it's above water and subsurface infrastructure to create **artificial habitats** for birds and marine organisms (i.e. shellfish, seaweed). For example, the ES could discuss whether the presence of mooring lines, support structures and drag anchors could create such habitats, and consider the use of above water structures by birds for roosting and undertaking foraging in the vicinity of the development. The ES could discuss the potential for long term habitat change, and changes in foraging opportunities, and proposals for monitoring any such effects.	See Section 7.14– Potential Impacts During Operations and Manteca Phase
Scottish Government-Planning	The ES should discuss the potential introduction and/or spread of **invasive non-native species** from movement of infrastructure and vessels, and risk of colonisation of these species on submerged infrastructure, anchors and cables. It is recommended that the developer consider the available guidance on the development of appropriate prevention and management measures, including that developed by SNH and the Scottish Government, and that the ES discuss how these risks will be addressed.	See Section 7.13 – Potential Impacts During Construction Phase
Scottish Government-Planning	The ES should include the identification and assessment of **cumulative impacts** that may occur in proceeding with the development. In particular, it should discuss the potential for impacts on marine mammals and migratory fish associated with an increased number of barriers affecting species movement (i.e. device arrays, construction vessels/equipment, etc.), on seabirds, and on nearby communities.	See Section 7.17 Projects for cumulative impact assessment agreed with Marine Scotland Licensing Operations Team (MS-LOT)

Consultee	Comment	Relevance / Cross Reference
Scottish Environmental Protection Agency (SEPA)	When addressing alien species then consideration should be given to the IMO ballast water convention.	See Section 7.15
SNH	For the assessment of potential impacts in the marine environment, we recommend using the guidance produced by the Chartered Institute of Ecology and Environmental Management. Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (2010) http://www.cieem.net/ecia-guidelines-marine-	See Section
SNH	Mitigation and monitoring We advise that, within the ES, a schedule of commitments is provided with regard to proposed mitigation. Furthermore, we advise that the applicant provides a draft Environmental Mitigation and Monitoring Plan (EMMP) as part of the ES. The proposed EMMP should provide details on mitigation measures and monitoring studies to be undertaken.	See Chapter 4: Project Description (Project Commitments) and Section 7.15
SNH	Cumulative and in-combination effects Our advice with regard to cumulative and in-combination assessment is that other projects and plans which should be included are agreed in consultation with the Regulators (Marine Scotland in consultation with the Highland Council).	See Section 7.17 Projects for cumulative impact assessment agreed with Marine Scotland Licensing Operations Team (MS-LOT)
SNH	Sites of Special Scientific Interest (SSSIs) We highlight that many of the Natura sites are also underpinned by SSSIs often with seabird or seal species as the notified features, which will also require consideration. Further information on SSSIs and their notified features is available from our website and on Sitelink. With regard to onshore works, Sandside Bay SSSI may require further consideration and we will be able to provide further advice once details have been confirmed.	The Sandside Bay SSSI will not be impacted by the installation of the export cable.
SNH	Priority Marine Features (PMFs) Consideration should also be given to the present or absence of PMFs within the development site. These should be specifically referenced and an account of	No PMFs are present in the Study Area

Consultee	Comment	Relevance / Cross Reference
	the presence, extent and quality (e.g. abundance, patchiness, density, % live/dead, and species richness) of the PMF in that location should be provided. The assessment of potential impacts and any consideration of mitigation options should also give particular consideration to PMFs, if identified. A list of PMFs can be found at: www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/	
SNH	The presence of any PMFs in the intertidal region will need to be considered – there is currently no mention of these in the scoping report. There are some intertidal species on the list which could be present (e.g. seagrass beds). See list at http://www.snh.gov.uk/docs/A1327320.pdf). The scoping report states that a baseline intertidal survey has been completed and that no protected species have been found. It would be useful to see a report of this survey work.	No PMFs are present in the Study Area. Intertidal survey report can be seen as Appendix 7.1 Intertidal Survey Report
SNH	Marine non-natives The applicant should give due consideration to these risks in their EIA and present best practice steps to which they can commit in order to manage these risks in the ES.	See Section 7.13.3
SNH	Sandside Bay Site of Special Scientific Interest (SSSI) The onshore search area lies within part of this SSSI, designated for its sand dune habitat. Section 4.46 of the scoping report refers to the location of the cable landfall. Option 1 (trenching) would be located within the SSSI and Option 2 (Horizontal Directional Drilling (HDD)) may also be located within the boundary of the site. Both of these options have the potential to affect the sand dune habitat (e.g. loss of habitat and destabilisation of dunes). Therefore, careful and thorough assessment of the potential impacts is required to ensure the proposal does not adversely affect the integrity of the site. Option 3 for the cable landfall (pinning) would utilise the disused Dounreay cooling water intake. This suggests the landfall would be close to Dounreay and therefore out with the SSSI. This is a preferred option in terms of minimising impacts to the natural heritage.	The Sandside Bay SSSI will not be impacted by the installation of the export cable. Option 1 as referred to in the Scoping Report (trenching) has been ruled out

7.8 Assessment Methodology

7.16 The overarching approach to the environmental assessment is described in Chapter 5: Environmental Impact Assessment. To support this, the following is a description of the specific criteria which have been used to evaluate the impact of the proposals on intertidal ecology.

7.17 The effects on intertidal ecology arising from the Project are considered to be associated with the presence of the cable and how this may directly or indirectly affect the existing intertidal ecology and habitat. The assessment has considered what, if any, impact these potential environmental changes are likely to have on intertidal communities. The EIA Guidelines (Marine) from the Chartered Institute of Ecology and Environmental Management (CIEEM, 2010) have been used as a guide for this assessment.

Design envelope considerations

7.18 The project description is outlined in Chapter 4: Project Description. Design assumptions about the project envelope (the Design Envelope) relevant to intertidal ecology are summarised in Table 7-3.

7.19 As described in Chapter 5: Environmental Impact Assessment Methodology the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

7.20 In the case of intertidal ecology the installation of the export cable through the intertidal zone has the potential to cause the greatest impact. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

Table 7-15 Design envelope parameters specific to intertidal ecology

Design Envelope Parameter	Value/description
Potential methods of installation of export cable at landfall	Option 1: Horizontal directional drilling (HDD). Option 2: Pinning to existing water cooler channel at the Dounreay Nuclear Site.
Potential methods of cable protection	HDD; the cable would not interact with the intertidal zone; and Pinning; the cable would be installed within an existing duct.
Vessels, vehicles or instrumentation used in installation	HDD; no vehicles would cross the intertidal zone. Pinning; crane and cable drum handling vehicle.

7.21 Impacts in the decommissioning phase will include temporary disturbance from the removal of the export cable and platform anchors will be comparable to those impacts assessed in the construction and operational phases. If the export cable is left *in situ* the potential impacts will be reduced further.

Methods of prediction

7.22 For intertidal ecology potential ***effects*** are identified and significance of ***impact*** is assessed for each stage of the project lifecycle and significance attributed relative to the background conditions.

7.23 A matrix approach has been used as a tool to inform the impact assessment, while expert judgement has also been used following best practice, best available scientific understanding and relevant EIA guidance (SNH, 2013; CIEEM, 2010).

7.24 Significance is attributed using the following attributes:

Magnitude of effect

7.25 Magnitude of Effect is based on the following four criteria:

- Spatial extent;
- Duration;
- Frequency; and
- Severity.

Table 7-16 Assessment of magnitude of effect

Category	Description
High	Effect is widespread covering entire project footprint and surrounding area. Effect is Permanent (during lifetime and following decommissioning of project). Effect will be repeated or continuous; causing major loss or major alteration to key elements of the baseline conditions such that the post-development character / composition / attributes will be fundamentally changed.
Medium	Effect is confined to project footprint. Effect is long term (during the project lifetime). Effect will be a common occurrence causing medium damage to intertidal species or biotope type. Loss or alteration to one or more key elements / features of the baseline conditions such that post-development character / composition / attributes will be partially changed.
Low	Effect is highly localised and medium term or temporary. Effect will be Intermittent causing low damage to intertidal species, with high recoverability. Minor shift away from baseline conditions; change arising from the loss / alteration will be discernible but underlying character / composition / attributes of the baseline condition will be similar to the pre-development situation.
Negligible	Limited or indiscernible extent of effect. Effect is short term or temporary. One off/one time effect causing indiscernible or slight change to a habitat.

Vulnerability of receptor

7.26 The vulnerability of the receptor is also taken into account and is attributed according to the following characteristics:

- Adaptability;
- Tolerance;
- Recoverability; and
- Value.

Table 7-17 Assessment of vulnerability of receptor

Category	Description
High	No capacity for receptor to avoid or adapt to an effect. No capacity for receptor to tolerate or absorb effect. No capacity to recover to baseline conditions. High level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).
Medium	Very little capacity for receptor to avoid or adapt to an effect Very little capacity for receptor to tolerate or absorb effect. Very little capacity to recover to baseline conditions. Medium level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).
Low	Limited capacity for receptor to avoid or adapt to an effect. Limited capacity for receptor to tolerate or absorb effect. Limited capacity to recover to baseline conditions. Low level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).
Negligible	Receptor has capacity to avoid or adapt to an effect. Receptor has capacity to tolerate or absorb effect or will not be affected. Receptor has full capacity to recover to baseline conditions. Negligible level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).

Significance of impact

7.27 Magnitude of effect is considered against the receptor’s vulnerability to determine an overall significance of impact. The significance of impact is based on best practice and expert judgement. Any impacts of ‘moderate’ or above are considered significant, in accordance with EIA guidance (SNH, 2013; CIEEM, 2010). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor (See Chapter 5: Environmental Impact Assessment Methodology for full details).

Table 7-18 Significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

7.9 Data Gaps and Uncertainties

7.28 Due to the timing of the site specific survey (see Appendix 7.1: Intertidal Survey Report), only one low tide window was available on the day during daylight hours for the survey to take place. This meant that there was a time limitation to the survey. However, it was possible to cover the entire Study Area (See Section 7.2) during the single survey period and the data gathered are deemed sufficient to provide a comprehensive baseline of the intertidal environment and inform a robust impact assessment.

7.10 Description of the Current Environment

7.29 The purpose of this section is to provide a description of those habitats of conservation importance, and those which are particularly abundant in this area. This description of the current environment is established from a field study (Appendix 7.1: Intertidal Survey Report) comprehensive desk based study and consultation with key stakeholders.

Figure 7-5 Study Area

7.30 There are nine different biotopes present in the intertidal Study Area (Table 7-7 and Figure 7-4). A biotope is a region of a habitat associated with a particular ecological community. The biotopes are described according to The Marine Habitat Classification for Britain and Ireland, (Connor *et al.,* 2004) (see Appendix 7.1: Intertidal Survey Report for full details). The biotope codes come from this method of assessing biotopes.

7.31 The rocky shore is characterised predominantly by bladder wrack *Fucus vesiculosus*, channelled wrack *Pelvetia canaliculata* and spiral wrack *Fucus spiralis* (see Table 7-7 for biotope descriptions). The lower shore is dominated by toothed wrack *Fucus serratus* and thongweed *Himanthalia elongata* and the higher shore is dominated by lichens (Table 7-7). There are numerous rock pools along the rocky shore, many of which are dominated by green seaweeds *Ulva spp*. (Table 7-7). A full description of all of the habitats and species recorded is presented in the Intertidal Survey Report (Appendix 7.1).

7.32 There are many faunal species to be found on the rocky shore. There are large zones of barnacle *Semibalanus balanoides* cover and an abundance of limpets *Patella vulgata*, winkles *Littorina spp.*, dog whelks *Nucella lapillus*, mussels *Mytilus edulis* and beadlet anemones *Actinia equina*.

Table 7-19 Breakdown of biotypes encountered at Study Area

Biotope Code[3]	Biotope Description	Notes
LR.MLR.BF.PelB	*Pelvetia canaliculata* and barnacles on moderately exposed littoral fringe rock.	*P. canaliculata* zone in between barnacle zone and black lichen zone.
LR.HLR.MusB.Sem	*Semibalanus balanoides* on exposed to moderately exposed or vertical sheltered eulittoral rock.	Above the level of low tide a large area of barnacle covered rock. This area also had *Patella vulgata and Nucella lapillus*.
LR.MLR.BF.FspiB	*Fucus spiralis* on full salinity exposed to moderately exposed upper eulittoral rock.	Mid- high shore, boulders dominated by *F. spiralis* and *Cladophora* spp..
LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools.	Rockpool that is big, deep and dominated by kelp, and fucoids.
LR.FLR.Rkp.G	Green seaweeds (*Enteromorpha spp*. and *Cladophora* spp.) in shallow upper shore rockpools.	Small, shallow rockpool covered in a carpet of green algae.
LR.FLR.Rkp.Cor	*Corallina officinalis*, coralline crusts and brown seaweeds in shallow eulittoral rockpools.	Small shallow rockpool dominated by *C. officinalis.*

[3] (colour coded to correspond to general biotopes in Figure 7-4 below)

Biotope Code[3]	Biotope Description	Notes
LR.FLR.Lic	Lichens or small green algae on supralittoral rock.	Occurs in the upper splash zone. Characterised by presence of lichens and *U. lactuca*.
LR.MLR.BF.Fser.Bo	*Fucus serratus* and under-boulder fauna on lower eulittoral boulders.	Low shore, large boulders dominated by *F. serratus*.
IR.MIR.KR.Ldig	*Laminaria digitata* on moderately exposed sublittoral fringe rock.	Sublittoral kelp zone. *Hemanthalia elongata* (thong weed) was mixed in with the kelp zone in this location.

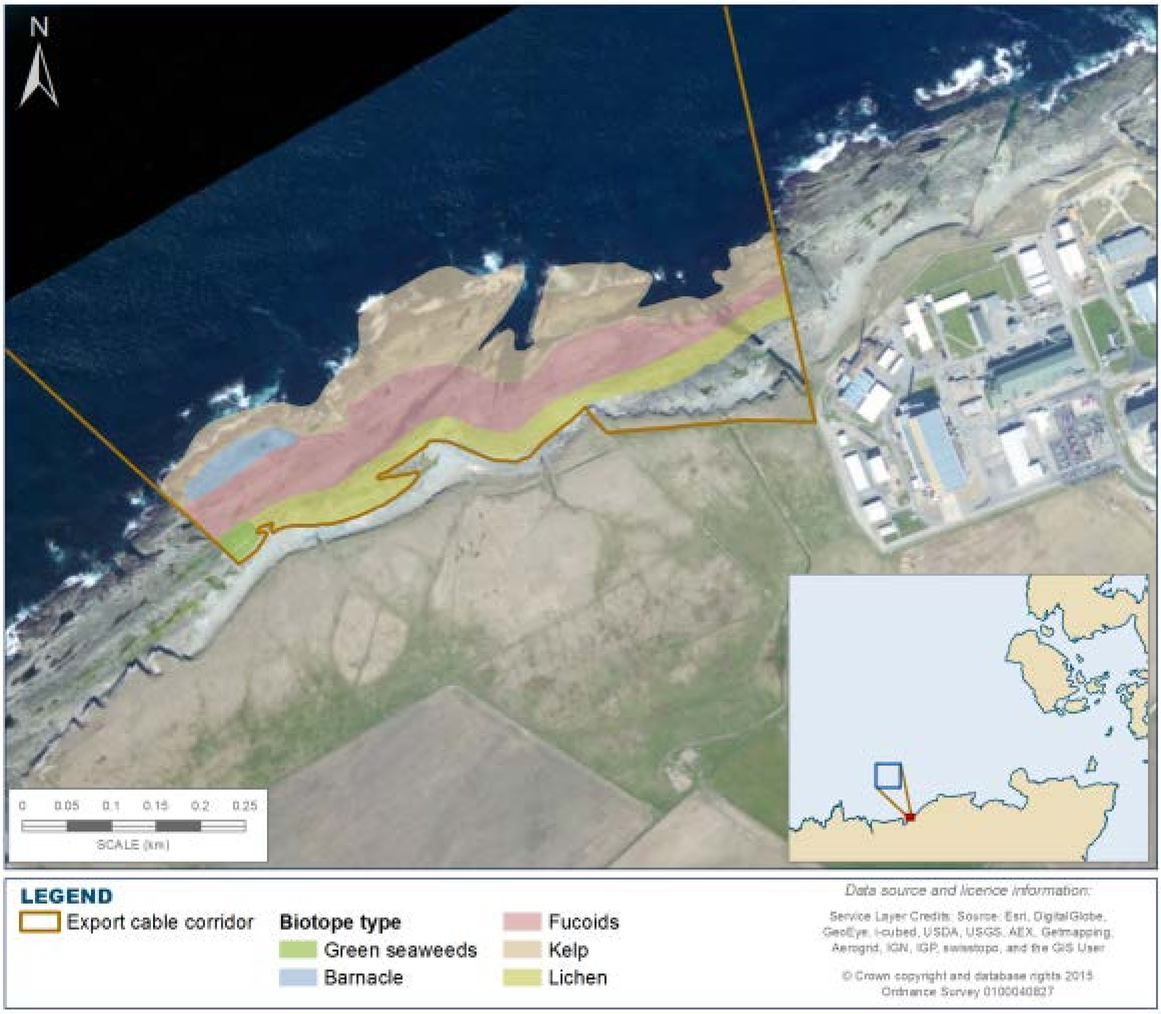

Figure 7-6 General biotopes present in the Study Area

Note: colour coding corresponds to representative biotopes in Table 7-7 above.

7.11 Designated Sites

7.33 The Sandside Bay Site of Special Scientific Interest (SSSI) (see Figure 7-5) is designated in order to protect the foreshore, dunes, dune slacks and the banks of the Burn of Isauld. This is approximately 1 km from the Study Area. The Red Point Coast SSSI is 90 m to the west of Sandside Bay and is listed for ornithological, geological and botanical interests. The marine area beyond the intertidal zone is a designated Special Protection Area (SPA) known as the North Caithness Cliffs SPA. This site is designated for its internationally important populations of breeding seabirds (Chapter 23: Terrestrial Ornithology).

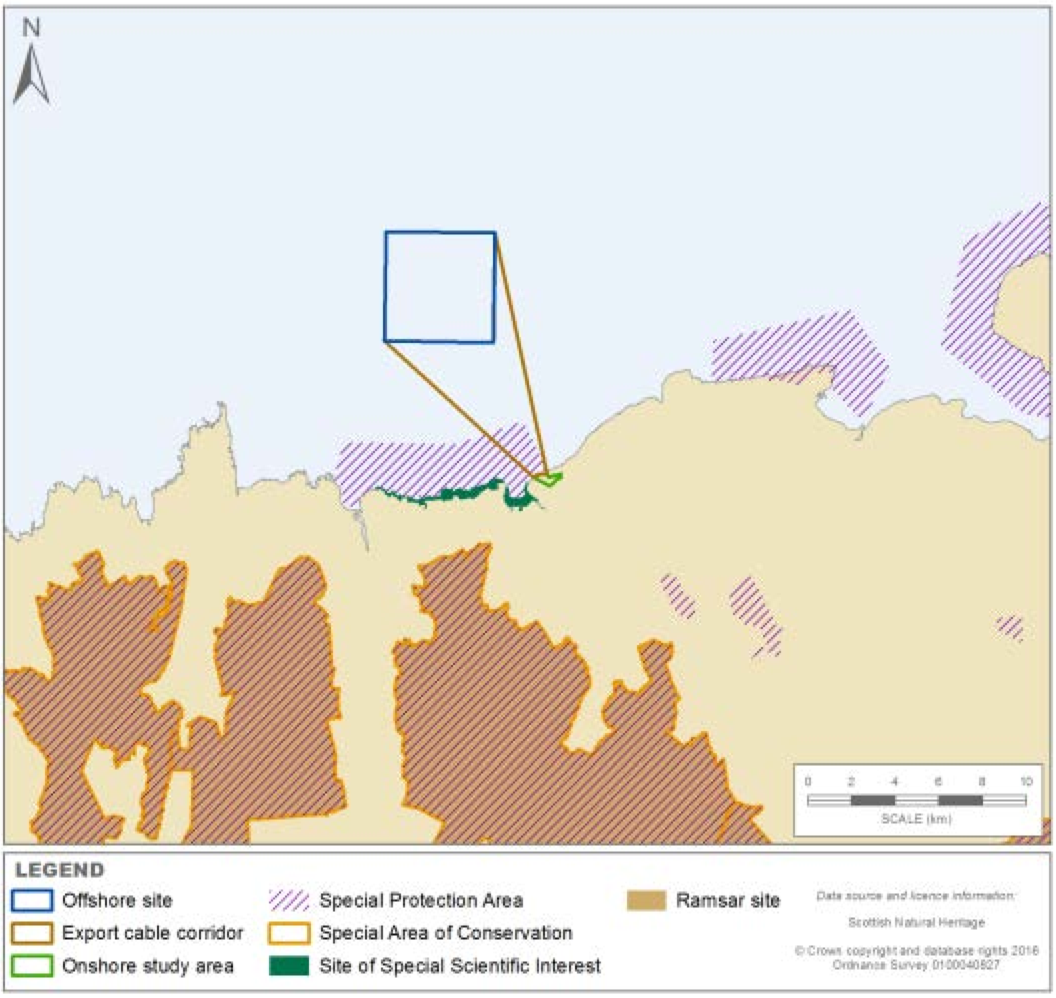

Figure 7-7 Onshore designated sites in the vicinity of the Project

Biotopes and species of conservation importance

7.34 The dog whelk *Nucella lapillus* is on the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR, 2008). This was a common species found in the Study Area. Although this is a protected species, the dog whelk is a common species in the UK and is not included on the Scottish List of Priority Marine Features or any other conservation legislation, as Scottish populations are not considered to be under threat or declining (SNH, 2014).

7.35 Part of the rocky shore area consisted of intertidal under-boulder communities (Table 7-8), which is a habitat on the UK Biodiversity Action Plan list of priority habitats (JNCC, 2015b). This is due to the fact that they are a functional habitat for many species and are threatened by human activity such as disturbance when searching for bait or species for human consumption. Despite this, this habitat is not considered to be under threat in Scotland (JNCC, 2008).

7.36 Of the eleven biotopes recorded in the Study Area, five biotopes were recorded that are listed under EC Habitats Directive (Table 7-8) as they may form part of an Annex I habitat (Table 7-8).

Table 7-20 Intertidal biotopes of conservation importance recorded at the intertidal Study Area

Biotope	Description	Conservation status
LR.MLR.BF.Fser.Bo	*Fucus serratus* and under-boulder fauna on lower eulittoral boulders	Part of 'Reefs' in Annex I of EC Habitats Directive UK BAP
LR.FLR.Rkp.FK	Fucoids and kelp in deep eulittoral rockpools	Part of 'Reefs' in Annex I of EC Habitats Directive
LR.FLR.Rkp.G	Green seaweeds (*Ulva spp*. and *Cladophora spp*.) in upper shore rockpools	Part of 'Reefs' in Annex I of EC Habitats Directive UK BAP
LR.LLR.F.FvesVS	*Fucus vesiculosus* on moderately exposed to sheltered mid eulittoral rock in variable salinity conditions	Part of 'Reefs' in Annex I of EC Habitats Directive
LR.MLR.BF.Fser.Bo	*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders	Part of 'Reefs' in Annex I of EC Habitats Directive UK BAP

Summary

7.37 UK BAP Priority habitats were recorded in the Study Area during the intertidal survey. However these habitats are widespread in the UK and are not included on the Scottish list of Priority Marine Features. In addition, the dog whelk *Nucella lapillus* was found through the Study Area. This species is protected by the OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR, 2008). This species is common throughout the UK and is not protected under any legislation (see Section 7.6).

7.12 Identification of Potential Impacts

7.38 The following impacts have been established through scoping and the consultation process as requiring assessment as part of the EIA.

Potential impacts in construction phase

- Loss of habitat or species through work at the cable landfall through direct or indirect impacts (for example sediment or other pollution events)
- Disturbance to or displacement of fauna in proximity to the Study Area through construction activities
- Introduction of new species

Potential impacts in operation and maintenance phase

- Habitat creation as a result of cable protection

Potential impacts decommissioning phase

- Potential impacts arising during the decommissioning phase are expected to be similar to, those arising during the construction phase.

7.13 Impact Assessment - Construction Phase

Loss of habitat or species through work at the cable landfall

7.39 There are two possible options for cable landfall installation currently under review. The 'worst' possible scenario for intertidal ecology of these two would be Option 2; pinning the cable (see Table 7-3); as Option 1 HDD will avoid the intertidal area completely. Pinning the cable will involve attaching the cable to an existing water cooler channel at the Dounreay Nuclear Site (see Chapter 4: Project Description for full details).

7.40 This will require a crane and cable drum handling vehicle to be present at the site during installation of the cable. This could cause loss of species along the area of installation and the surrounding area.

7.41 The area of installation is extremely small in relation to the surrounding similar impact. This is a highly dynamic environment where the species are adapted to disturbance.

7.42 As a result of this, any disturbance is likely to have negligible impact. The magnitude of the impact is considered to be negligible and the vulnerability of the receptor is low. Therefore the significance of this impact is considered to be negligible.

Disturbance to or displacement of fauna in proximity to the Study Area through construction activities

7.43 As above, the worst possible scenario will be taken into consideration here whereby the pinning method will be used for the cable landfall. As a result of the installation of the cable, in the intertidal zone of Sandside Bay, there will be disturbance to and displacement of fauna in proximity to the Study Area.

7.44 The installation of the cable by pinning it to the existing outfall will involve a single excavation team working in the area for a period of up to 3 months. This would cause disturbance to or displacement of fauna in proximity to the Study Area through construction activities.

7.45 There is a possibility of disturbance to or displacement of *N. lapillus* as a result of the construction activities. This is the only species recorded in the area of conservation concern. Despite being protected by OSPAR (2008), this species is common throughout the UK and is not protected under any legislation.

7.46 As a result, there is low vulnerability of the receptor. The disturbance will be a one-time, short term event in a localised area of the intertidal zone. It is unlikely that this disturbance will cause significant impact. As a result, this impact is considered to have negligible significance.

Introduction of new species

7.47 This impact could occur at any stage of the development including installation. There is a possibility for the introduction of new species as a result of vessels, vehicles or instrumentation used in the installation. The worst possible scenario for this would be the pinning option as that would require up to 3 months of work to pin the cable in the existing outfall. The introduction of non-native species could occur through construction vehicles onshore (crane and cable drum handling vehicle) or through vessels offshore, particularly those with an international market such as anchor handler vessels and cable installation vessels, through attachment or organisms to boat hulls or released in ballast water.

7.48 The introduction of new species would only cause a measurable negative impact on the local ecology if the new species were invasive. Invasive non-native species are classified as such if they have the ability to out compete the local species and cause a decline in biomass or biodiversity as a result. Common examples include Chinese mitten crab, carpet sea squirt (GB Non Native Species Secretariat, 2015).

7.49 The vulnerability of the habitat is medium as invasive species could seriously damage the populations present. The intensity of construction activities will be low due to the small scale of the Project. However there will be a moderate magnitude of effect due to the number of installation vehicles and vessels present. Therefore overall significance of this risk is considered to be moderate.

7.14 Impact Assessment - Operation and Maintenance Phase

Habitat creation as a result of cable protection

7.50 The two possible options for cable installation at the landfall site are Horizontal Directional Drilling (HDD), or pinning to an existing outfall. Habitat creation would likely have a positive impact on the ecology of the Study Area.

7.51 As HDD would avoid the intertidal area completely, pinning the cable is the only option that has a chance of leading to habitat creation.

7.52 Any habitat creation will be inhabited by intertidal species, boosting the biomass of the area and in turn, increase the food source available to larger species such as seabirds.

7.53 This impact is unlikely to occur, but if it does, the magnitude will be negligible and will be likely to have a positive effect. The overall significance is negligible.

7.15 Mitigation Measures

7.54 Project commitments relevant to intertidal ecology listed below. For full list or Project commitments, see Chapter 4: Project Description.

- GM19: Project Environmental Monitoring Programme (PEMP)
- GM20: International Marine Contractors Association (IMCA) Guidance: IMCA Guidance will be followed by all vessels exceeding identified thresholds, to ensure correct protocol for ballast water management and discharge.

7.55 There are no specific mitigation measures for this receptor as the mitigations required for the potential impacts are all covered by the Project commitments.

7.16 Residual Effects

7.56 All impacts bar one were assessed as not significant. Dounreay Trì Ltd. is committed to reducing impacts wherever possible and so the above mitigation has been applied to assessed impacts.

7.57 The mitigation GM19 and GM20 will reduce the magnitude of the impact of introduction of non-native species. IMCA guidance (international Marine Contractors Association; See Project commitments, Chapter 4: Project Description) will be followed to ensure that vessels exceeding identified thresholds will be required to demonstrate a protocol for ballast water management and discharge (see Chapter 8: Benthic and Shellfish Ecology). All ships will have to carry a Ballast Water Record Book and will be required to carry out ballast water management procedures to a given standard prior to operating on site. The Project Environmental Monitoring Programme (PEMP) will also monitor this risk.

7.58 These mitigations will minimise the chance of introduction of new species. This reduces the magnitude of this impact to low, as it will be a small scale impact, with a low frequency of occurrence. The severity of the impact is reduced as a result of the mitigation measures. The overall significance of this impact is therefore minor.

7.59 All impacts to intertidal ecology are therefore regarded as negligible or minor significance i.e. not significant.

7.17 Cumulative Effects

7.60 There is potential for cumulative impacts to arise from the development of a number of other projects in the nearby area (See Figure 5-1 in Chapter 5: Environmental Impact Assessment Methodology). See Chapter 5: Environmental Impact Assessment Methodology for the full cumulative approach.

- The SHE-T Orkney-Caithness interconnector cable;
- HIE Dounreay Demonstration Centre (DDC);
- Brims Tidal Array, Brims Ness;
- MeyGen, Inner Sound;
- Scotrenewables, Lashy Sound; and
- DP Energy, Westray South.

7.61 The consideration of projects that could result in potential cumulative impacts is assessed based on the results of the impact assessment, together with expert judgement of the specialist consultants.

The SHE-T Orkney-Caithness interconnector cable

7.62 There is potential for cumulative impacts to arise from the development of the Project and the SHE-T Orkney-Caithness interconnector cable. From the information available, there is a possibility that the cable landfall area of the Project will overlap with that of the SHE-T Orkney-Caithness interconnector cable.

7.63 The developer will liaise with SHE-T and negotiate suitable locations for the development so as not to conflict with or impede activity to develop either project (see Chapter 17: Other Users of the Marine Environment; Mitigation OM03). The developer will notify SHE-T of intended project installation activities and ensure adequate notification is provided so as not to disrupt any planned works (see Chapter 17: Other Users of the Marine Environment; Mitigation OM01), this will form part of the project construction plans (see Chapter 4: Project Description: Project Commitments GM19 and GM20) and will include a range of measures to minimise disturbance to other users and ensure safety is prioritised. Residual effects are therefore likely to not be significant.

HIE Dounreay Demonstration Centre (DDC)

7.64 HIE's Dounreay Demonstration Centre is not being progressed to meet the Renewables Obligation Certificate timescales. It is highly unlikely that the DDC and this Project shall be constructed simultaneously.

7.65 However, should progress be made by DDC and construction works were to coincide, the magnitude of construction impacts such as habitat loss and displacement of intertidal species could be increased. There is also an increase in the chance of introduction of new species due to the increased number of construction vessels and vehicles. The Applicant shall continue to liaise with HIE to ensure that HIE are informed of the Dounreay Trì programme. The Applicant shall liaise with HIE and negotiate suitable timing of intertidal installation activities and suitable locations for the SHE-T development to avoid, offset or reduce potential cumulative effects (see Chapter 17: Other Users of the Marine Environment mitigations OM01 and OM03).

7.66 As stated above (see Section 7.13.3) any material removed from the intertidal habitat will be restored following the cable installation works. The mitigations described above will minimise the risk of introduction of new species. The project commitments of the DDC and Orkney-Caithness cable Project would also be expected to follow this approach and thus mitigate this risk.

7.67 The combined Study Area and DDC footprints are extremely small, with temporary construction activities across the intertidal zone are not expected to coincide; therefore cumulative impacts are not anticipated to be significant.

Brims Tidal Array, Brims Ness

7.68 The planning application and Environment Statement have not yet been submitted for the Brims project; however it is of sufficient distance (approximately 36 km) from the Dounreay Trì project such that significant cumulative impacts on intertidal ecology are not likely to occur.

MeyGen, Inner Sound

7.69 Impacts on intertidal ecology from the MeyGen project were all assessed as not significant or positive (Refer to the Environmental Statement on the Marine Scotland Licensing page: http://www.gov.scot/Topics/marine/Licensing/marine/scoping). Due to the small Project footprint and the distance from the MeyGen site (approximately 40 km), there are unlikely to be cumulative effects associated with the Project and the MeyGen site.

7.70 ***Scotrenewables, Lashy Sound and DP Energy, Westray South***.

7.71 Due to the distance between the Project and both Westray South (approximately 83 km) and Lashy Sounds sites (approximately 93 km) there are unlikely to be cumulative effects associated with the Project.

7.18 Summary

7.72 No significant impacts to intertidal ecology have been identified in the assessment of potential impacts at any stage of the Project construction, operation, and maintenance or decommissioning.

7.73 One potentially significant impact was identified in the process of impact assessment; introduction of non-native species. This impact will be mitigated through general project commitments. As a result of this mitigation, the impact significance as assessed as minor.

7.74 Where there is potential for overlap of Project infrastructure or construction activity with proposed developments in the area i.e. SHE-T Orkney-Caithness interconnector and HIE'S DDC for offshore floating wind, these will be mitigated through consultation and collaboration with developers to ensure there is no significant conflict or disruption to activities.

Table 7-21 Summary of residual impacts

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Loss of habitat or species through work at the cable landfall	Negligible	Low	Negligible
Disturbance to or displacement of fauna in proximity to the Study Area through construction activities	Negligible	Low	Negligible
Introduction of new species	Low	Low	Minor
Operations and Maintenance			
Habitat creation as a result of cable protection	Negligible (Positive)	Low	Negligible (Positive)
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	N/A	N/A	N/A

8 Benthic and Shellfish Ecology

8.1 Introduction

8.1 This chapter describes the marine benthic habitats and shellfish ecology in the offshore Study Area and export cable corridor (see Section 8.2). A discussion of the key sensitivities and potential ecological impacts arising from the development of the proposed Dounreay Trì Project (the 'Project') during the construction, operation and maintenance and decommissioning phases has been carried out and the findings are presented in this chapter. The mitigation measures which will be implemented to prevent, reduce or offset any potential adverse effects are described.

8.2 This chapter includes an assessment of potential impacts of the Project on benthic ecology and commercially important shellfish. All other commercial species are covered in Chapter 12 Commercial Fisheries. Fish Ecology is discussed in Chapter 9. Physical conditions such as sediments, water quality and physical processes are considered in Chapter 6 Physical and Coastal Processes.

8.2 Study Area

8.3 The offshore site (the 'Site') comprises a 5 by 5 km offshore area located approximately 6 km from the north coast of Scotland in the Pentland Firth and an export cable corridor running from the Site to the coast, immediately to the west of the Dounreay fence line (Figure 8-1).

8.4 For the purposes of this impact assessment, the impacts on the benthic environment will be considered at a 2 km buffer zone around the Site (Figure 8-1). This area will be referred to as the Study Area.

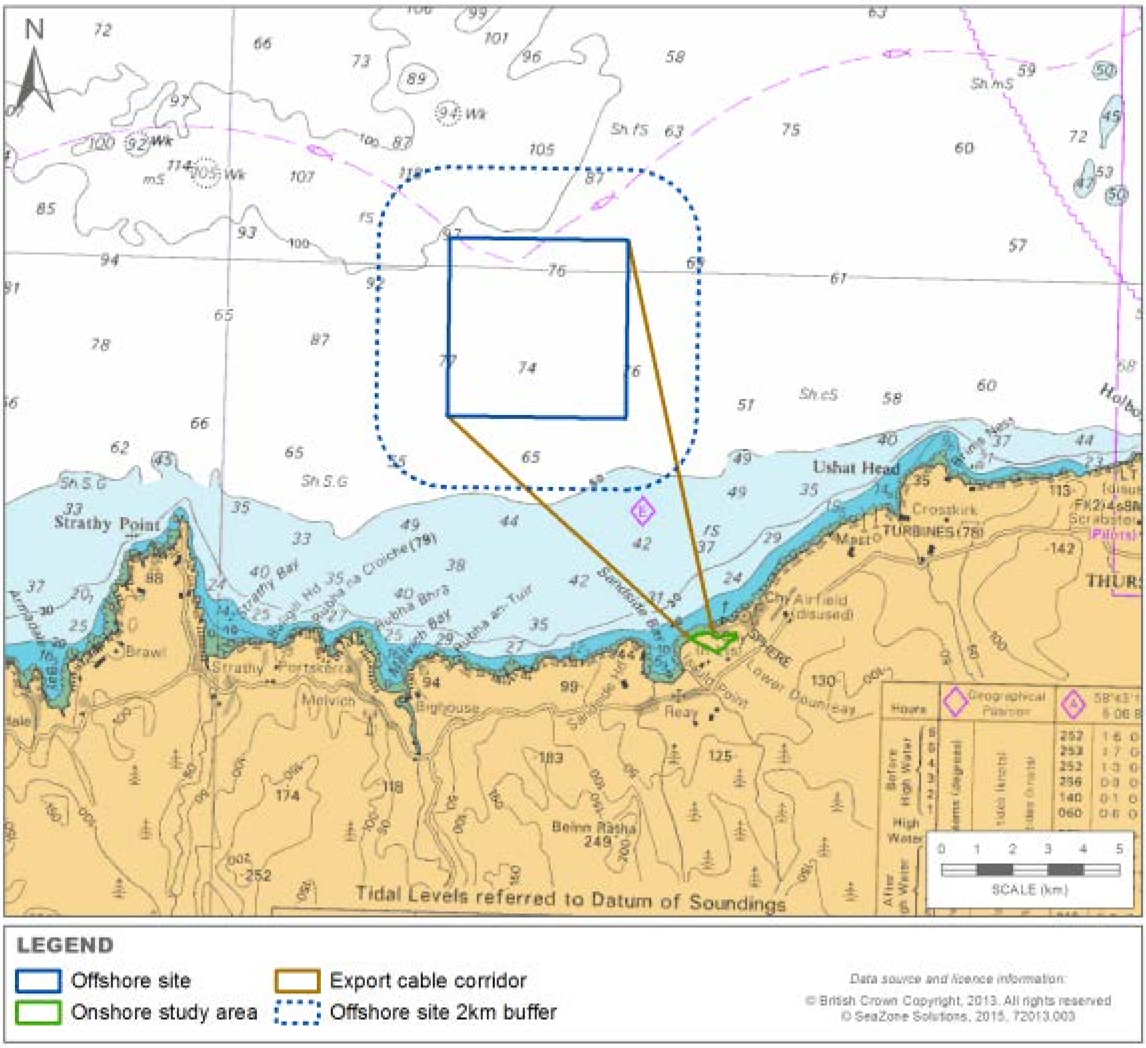

Figure 8-8 The Site and export cable corridor showing 2 km buffer zone

8.3 Legislation and Guidance

8.5 The following relevant legislation and guidance relating to Benthic and Shellfish Ecology were used in the preparation of this chapter:

8.6 Conservation importance of key species will be identified using the following pieces of legislation and guidance:

- European Council Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (EU Habitats Directive 92/43/EEC) 1992;
- Wildlife & Countryside Act 1981 (as amended);
- Nature Conservation (Scotland) Act 2004;
- Priority Marine Features (PMFs);
- UK Biodiversity Action Plan (BAP); and
- The Convention for the Protection of the Marine Environment of the North East Atlantic (the OSPAR Convention).

8.7 Designated sites were also considered as part of the impact assessment. The following legislation were used to guide this assessment:

- The Habitats Regulations 1994 (as amended in Scotland); and
- Marine (Scotland) Act (2010).

Sources of Information

8.8 A review was undertaken of the existing literature and data relating to Benthic and Shellfish Ecology in the Study Area and was used to give an overview of the existing environment. The key data sources used in the preparation of this chapter are listed below in Table 8-1.

Table 8-22 Data sources used in the preparation of this chapter

Source	Content
Marine Scotland Interactive (MSI) website (bathymetry, video and photographic data)	Seabed habitats and benthic species distributions
Mapping European Seabed Habitat (MESH) project data	Seabed habitats and benthic species distributions
UKSeaMap (McBreen *et al.*, 2011)	Bathymetry, seabed characteristics
JNCC	Marine habitat (biotope) classification system
Orkney – Caithness 220 kV Link, Marine Environmental Appraisal. Prepared by Environ UK for SSE	Published Environmental Impact Assessment for potential cable installation in the vicinity of the Project area
Moore, C.G. 2015. Biological analyses of underwater video from research cruises in marine protected areas and renewable energy locations around Scotland in 2014. Scottish Natural Heritage Commissioned Report No. 819	Video-based monitoring of the benthic environment located off the north coast of Scotland

8.4 Surveys and Studies Carried out to Date

8.9 A multi-beam survey of the north coast of Scotland between the Kyle of Tongue and 8 miles west of Thurso was surveyed by the Marine Scotland Science vessel, the MRV Scotia in 2014. Video-based monitoring of the benthic environment located in the same area was also conducted in 2014.

- MSS (2014a). Marine Scotland Science Farr Point Bathymetry Survey http://www.gov.scot/Topics/marine/science/MSInteractive/datatype/Bathymetry/data/farr-point; and
- Moore, C.G. 2015. Biological analyses of underwater video from research cruises in marine protected areas and renewable energy locations around Scotland in 2014. Scottish Natural Heritage Commissioned Report No. 819.

8.5 Consultation

Pre-application consultation

8.10 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date, and included the following relevant information:

8.11 Dounreay Site Restoration Limited (DSRL) Senior Environmental Specialist:

- Confirmed that beach surveys are carried out approximately every two weeks per month, throughout the year with surface driven detectors but no ploughing is undertaken;
- Seabed monitoring has ceased; and
- The Dounreay foreshore is monitored with sediment sampling and water sampling carried out several times per month.

Scoping responses

8.12 The following stakeholder responses have been received specifically relating to this chapter.

Table 8-23 Summary of scoping responses

Consultee	Comment	Relevance/Cross Reference
Scottish Government Planning	Based upon the consideration of potential environmental effects, issues identified for consideration within the ES include: **Loss of or damage to seabed habitat or species** from the placement of drag anchors onto the seabed, movement across the seabed during the operational phase, installation of pin piling, burial of the export cable beneath the seabed and at landfall, addition of scour protection to the seabed, the presence of vessels (e.g. anchoring, discharges, etc.), accretion of sediment around anchors, and scouring and abrasion caused by moving mooring lines should also be discussed in the ES. This should also include the potential for impacts on species, notably fish nursery and spawning, and impacts on shellfish species from the proposed development. The developer should also address mitigation measures in the ES, including the consideration of measures such as avoiding undertaking construction and decommissioning works during seabird breeding or seal pupping periods, and the use of piling curtains and soft-start piling, amongst others.	See Section 8.11

Consultee	Comment	Relevance/Cross Reference
Scottish Government Planning	Based upon the consideration of potential environmental effects, issues identified for consideration within the ES include: **Disturbance of contaminants in soils and seabed sediments** during pin piling, cable burial, landfall excavation works and onshore excavation works should be considered in the EIA. Given the proximity of the offshore site to the Dounreay Nuclear Power Plant, the potential disturbance of seabed sediments containing radioactive particles in the construction and decommissioning stages should be factored into the EIA. The ES should explore the potential for secondary or indirect effects associated with the disturbance of contaminated sediments; particularly on benthic ecology.	See Section 8.11
Scottish Government Planning	Based upon the consideration of potential environmental effects, issues identified for consideration within the ES include: **Changes to marine water quality** also have the potential for impacts on not just marine biodiversity, but also those who depend upon water quality (e.g. commercial and recreational fisheries, aquaculture). We would expect the ES to discuss the potential for impacts to water quality from the installation of mooring anchors or pin-piles, and construction works associated with onshore and landfall development (i.e. turbidity, seabed disturbance from placement of gravity anchors, potential for contamination from installation equipment and maintenance vessels), and that it should propose suitable assessment and mitigation measures (i.e. avoiding discharges of harmful material and substances, hydrodynamic and water quality modelling, project design). The ES should also consider the potential for associated impacts on marine biodiversity, particularly on benthic and coastal habitats, on species dependent on existing water conditions, the potential for impacts to the ability of fish and species to spawn, respire and feed, on those coastal and marine users that rely on water quality, and the potential for associated impacts on other aspects of the environment (e.g. soil/seabed sediment quality).	See Section 8.11

Consultee	Comment	Relevance/Cross Reference
Scottish Government Planning	Based upon the consideration of potential environmental effects, issues identified for consideration within the ES include: **Impacts to seabed sediments and onshore soils** from spill or leakage of pollutants should also be discussed, particularly during the construction and decommissioning stage (e.g. from vehicles, vessels, storage of chemicals onsite). The ES is expected to provide detail on mitigation measures, such as avoiding/managing spills and leaks, and the development of emergency response plans.	See Section 8.12
Scottish Government Planning	Based upon the consideration of potential environmental effects, issues identified for consideration within the ES include: The ES should discuss the potential for **thermal changes and electromagnetic field (EMF)** impacts associated with cabling and grid connection infrastructure, including the risks that this could pose for fauna in Scoping Direction: Dounreay Trì Floating Wind Demonstration Project 6 Scottish Government Planning and Architecture Division the marine environment and fauna and human health in coastal and onshore areas.	See Section 8.12
Scottish Government Planning	Based upon the consideration of potential environmental effects, issues identified for consideration within the ES include: There may be potential for the development and its above water and subsurface infrastructure to create **artificial habitats** for birds and marine organisms (i.e. shellfish, seaweed). For example, the ES could discuss whether the presence of mooring lines, support structures and drag anchors could create such habitats, and consider the use of above water structures by birds for roosting and undertaking foraging in the vicinity of the development. The ES could discuss the potential for long-term habitat change, and changes in foraging opportunities, and proposals for monitoring any such effects.	See Section 8.12

Consultee	Comment	Relevance/Cross Reference
Scottish Government Planning	The ES should discuss the potential introduction and/or spread of **invasive non-native species** from movement of infrastructure and vessels, and risk of colonisation of these species on submerged infrastructure, anchors and cables. It is recommended that the developer consider the available guidance on the development of appropriate prevention and management measures, including that developed by SNH and the Scottish Government, and that the ES discuss how these risks will be addressed.	See Section 8.12
Scottish Government Planning	The ES should include the identification and assessment of **cumulative impacts** that may occur in proceeding with the development.	See Section 8.16
Scottish Environmental Protection Agency (SEPA)	We suggest that 'Damage to habitat or species due to pollution from routine and accidental discharges' may be just as relevant during construction and decommissioning works (Scoping Report: Table 7-2 and summary tables in Section 12) and therefore should be scoped in for these phases as well.	See Sections 8.11 and 8.12
SEPA	We highlight the need to consider Priority Marine Features, which were developed under the Marine (Scotland) Act 2010 and are recognised as species of importance to Scotland. Whilst we agree that there are no Marine Protected Areas present in the vicinity of the development, this doesn't mean there will not be any Priority Marine Features, and this needs to take into consideration in subsequent survey work and in finalising layouts. Consideration should also be given to the National Marine Plan.	See Section 8.9
SEPA	When addressing alien species then consideration should be given to the IMO ballast water convention.	Noted in Chapter 4 Project Description, Project Commitments

Consultee	Comment	Relevance/Cross Reference
SEPA	We are generally content with the proposed scope for historic radioactive contamination, the only issues we previously gave specific marine advice on, however we do not agree that monitoring can automatically be ruled out at this stage; it will be dependent on the results of the initial assessment. As outlined previously we ask that the application includes: (1) an assessment outlining the risk of disturbance of particles currently within the sediment and methods to minimise this risk, (2) detailed information on the route of the cables within the marine environment, (3) information on the methods of laying cables, including information on the depth of laying within the sediment, with a justification as to why the method chosen is acceptable, and (4) information on any monitoring proposals.	Chapter 6 Physical and Coastal Processes See Section 8.11
Scottish Natural Heritage (SNH)	**Mitigation and monitoring** We advise that, within the ES, a schedule of commitments is provided with regard to proposed mitigation. Furthermore, we advise that the applicant provides a draft Environmental Mitigation and Monitoring Plan (EMMP) as part of the ES. The proposed EMMP should provide details on mitigation measures and monitoring studies to be undertaken.	See Chapter 4: Project Description, Project Commitments
SNH	**Cumulative and in-combination effects** Our advice with regard to cumulative and in-combination assessment is that other projects and plans which should be included are agreed in consultation with the Regulators (Marine Scotland in consultation with the Highland Council).	See Section 8.16 Projects for cumulative impact assessment agreed with Marine Scotland Licensing Operations Team (MS-LOT)
SNH	It is considered unlikely that the proposed Dounreay Trì Project will have any potential adverse impacts on any Nature Conservation MPAs.	See Section 8.9

Consultee	Comment	Relevance/Cross Reference
SNH	**Priority Marine Features (PMFs)** Consideration should also be given to the presence or absence of PMFs within the development site. These should be specifically referenced and an account of the presence, extent and quality (e.g. abundance, patchiness, density, % live/dead, and species richness) of the PMF in that location should be provided. The assessment of potential impacts and any consideration of mitigation options should also give particular consideration to PMFs, if identified. A list of PMFs can be found at: www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/.	See Sections 8.9 and 8.11

Consultee	Comment	Relevance/Cross Reference
SNH	Unless there is adequate existing data to inform the impact assessment, we strongly advise that cable route to shore and mooring site should be subject to benthic baseline characterisation surveys. Volume 5 (Benthic Habitats) of SNH's recently published 'Draft Guidance on Survey and Monitoring in Relation to Marine Renewables Developments in Scotland' (Saunders *et al.*, 2011), provides further information on survey, monitoring and analytical techniques for benthic surveys. Pre-construction baseline surveys should seek to answer the following: Are there any benthic habitats or species of note present (i.e. Priority Marine Features, rare, protected or invasive)? What is the spatial distribution and abundance of these species? How will these habitats or species be affected by the development? What would be the significance or implications of any loss incurred? Reference: Saunders, G., Bedford, G.S., Trendall, J.R., and Sotheran, I. (2011). Guidance on survey and monitoring in relation to marine renewables deployments in Scotland. Volume 5. Benthic Habitats. Unpublished draft report to Scottish Natural Heritage and Marine Scotland. http://www.snh.gov.uk/docs/B925810.pdf www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/	See Sections 8.5 and 8.9
SNH	We advise that the ES presents clear information on, and identification of, the main biotopes found within the proposed development site. The biotopes/habitat map should be used by the applicant to inform their finalised mooring location and cable route. Consideration should also be given to indirect impacts on birds, fish and marine mammals, where appropriate.	See Section 8.9

Consultee	Comment	Relevance/Cross Reference
SNH	There are also likely to be various marine fish PMFs relevant to the proposed development location and with some sensitivity to some of the possible pressures. In all cases, however, the scale and nature of any impacts are sufficiently small and/or temporary that we can reasonably consider there to be no significant impacts upon the national, regional or population-level status of these species. Neither is a proposal of this size likely to add markedly to cumulative impacts on marine fish or shellfish.	Noted. See Section 8.11
SNH	Assessment of potential impacts from EMF should pay particular heed to scientific uncertainties in reaching appropriate conclusions. Cumulative impact considerations may be relevant for EMF, given the proximity to the proposed Dounreay Floating Wind Deployment Centre and the Caithness to Orkney interconnector.	See Section 8.12 and 8.16

Consultee	Comment	Relevance/Cross Reference
SNH	We advise to minimise the transfer of invasive non-native species, biofouling management practices should be implemented, including the use of anti-fouling and/or foul-release systems and other operational management practices to reduce the accumulation of biofouling. Although guidance specific to the renewables industry is yet to be produced, guidance for other related industries will be useful in identifying ways to minimise risks. For example: The Code of Practice published by the Scottish Government on non-native species to provide guidance on the recently amended legislation in Scotland. This CoP comes into effect on 2 July 2012 and applies in Scotland only. Guidelines produced by The International Maritime Organisation (IMO) provide useful recommendations on general measures to minimise the risks associated with biofouling for all types of ships. Guidance produced for the prevention and management of invasive species in the oil and gas industry. References: www.scotland.gov.uk/Resource/0039/00393567.pdf 2011 guidelines for the control and management of ships' biofouling to minimise the transfer of invasive aquatic species. Resolution MEPC.207(62). MEPC 62/24/Add.1 Annex 26. Adopted 15 July 2011. Available at: www.mardep.gov.hk/en/msnote/pdf/msin1136anx1.pdf www.ipieca.org/publication/alien-invasive-species-and-oil-and-gas-industry	Noted. See Chapter 4 Project Description, Project Commitments

8.6 Assessment Methodology

8.13 The overarching approach to the Environmental Impact Assessment is described in Chapter 5 Environmental Impact Assessment Methodology. This section describes the specific criteria which have been used to evaluate the impacts of the proposals on Benthic and Shellfish Ecology.

8.14 The effects on Benthic and Shellfish Ecology arising from the Project are considered to be associated mainly with the presence of the infrastructure on the seabed, any changes to water quality and how this may directly or indirectly affect the existing benthic and shellfish ecology and habitat. The assessment has considered what, if any, impact these potential environmental changes are likely to have on benthic and shellfish communities in the Site and export cable corridor (see Section 8.10.). The EIA Guidelines (Marine) from the Chartered Institute of Ecology and Environmental Management (CIEEM, 2010) have been used as a guide for this assessment.

Design envelope considerations

8.15 The Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

8.16 Dredging and anchor and cable installation have the potential to cause the greatest impact on Benthic and Shellfish Ecology. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

8.17 Table 8-3 describes the Design Envelope parameters specific to Benthic and Shellfish Ecology.

Table 8-24 Design envelope parameters specific to Benthic and Shellfish Ecology

Design Envelope Parameter	Value/description
Parameters of drag anchors (including dredging)	Maximum 16 anchors (9 m x 9 m). 100 m disturbance per anchor. Anchors will be dragged to penetrate 10-15 m into the seabed. It is likely that no scour protection will be required, however if it is required, the footprint would extend no more than 20 m from each anchor to a depth of approximately 5 m.
Parameters of clump weight (including dredging)	50 x 50 m clump weight. 600 tonne clump weight. Dredging 70 x 70 m area (0.005 km^2) to depth of 5 m and fill in with gravel to create level plinth. Clump weight will rest on seabed during installation before being raised off the seabed. During operation, clump weight will be suspended in the water beneath the platform.
Export Cable (including Dynamic cable)	Maximum footprint: 0.11 km^2. Cable will be buried up to 2 m where possible. Where seabed conditions prohibit the burial of the cable, rock dumping may be required to protect the cable. Dynamic cable 250 m long with "lazy-wave" configuration. A trench of 8 m wide will be dug in order to bury the cable.

Design Envelope Parameter	Value/description
Parameters of mooring lines	The mooring system shall consist of up to 8 mooring lines which are anchored to the seabed. The mooring lines shall pass through the clump weight. The mooring lines are most likely to be chain, steel wire or a combination thereof. Offshore grade mooring chains of 100 mm to 160 mm diameter may be used.
Vessels used during construction, operation, maintenance and decommissioning Equipment carrying lubricant that has potential to leak (platform)	2 cable installation vessels; DP Fall-pipe Vessel & Crew transfer vessel. 5 platform installation vessels; 4 anchor handling tugs and 1 dive support vessel. Crew vessels, crew transfer vessels and O&M vessels for operation and maintenance. 1 barge (scour protection installation and decommissioning).

8.18 Impacts in the decommissioning phase will include temporary disturbance from the removal of the export cable and platform anchors will be comparable to those impacts assessed in the construction and operational phases. If the export cable is left *in situ* the potential impacts will be reduced further.

Methods of prediction

8.19 Potential ***effects*** are identified and the significance of ***impact*** is assessed for each stage of the project lifecycle and significance attributed relative to the background conditions.

8.20 A matrix approach has been used as a tool to inform the impact assessment, while expert judgement has also been used following best practice, best available scientific understanding and relevant EIA guidance (SNH, 2013; CIEEM, 2010).

8.21 Significance is characterised using the following attributes:

Magnitude of effect

8.22 Magnitude of effect which is based on the following four criteria:

- Spatial extent;
- Duration;
- Frequency; and
- Severity.

Table 8-25 Assessment of magnitude of effect

Category	Description
High	Effect is widespread covering entire project footprint and surrounding area. Effect is permanent (during lifetime and following decommissioning of project). Effect will be repeated or continuous; causing major loss or major alteration to key elements of the baseline conditions such that the post-development character/composition/attributes will be fundamentally changed.
Medium	Effect is confined to project footprint. Effect is long-term (during the project lifetime). Effect will be a common occurrence causing medium damage to benthic or shellfish species. Loss or alteration to one or more key elements/features of the baseline conditions such that post-development character/composition/attributes will be partially changed.
Low	Effect is highly localised and medium-term or temporary. Effect will be intermittent causing low damage to fish species, with high recoverability. Minor shift away from baseline conditions; change arising from the loss/alteration will be discernible but underlying character/composition/attributes of the baseline condition will be similar to the pre-development situation.
Negligible	Limited or indiscernible extent of effect. Effect is short-term or temporary. One off/one time effect causing indiscernible or slight change to benthic or shellfish species or habitat.

Vulnerability of receptor

8.23 The vulnerability of the receptor is also taken into account and is attributed according to the following characteristics:

- Adaptability;
- Tolerance;
- Recoverability; and
- Value

Table 8-26 Assessment of vulnerability of receptor

Category	Description
High	No capacity for receptor to avoid or adapt to an effect. No capacity for receptor to tolerate or absorb effect. No capacity to recover to baseline conditions. High level of conservation status or keystone species, rarity (e.g. how much of it exists relative to the potential area impacted) and worth (e.g. its socio-economic, cultural and amenity value).
Medium	Very little capacity for receptor to avoid or adapt to an effect. Very little capacity for receptor to tolerate or absorb effect. Very little capacity to

Category	Description
	recover to baseline conditions. Medium level of conservation status or keystone species, rarity (e.g. how much of it exists relative to the potential area impacted) and worth (e.g. its socio-economic, cultural and amenity value).
Low	Limited capacity for receptor to avoid or adapt to an effect. Limited capacity for receptor to tolerate or absorb effect. Limited capacity to recover to baseline conditions. Low level of conservation status or keystone species, rarity (e.g. how much of it exists relative to the potential area impacted) and worth (e.g. its socio-economic, cultural and amenity value).
Negligible	Receptor has capacity to avoid or adapt to an effect. Receptor has capacity to tolerate or absorb effect or will not be affected. Receptor has full capacity to recover to baseline conditions. Negligible level of conservation status or keystone species, rarity (e.g. how much of it exists relative to the potential area impacted) and worth (e.g. its socio-economic, cultural and amenity value).

Significance of impact

8.24 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact. The significance of impact is based on best practice and expert judgement. Any impacts of 'moderate' or above are considered significant, in accordance with EIA guidance (SNH, 2013; CIEEM, 2010). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor (see Chapter 5 Environmental Impact Assessment Methodology for full details).

Table 8-27 Table used to determine significance of impact

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

8.7 Data Gaps and Uncertainties

8.25 The sensitivities of benthic species to potential impacts are generally not well understood. Environmental effects of marine renewable deployments in terms of direct impacts such as habitat loss, scour and suspended sediments are recognised; however there are uncertainties around the impacts relating to the effects of some pollutants and electromagnetic fields (EMF). There are limited data available concerning the effect of EMFs on any particular benthic invertebrate species, particularly as levels of emission are likely to be significantly lower than those administered during laboratory experiments. However the limited EMF research places benthic species in a category of least concern (discussed further in Section 8.12.5) and this has been taken into account when undertaking the impact assessment. A precautionary approach is taken with regards to the release of potential pollutants and as a mitigation measure, the use of chemicals, oils and lubricants will be limited and strictly controlled (discussed in Section 8.11.4).

8.26 There has not been an offshore benthic survey carried out for the specific purposes of this impact assessment. The reason for this is that Marine Scotland Science carried out a benthic survey in this area in 2014 (MSS, 2014a) which is deemed sufficient to inform a robust baseline for the benthic environment.

8.8 Description of the Current Environment

Offshore area

8.27 Water depths in the offshore area range from approximately 60 to 110 m. Geological surveys of the area (BGS, 1989) indicate that the surface sediments are mainly composed of sand and slightly gravelly sand (see Figure 8-3). The broad-scale habitats predicted by European Nature Information System (EUNIS) for this area are circalittoral fine sand and circalittoral muddy sand (McBreen *et al.*, 2011). The Site and export cable corridor falls within an area of seabed surveyed by Marine Scotland in 2014 using multi-beam echo sounders, grab sampling and drop-down video camera (Moore C.G., 2015). The detail shown in the map was extrapolated from the data presented in Moore C.G. (2015). The data points shown in Moore C.G. (2015) are presented here as the general biotope present in that area. Where *A. islandica* was found, this is overlayed in the Area of Search in Figure 8-2.

8.28 The dominant habitat type observed within the offshore area during this survey was slightly rippled fine sand area with patches of scattered gravel, pebbles, cobbles and occasional boulders on sand found mainly in the south western corner of the Site.

8.29 Two dominant seabed biotopes were recorded in the offshore area. A biotope is a region of a habitat associated with a particular ecological community. The biotopes are described according to The Marine Habitat Classification for Britain and Ireland, (Connor *et al.,* 2004) SS.SSa.CFiSa (circalittoral fine sand) and SS.SMx.CMx (circalittoral mixed sediment). Sandy sediment habitats typically support a diverse range of infauna (animals living in the sediment) including polychaetes and bivalves. In mixed sediment areas where hard substrata are present, a range of epifaunal species including hydroids, bryozoans and echinoderms are found. The visible fauna present in fine sand habitat covering the majority of the offshore area was generally sparse, although evidence of infauna was indicated by observations of emergent tubes, polychaete casts and bivalve siphons (most of which resembled those of *Arctica islandica)* in the video images collected (Moore, C.G. 2015).

Export cable corridor

8.30 The export cable corridor covers an area of 31.5 km^2, which extends from the intertidal zone to the southern boundary of the offshore area in water depths of approximately 60 m. The seabed characteristics within the cable corridor vary from homogeneous sandy sediment in the Site through areas of mixed sediment types and with rocky seabed located closer to the coast (McBreen *et al*., 2011).

8.31 In water depths between approximately 40 - 60 m the 2014 seabed video survey (Moore, C.G. 2015) found a similar seabed biotope to that found in the offshore area - SS.SSa.CFiSa (Circalittoral fine sand). In the shallower water area (in depths between 30 and 40 m) located approximately 2-3 km from the coast a more heterogeneous seabed was recorded with areas of mixed substrates consisting of varying proportions of gravel, pebbles, cobbles and boulders (classified as SS.SCS.CCS - Circalittoral coarse sediment) and moderate energy, rocky reef habitats composed of boulders and cobbles encrusted with bryozoans, pink coralline algae (classified as the moderate energy circalittoral rock biotopes CR.MCR.EcCr.FaAlCr.Pom and CR.MCR.EcCr.FaAlCr.Flu).

8.32 The seabed habitats present in the shallow areas (depths less than 30 m) of the export cable corridor were not surveyed as part of the 2014 Marine Scotland survey (Moore C.G., 2015). Two habitat types are likely to occur in these near-shore parts of the export cable corridor. High energy infralittoral rock on the exposed coast to the east and west of the cable landfall area and infralittoral fine and muddy sand within the sheltered parts of the bay (McBreen *et al.*, 2011). Based on knowledge of the seabed characteristics and habitats recorded in the Pentland Firth area, the higher energy coastal area is likely to be dominated by exposed bedrock with varying densities of kelp and other seaweed communities consistent with the IR.MIR.KR (kelp and red seaweeds - moderate energy infralittoral rock) biotope.

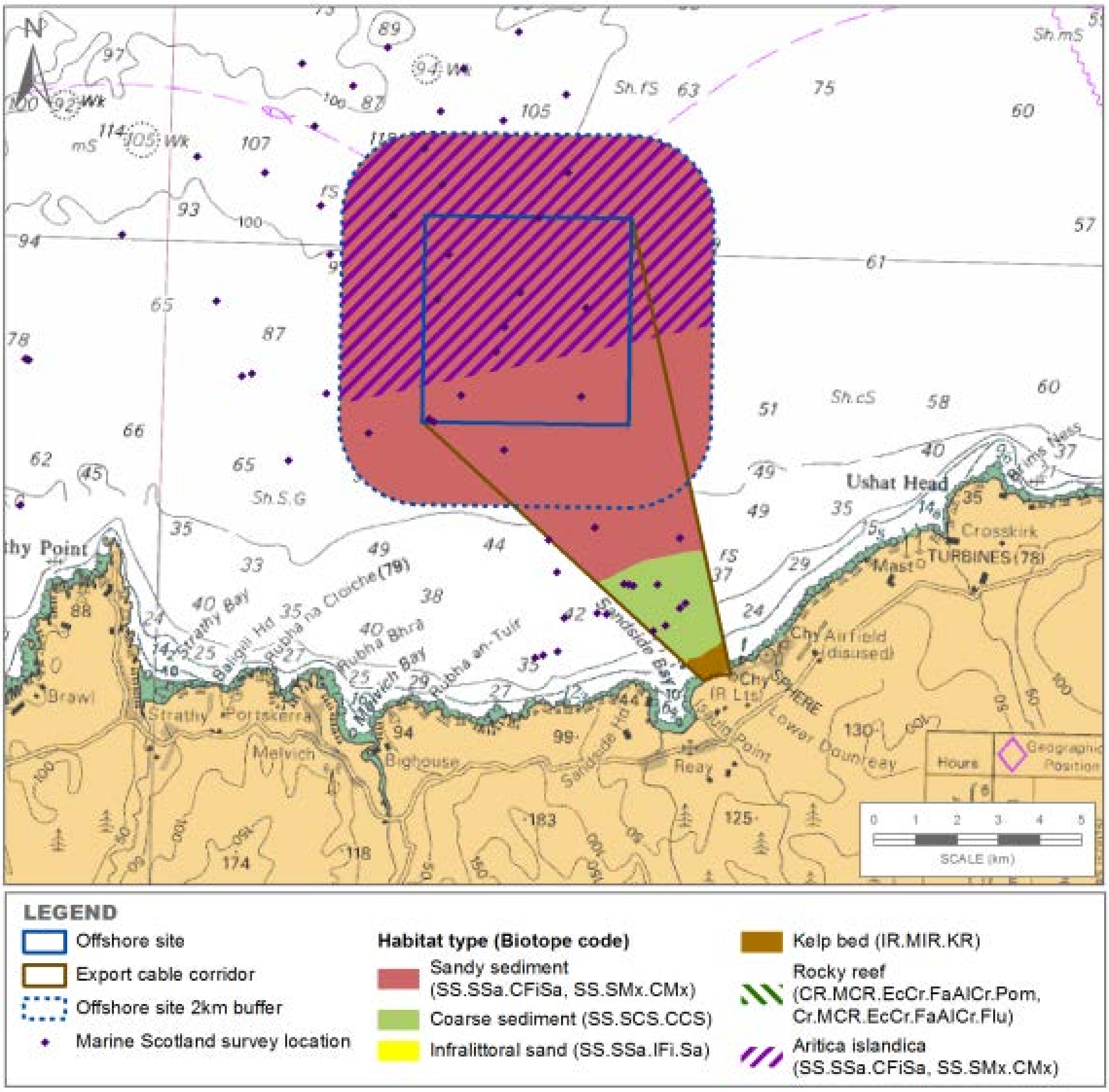

Figure 8-9 Seabed habitats and biotopes observed in Site and export cable corridor

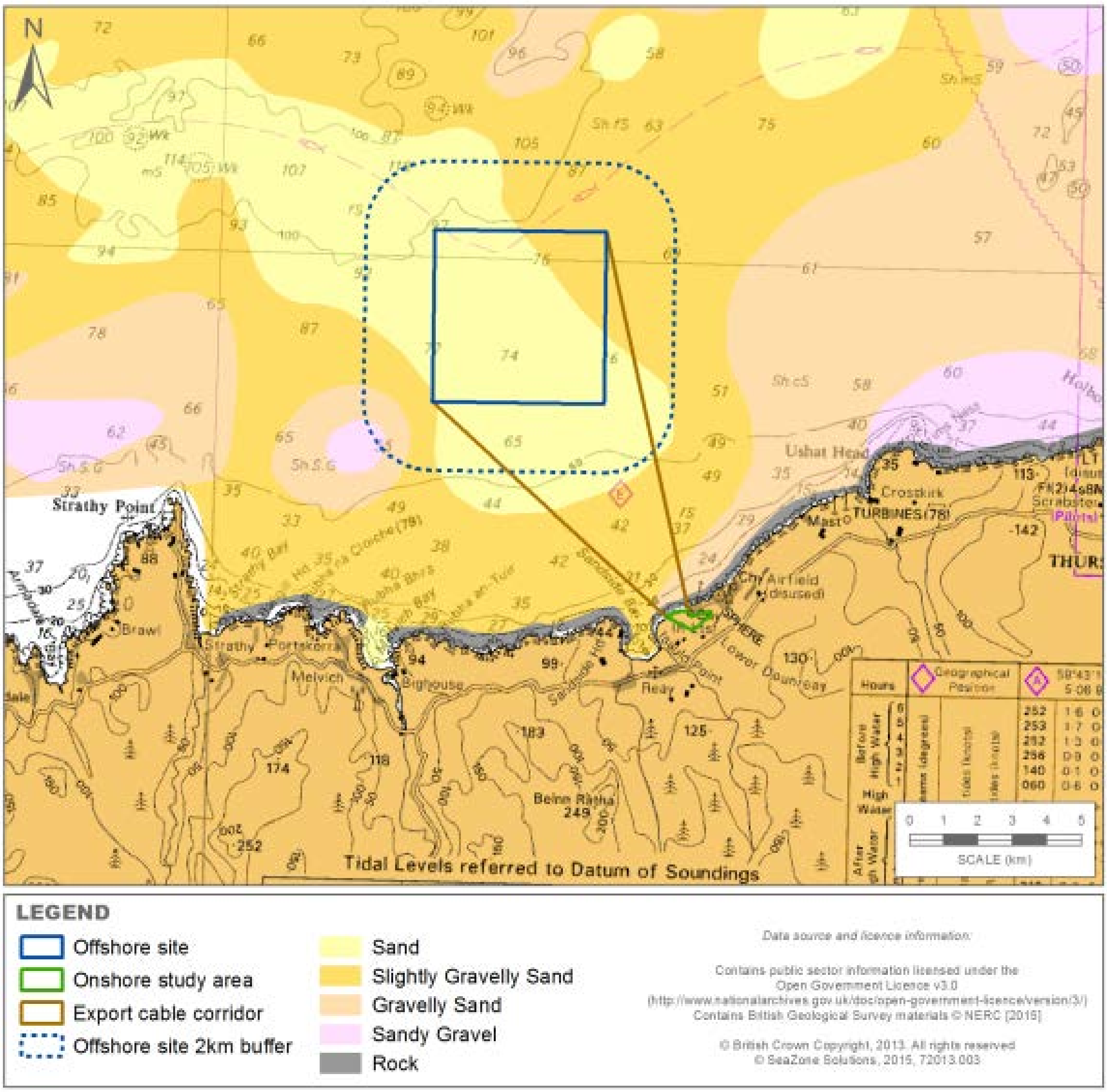

Figure 8-10 Summary of surface sediments in Site and export cable corridor

Habitats and species of conservation interest

8.33 Special Areas of Conservation (SACs) and Marine Protected Areas (MPAs) enable the management and protection of marine habitats and species in line with the requirements of the EU Habitats Directive. The Scottish Government has also developed a list of Priority Marine Features (PMFs), including species and habitats, as part of a nature conservation strategy to be used as a tool to aid in the identification of potential MPAs. Independently, a series of priority habitats and species have also been designated as part of the UK Biodiversity Action Plan (UK BAP) to help identify and focus management and research effort throughout the UK.

8.34 There are no SACs relevant to benthic and shellfish ecology within the Site, export cable corridor or the immediate vicinity and the nearest MPA is north west Orkney MPA, located approximately 33 km to the north of the Site; designated for its importance to biodiversity (sandeels) and geodiversity (marine geomorphology of the Scottish Shelf Seabed including sandbanks and sand and sediment wave fields) (Figure 8-4).

8.35 The rocky reef area observed within the export cable corridor in water depths of 20 and 40m during the 2014 seabed survey (biotopes CR.MCR.EcCr.FaAlCr.Pom and

CR.MCR.EcCr.FaAlCr.Flu) are classified as an EU Habitats Directive Annex I protected habitat 'Reef'. The 2014 Marine Scotland survey (Moore C.G., 2015) encountered these habitats between 35 and 44m depth. These habitats were encountered in low density, and are therefore not included in Figure 8-2. Rocky reef communities are widespread throughout the Pentland Firth area and around the coast of the UK and it is therefore considered unlikely that the relatively small area occurring within the export cable corridor would be formally designated as an area of Annex I habitat.

8.36 The only PMF definitively identified in the offshore area is the ocean quahog *Arctica islandica* (Moore C.G., 2015) - a long-lived and large burrowing bivalve living in medium to fine sands and mud from the extreme lower shore down to the circalittoral seabed. The European spiny lobster *Palinurus elephas* is a PMF species that has been historically abundant along the west and north coasts of Scotland, but has undergone significant reduction in population size in Scottish waters (SNH, 2014). The spiny lobster prefers rocky, exposed subtidal areas in the circalittoral zone therefore it is possible that this species may be present in rocky seabed areas within the export cable corridor. It also is likely that areas of kelp bed (classified as a PMF habitat) will occur within the export cable corridor on infralittoral rocky seabed in water depths of less than 20 m.

8.37 No UK BAP habitats and species have been recorded in previous surveys of the offshore and export cable corridor areas.

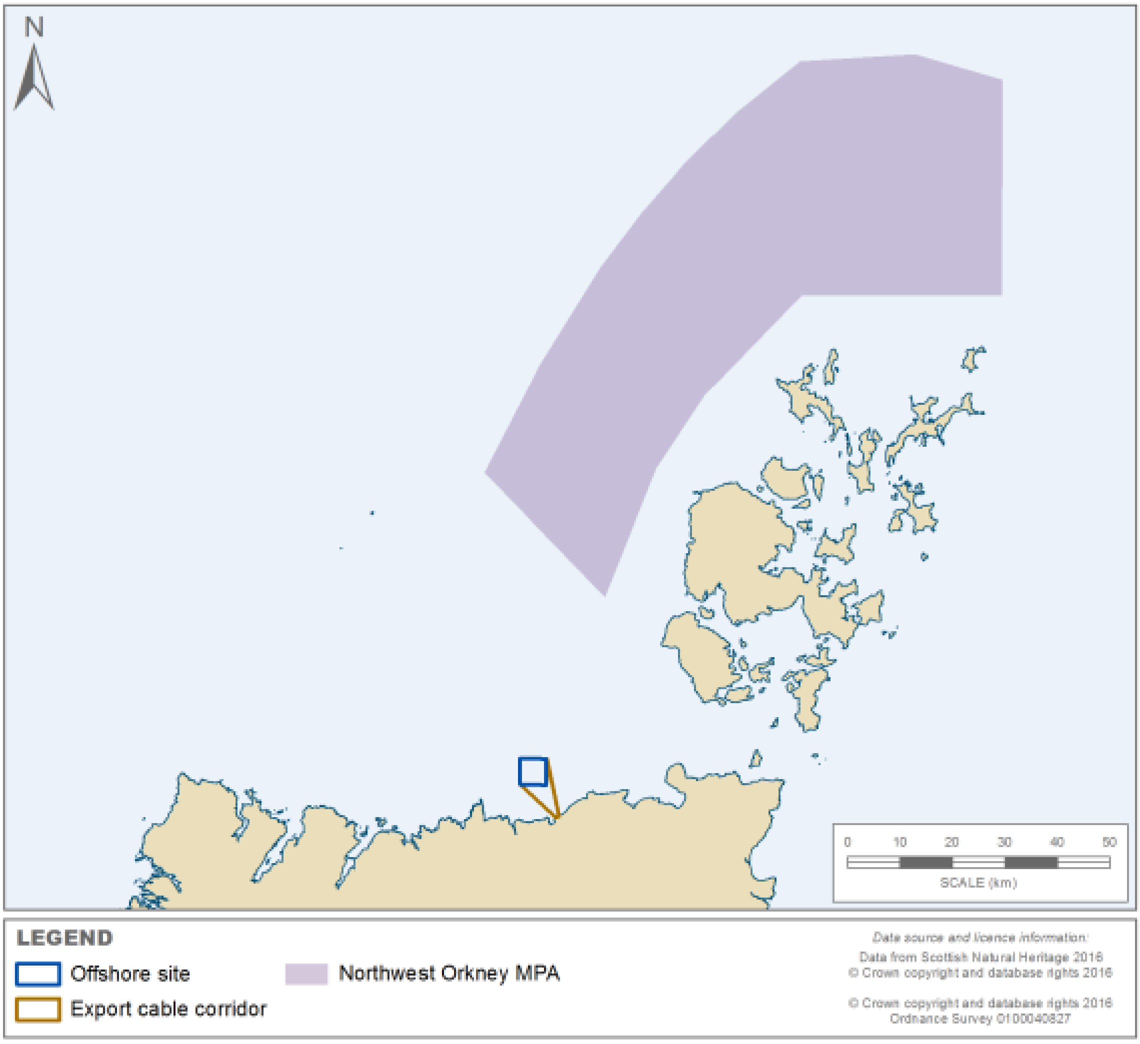

Figure 8-11 North West Orkney MPA in relation to the Project site

Commercial shellfish species

8.38 The Site and export cable corridor are situated within ICES sub-area rectangle 46E6 (Figure 8-5). This area includes the north east coast of Scotland from Strathy Point to Duncansby Head and the south west region of the Orkney Islands. This area will be used in the impact assessment of the commercial shellfish species as this is the area used in official stock assessment of these species (Marine Scotland Science, 2014b). See Chapter 12 Commercial Fisheries for impact assessment of commercial fish species.

8.39 The three most economically important commercial species from the area include Brown crab *Cancer pagurus* (Marine Scotland Science, 2014b; See Chapter 12 Commercial Fisheries), European lobster *Homarus gammarus* and king scallop *Pecten maximus*. Velvet crab *Necora puber* is also commercially fished in this area, as is periwinkle *Littorina littorea*, green crab *Carcinus maenus*, common whelk *Buccinum undatum*, Norway lobster *Nephrops norvegicus* and queen scallop *Aquipecten opercularis*.

8.40 None of these species are protected by any specific legislation or regulations (see Section 8.3), although they are fished subject to management regulations such as maximum landing size or total allowable catch.

8.41 Brown crab are found across a wide depth range from the lower shores of exposed and moderately exposed rocky shores, through the shallow sub-littoral fringes and in offshore water depths down to 100 m. They tend to inhabit rocky reefs, mixed coarse grounds and, for females in particular, offshore in soft sediments such as muddy sand (Neal & Wilson, 2008). Although non-migratory from a geographical perspective, females make short local migrations inshore from deeper offshore waters to mate before returning, while the males are generally sedentary and stay in inshore waters. They are fished off the entire rocky north coast of Sutherland and Caithness.

8.42 European lobster live from the lower shore down to 60 m on a hard bedrock or boulder substrate with holes, caves and overhangs which are used as safety retreats. The entire north coast of Sutherland and Caithness provides abundant suitable habitat.

8.43 King scallops have a patchy distribution and are generally found in shallow depressions in the seabed on a mix of sediment types including firm sand, fine or sandy gravel and occasionally on muddy sand (Marshall & Wilson, 2009).

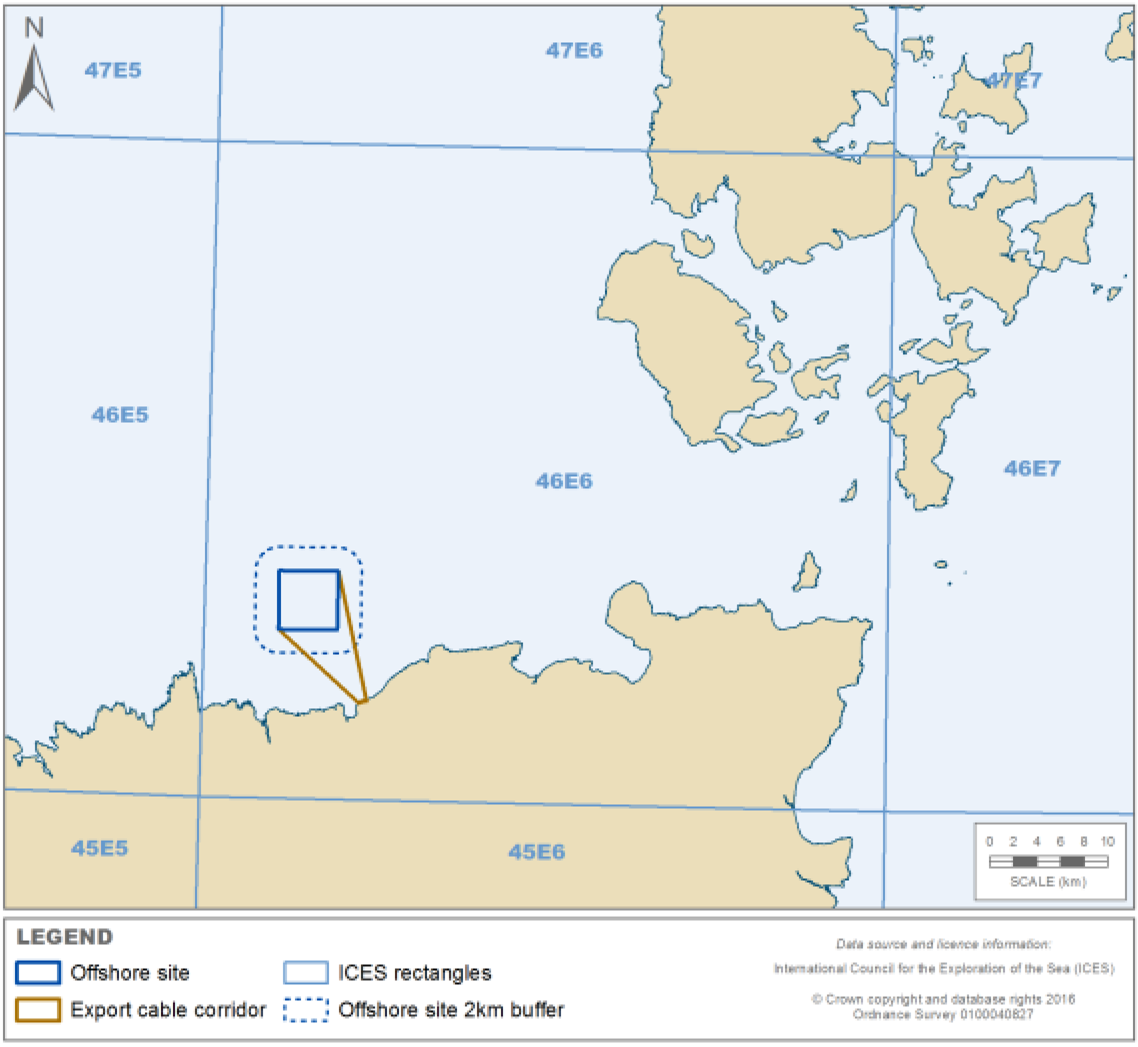

Figure 8-12 Project site and cable corridor within ICES Rectangle 46E6

Summary

8.44 Sandy sediment habitats supporting primarily infaunal communities dominate in the water depth of between 40 m and 90 m in the Site and export cable corridor. The seabed sediments tend to become coarser as water depth decreases towards the coastline and areas of biota-encrusted gravel, cobbles and boulders as well as rocky outcrops occur in water depths of approximately 20 to 40 m.

8.45 Those PMF species identified as being present in the Site, and buffer zone and export cable corridor are the ocean quahog *Arctica islandica* and the European spiny lobster *Palinurus elephas.* One PMF habitat was also identified as likely to occur in the export cable corridor; kelp bed. These species and habitats are being taken forward to the assessment phase due to their conservation importance.

8.9 Identification of Potential Impacts

8.46 The following impacts have been considered in the assessment. These have been informed through scoping and the consultation process.

Potential impacts in the construction phase

- Substrate, habitat and species loss due to placement of infrastructure (cables, mooring, anchors);
- Increased suspended sediment and turbidity due to installation of subsea infrastructure;
- Release of radioactive particles present in sediment into wider environment as a result of disturbance of sediment; and
- Damage to habitat or species due to pollution from routine and accidental discharges.

Potential impacts in the operations and maintenance phase

- Hydrodynamic changes leading to scour around subsea infrastructure;
- Damage to habitat or species due to pollution from routine and accidental discharges;
- Introduction of marine non-natives as a result of vessel movement or through use of subsea infrastructure as stepping stones;
- Creation of habitat for benthic fauna through colonisation of subsea infrastructure; and
- Impact to benthic communities from any thermal load or EMF arising from the cables during operation.

Potential impacts in the decommissioning phase

- Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase. Following removal of structures opportunities for habitat recovery in the former location of foundations may arise.

8.10 Impact Assessment – Construction Phase

Substrate, habitat and species loss due to placement of infrastructure (cables, mooring, anchors and scour protection)

8.47 Dredging of the development area and the installation of drag anchors, clump weight, export cable, scour protection, presence of vessels (anchoring, discharge etc.) on the seabed will result in some loss of sedimentary habitat. The worst possible scenario for anchor design and scour protection will be considered here (see Table 8-3).

8.48 The development will use a maximum of 16 drag embedded anchors (up to two anchors on up to 8 mooring lines). There will be a 100 m disturbance area associated with the installation of each anchor, which will be buried to 10-15 m. There will also be a clump weight which will require a 70 m by 70 m area of the seabed to be dredged to a depth of 5 m and infilled with gravel. The export cable will be buried where possible to a depth of 1-2 m. The remainder of the cable will lie on the seabed and will require some protection in the form of rock dumping. The worst case scenario is that 2.8 km of the cable will not be buried and will require protection.

8.49 Dredging and the placement of anchors and cables could potentially result in localised injury or mortality of sessile species present in the seabed area. More mobile species such as shellfish will likely be able to move away from the area of installation. This disturbance will be temporary in the majority of the area as the anchors will be buried, the clump weight will be lifted off the seabed and up to 80% of the export cable will be buried. Upon completion of installation the areas of anchor and clump weight will be recolonised. The benthic habitat where the export cable is not buried not be recolonised. The total area of the export cable is 0.11 km^2, with 20% of the cable predicted to be sitting on the seabed; this will be an area of less than 0.04 km^2.

8.50 Existing seabed habitats may subsequently be lost due to surface laying or cable protection options. Cable protection options are likely to change benthic communities locally via the provision of different habitat environments.

8.51 This impact will begin at the initial construction stages. In the area of the unburied export cable this impact will continue throughout the life of the array. In the area of the buried export cable, buried drag anchors and dredging underneath the platform, the re-establishment of benthic communities would begin immediately after completion of the cable laying operations.

8.52 Although there are areas of important habitats at the Site, (rocky reef habitats CR.MCR.EcCR.FaAlCr.POM and CR.MCR.EcCr.FaAlCr.Flu), these are widespread throughout the coast of the UK and it is therefore unlikely that the relatively small area occurring within the export cable corridor would be formally designated as an area of Annex I habitat.

8.53 Two PMF species, ocean quahog *Artica islandica* and spiny lobster *Palinurus elephas* and the commercially important shellfish species discussed in the baseline section (Section 8.9.4) are likely to be present in the area and could therefore be impacted. The species such as Spiny lobster, brown crab and European lobster are mobile species, and it is likely that they would be able to avoid the area during dredging and construction and installation of the anchors and export cable.

8.54 There is a possibility that some sessile species such as the PMF *A. islandica* and commercially important king scallop could be lost as a result of habitat loss at the Site. MSS survey data (Moore *et al*., 2015) showed that *A. islandica* was widespread in the survey area. As shown in Figure 8-2, this includes the Site and a small portion of the export cable corridor.

8.55 According to the OSPAR Commission (2009a) the range of *A. islandica* covers the entire British and Irish coasts and in offshore waters. The European range extends from Norway to the Bay of Biscay. OSPAR Commission also reports that the spawning season is June to October. The installation period is planned to take place in quarter 2 of 2018 (April - June). Therefore the installation will not coincide with the majority of the spawning season.

8.56 The small size of the area of habitat disturbance in relation to the distribution of *A. islandica* in this area, in addition to the wide range of *A. islandica* means that any impact to *A. islandica* is not likely to have an effect on the population as a whole.

8.57 Overall, the loss of such a small area in an already dynamic environment is considered to be of low impact magnitude, and the vulnerability of the sensitive species in the area is considered to be medium. Therefore the overall impact is considered to be of minor significance.

Increased suspended sediment and turbidity due to installation of subsea infrastructure

8.58 Installation of the anchors and export cable and dredging of the development area could cause increased suspended sediment and turbidity. This could potentially stir up any hazardous substances or toxins that are held in the sediment, potentially causing damage to benthic fauna in the area. However a review of the status of the marine environment around Scotland, covering hazardous substances, eutrophication, radioactivity, oil/chemical spills, algal toxins and microbiology of bathing and shellfish waters (Baxter *et al.,* 2011) found no significant concerns for the northern coastal area. Also, as this is a high dynamic environment, a certain level of suspended sediment and turbidity is normal for this habitat (see Chapter 6 Physical and Coastal Processes) for further detail.

8.59 Increased suspended sediment could also cause smothering of sessile or slow moving fauna when the sediment resettles on the benthos. Qualititatively, there will not be a large increase in sediment due to the relatively small area of the development.

8.60 As a result of this, the magnitude of the effect and vulnerability of the receptor are considered to be low, therefore the overall impact is considered to be of minor significance.

Release of radioactive particles present in sediment into wider environment as a result of disturbance of sediment

8.61 Fragments of irradiated nuclear fuel were discharged to sea as a result of reprocessing of nuclear fuels at the Dounreay Nuclear Facility during the 1960s and 1970s (DSRL, 2015). Studies have shown that the most hazardous particles are clustered on the seabed in the immediate vicinity of the discharge outfall located to the north of the facility located 1 - 2 km to the east of the export cable corridor. There have been smaller, less hazardous particles detected in the wider area – most notably in the Sandside Bay area (see Chapter 7 Intertidal Ecology; Sandside Bay is outwith the export cable corridor). An extensive programme of remediation activity has been undertaken by DSRL to detect and retrieve hazardous particles from a 60 ha area of seabed near the outfall using remotely operated vehicles (ROVs), clean-up vehicles and divers. Sandside Bay is also routinely monitored for particles and other contamination (DSRL, 2015). This remediation work is currently ongoing, however seabed monitoring has now ceased (see Section 8.5 and Chapter 6 Physical and Coastal Process). Based on the results of the reported survey results (SEPA, 2015, PRAG-D, 2011 and DSG, 2014) there is no evidence to suggest that potentially significant particles (with activities of greater than 1 million becquerels (Bq)) would be encountered within the Site or the export cable corridor. SEPA also undertook a survey of radioactive particles in the Dounreay area present in shellfish such as crabs, winkles and mussels (SEPA, 2015) and found no significant levels of radioactive particles present in the measurements.

8.62 There is a possibility that construction and installation activities could disturb radioactive particles resulting in their release to the wider environment. These particles would be damaging if consumed by benthic fauna including shellfish. The particles are likely to be in extremely low numbers. Many benthic fauna are filter feeders and are therefore resilient to the consumption of a wide range of toxins.

8.63 As a result of these factors, the vulnerability of the receptor is considered to be low and the magnitude of the impact is negligible. The overall impact is considered to be of negligible significance. In addition, the Applicant would commit to work with SEPA and DSRL to ensure that installation works are subject to the same monitoring that occurs at present.

Damage to habitat or species due to pollution from routine and accidental discharges

8.64 Leakage of pollutants from vessels or equipment could occur during the construction phase or at any stage of the development lifetime. This could be damaging to benthic fauna and habitats. An accidental event has the potential to result in the release or spillage of fuel or other contaminants from vessels.

8.65 The initial result of such a spill or leakage would likely include physical disturbance at the discharge location. As the area is a high energy environment, it is likely that there would be a reasonably high dispersal rate of any material.

8.66 The significance of this impact is considered to be moderate as the magnitude of the effect would be medium and the vulnerability of the receptor is also medium.

8.11 Impact Assessment - Operations and Maintenance Phase

Hydrodynamic changes leading to scour around subsea infrastructure

8.67 Scour and abrasion caused by the presence of anchors, mooring lines, dynamic cable and export cable have the potential to change habitats, exclude some species from the immediate area and select for scour resistant species. Scour results from turbulent flow which has the ability to suspend and redistribute sediment and is induced by the presence of structures (anchors and cables) on the seabed. Movement of infrastructure on the seabed (mooring lines and dynamic cables) may locally abrade the surface of the seabed under more extreme wave conditions. There will be a maximum of 16 anchors with a maximum of 8 mooring lines. The dynamic cable will have one touchdown point approximately 250 m from the development, and approximately 20% of the dynamic cable may come into contact with the seabed as the platform moves. The export cable will cover an area of 0.11 km^2. This impact is present throughout the lifetime of the array.

8.68 Monitoring work undertaken at the European Marine Energy Centre (EMEC), a similar site exposed to Atlantic swell approximately 25 nautical miles to the north east of the Site, indicated that tidal currents alone do not provide enough energy to generate sediment movement based on critical threshold current velocities (velocity required to initiate movement of sediment grains), but large, long period waves can mobilise sediment at depths of 60 m for a few hours at a time. The Site ranges between 60-110 m depth of water, where wave action will rarely generate sufficient energy to suspend sediment.

8.69 Tidal currents in the area are more than twice as fast as those at the EMEC site with maximum values reaching 0.75 m/s on spring flood tides. However tidal currents also decay with depth and it is unlikely that the critical threshold value for lifting fine gravel will be reached (1.67 m/s^{-1} depth averaged velocity). The critical threshold for suspending slightly gravelly sand (0.605 m/s^{-1} depth averaged velocity) will almost definitely be exceeded at some points in the tidal cycle. Given that the Site and export cable corridor is made up of variable proportions of gravel and sand there is therefore a potential for scour to occur. The interactions of wave and tidal action on the sediment movement will increase with decreasing depth along the export cable route. Movement around the anchors, and export cable including the area of touchdown of the dynamic cable will induce surface abrasion, disturbing the benthic habitat.

8.70 Where the drag anchors reach target burial (10-15 m), there will be no scour protection required. However it is likely that not all anchors will reach target burial depth due to seabed conditions and will therefore have scour protection installed to mitigate the effects of scour. Rock will be used as scour protection. The extent of scour protection for each anchor will be a maximum of 20 m.

8.71 The combination of water depth, characteristics of the sediment composition in the Site and export cable corridor and the small seabed footprint of the platform may result in some scour around the development infrastructure and some local abrasion to the seabed in the proximity of anchors, and dynamic cable. Such effects will be of low magnitude, and the vulnerability of the receptor is considered to be medium. Therefore the predicted significance of the impact is minor.

Damage to habitat or species due to pollution from routine and accidental discharges

8.72 Same as impact assessed in Construction Phase above (see Section 8.11.4 above for full analysis of this impact).

Introduction of marine non-natives as a result of vessel movement or through use of subsea infrastructure as stepping stones

8.73 There is potential for marine non-native species to be introduced or transferred by construction vessels, particularly those vessels with an international market such as anchor handler vessels and cable installation vessels. This can happen through attachment of organisms to boat hulls or released in ballast water. Introduction of non-native species can have a detrimental effect on the wildlife through predation on existing wildlife or outcompeting for prey and habitat.

8.74 There will be approximately nine vessels used during the construction, operation and maintenance of the development. Vessels will be sourced locally where possible.

8.75 However, the magnitude of the effect and the vulnerability of the receptor are both assessed as medium. Therefore the impact significance is assessed as moderate.

Creation of habitat for benthic fauna through colonisation of subsea infrastructure

8.76 Throughout the life of the platform, the presence of mooring lines, and scour protection and cable protection on the seabed all provide new hard surfaces for colonisation by benthic species. Successful colonisation is likely to increase the biodiversity of the local area.

8.77 The platform shall use a passive mooring system up to 8 mooring lines which are anchored to the seabed. Each mooring line will be 800 m long. The mooring lines shall pass through a 600 tonne 50 m by 50 m clump weight. This mooring system will provide colonisable surfaces. The 250 m of suspended dynamic cable and its associated clump weight will also provide new hard surfaces. Additionally the submerged exterior surface of the platform will provide additional colonisable surface. The draught of the platform will be 15 m meaning that there will be a surface area of the submerged platform consisting of colonisable hard substrate. Although these surfaces are not on the seabed, they will effectively provide new shallow benthic habitat.

8.78 A 13.8 km length of export cable will be installed, covering a maximum of under 0.2 km^2 of seabed. The cable will be buried where the seabed allows, however it is estimated that 20% of the cable may not be buried. The length of cable laid directly on the seabed will provide a colonisable surface, as will the cable protection placed on the cable where required.

8.79 These structures are all likely to be colonised by significant amounts of encrusting epifauna typical of local bedrock and cobbles – hydroids, bryozoans, tunicates. Their lack of structural complexity makes it unlikely that highly diverse communities will develop, however all bio-fouling represents additional food supply within the local ecosystem. It is unlikely that this will significantly increase the productivity of the local area or attract significant numbers of foraging species to the area.

8.80 The total area of potential new habitat is small but represents a minor shift away from baseline conditions; the effect is therefore considered to be of positive but low magnitude and the receptor is of low vulnerability, therefore and the overall impact will be negligible but positive.

Impact to benthic communities from any thermal load or EMF arising from the cables during operation

EMF

8.81 Electromagnetic fields (EMFs) have the potential to alter the behaviour of marine organisms that are able to detect electric or magnetic fields. Throughout the operational life of the platform electricity will be transferring constantly along the export cable. The export cable will be in contact with the seafloor for a maximum length of 13.8 km; and selection of the "lazy-wave" S-shape dynamic cabling configuration adds a further 250 m length of cable; 20% of which (50 m) may come in contact with the sea floor. There will also be inter-array cables linking the two turbines which will be integrated into the top-side of the platform, and not submerged.

8.82 The export cable will be a 33 kV cable, conforming to the industry standard specification which includes shielding technology to prevent the direct emission of electric fields (E fields). The magnetic component (B field) of the EMF however will not be contained and will penetrate the surrounding environment. Previous studies suggest that the magnitude of these emissions in a 33 kV cable is in the order of 1.5 μT, a value much lower than the 30 to 70 μT range that is produced naturally by the earth (Gill *et al.,* 2005). Despite this low value emission, the movement of water and organisms through the B field causes the production of an induced electric field (iE field).

8.83 Where seabed conditions allow, the export cable will be buried to a depth of 1-2 m. Burial of the cable is effective at moving the source away from the water/seabed interface; however the B field still propagates through the sediment. As a result, burial may reduce the proportion of the water affected by EMFs, but does not mitigate the effect on species living in or on the sediment. It is estimated that 20% of the cable may not be buried as well as the dynamic cable in the lazy S configuration; these will be placed directly onto the seabed. In the case of the unburied cable, rock placement will be used as cable protection. Both B field and iE fields dissipate rapidly from the source; therefore effects are confined to a local area of seabed.

8.84 There are very few data relating to the effect of EMFs benthic invertebrate species; some limited experimental work has been carried out with conflicting outcomes. Detrimental effects upon sea urchin and barnacle larvae exposed to high frequency static B fields have been observed in laboratory studies. Tested fields were in the order of 10μT - 1T (Levin & Ernst 1994; Leya *et al.,* 1999), magnitudes at least eight times greater than the EMF expected to be reached by the planned deployment. Bochert and Zettler (2004) concluded from experimental investigations that static magnetic fields from power cables do not influence the orientation, movement or physiology of benthic species. By contrast, a study by Rosario and Martin (2010) suggests that some species, such as the freshwater crab *Barytelphusa cunicularsis*, do show sensitivity to low frequency magnetic fields, causing increased aggregation and aggressive behaviour.

8.85 There is insufficient data to reach a conclusion on the effect of EMFs on any particular benthic invertebrate species. The literature indicates that the greatest effect will be upon fish species that use electroreception for benthic prey detection (see Chapter 9 Fish Ecology). The outcome of limited benthic-EMF research appears to place benthic species in a category of least concern.

8.86 There will be protection used on the portions of the cable that are not buried in the form of rock placement. If the protection placed on top of the export cable extends beyond the limits of the generated EMF epifauna are likely to be less exposed than those resulting from the unprotected inter-array cables.

8.87 The EMF emissions from this project are likely to be much smaller than those predicted by modelling studies. As a result of this, the magnitude of the effect is considered to be low, and the vulnerability of the receptor is assessed as medium. Overall, the significance of this impact is considered to be minor.

Thermal load

8.88 When electric energy is transported, a certain amount gets lost as heat energy. This increases the temperature of the cable surface and therefore increases the temperature of the surrounding environment (OSPAR, 2009a). There will be heat released from the export cable which has the potential to increase the temperature in the surrounding sediment and water (Boehlert & Gill, 2010). There has been limited research into this effect and the potential impact on the benthic community is therefore unknown (Boehlert & Gill, 2010).

8.89 There has been only one field study carried out so far to test the effects of operational buried cables on the surrounding environment. This study did not provide conclusive results due to a lack of data. The rise in temperature did not exceed 1.4°C in 20 cm depth above a 166 MW cable.

8.90 Although the effects of this impact are largely unknown, the magnitude of this project is small. In addition there are no species of conservation concern present in the area apart from ocean quahog *Arctica islandica* and spiny lobster *Palinurus elephas.* The burial of the cable will mitigate this impact for macrofauna such as *P. elephas*. As a result of the possible impact to *A. islandica*, the vulnerability of the receptor in relation to this impact is considered to be medium. The magnitude of this impact is low, therefore overall the significance of the impact is assessed as minor.

8.12 Mitigation Measures

8.91 Project commitments relevant to Benthic and Shellfish Ecology are listed below. For full list of project commitments, see Chapter 4 Project Description.

- GM19: Project Environmental Monitoring Programme (PEMP);
- GM2: Construction Environmental Management Document (CEMD);
- GM3: Operational Environmental Management Plan (OEMP);
- GM5: Pollution Control Plan (PCP);
- GM20: International Marine Contractors Association (IMCA) Guidance (Including Ballast Water Management); and
- GM11: Industry best practice and safety measures for pollution control (SEPA, 2009).

Specific Mitigation Measures

Mitigation Measures Specific to Marine Habitats and Benthos		
Ref	**Title**	**Description**
BSE01	Use of clean rock for cable protection	Should rock placement be used, in cable protection and scour protection, all contractors will be required to use clean rock only. The preference would be to source this rock locally, from an existing onshore quarry to reduce transportation costs.
BSE02	Cable protection management	Should rock placement be used, all contractors will ensure that the volume of any rock used in rock placement activities will be kept to a minimum. The width of rock covering should be minimised in order to minimise the risk of introduction of non-native species

8.13 Residual Impacts

8.92 The majority of impacts were assessed as having minor or negligible significance. The remaining impacts were assessed as moderate. Dounreay Trì Limited is committed to reducing impacts wherever possible. Those impacts that were assessed as moderate will have mitigation measures applied thus reducing impact significance of all impacts to negligible or minor i.e. not significant.

Damage to habitat or species due to pollution from routine and accidental discharges

8.93 In order to mitigate the potential damage to habitat or species that would result from pollution from routine or accidental discharges, industry best practice and safety measures will be followed in accordance with best practice policy provided by SEPA (2009) to ensure such incidents are avoided therefore the likelihood of accidental spillage is considered extremely unlikely. The Pollution Control Plan (which forms part of the wider Operational Environmental Management Document) would be used to manage the potential for accidental pollution, management of materials on site and response for any pollution events.

8.94 As a result of this, the magnitude of the effect is reduced to low, reducing the overall significance of the impact to minor.

Introduction of marine non-natives as a result of vessel movement or through use of subsea infrastructure as stepping stones

8.95 Operational control measures include ensuring that standard vessel audits are undertaken for all project vessels. IMCA guidance will be followed to ensure that vessels exceeding identified thresholds will be required to demonstrate a protocol for ballast water management and discharge (mitigation measure GM11). All ships will have to carry a Ballast Water Record Book and will be required to carry out ballast water management procedures to a given standard prior to operating on site. In addition, should rock placement be used, all contractors will be required to use clean rock only for cable protection where rock placement is required. This will minimise the chance of introducing non-native species to the habitat.

8.96 Mitigation measures BSE01 and BSE02 will also mitigate this risk to minimise the change of non-native species being introduced to the environment.

8.97 As a result of these mitigation measures, the magnitude of the impact is reduced to low which reduces the overall impact significance to minor.

8.14 Cumulative Impacts

8.98 There is potential for cumulative impacts to arise from the development of a number of other projects in the nearby area (see Chapter 5: Environmental Impact Assessment Methodology, for map of developments in nearby area):

- The SHE-T Orkney-Caithness interconnector cable;
- HIE Dounreay Demonstration Centre (DDC);
- Brims Tidal Array, Brims Ness;
- MeyGen, Inner Sound;
- Scotrenewables, Lashy Sound; and
- DP Energy, Westray South.

8.99 The consideration of projects that could result in potential cumulative impacts is assessed based on the results of the impact assessment, together with expert judgement of the specialist consultants.

The SHE-T Orkney-Caithness interconnector cable and HIE Dounreay Demonstration Centre

8.100 There is potential for cumulative impacts to arise from the development of the Project, the Orkney-Caithness interconnector cable and the DDC. However, there is limited information available about these projects, therefore it is difficult to fully assess the extent of potential impacts.

8.101 Construction impacts will be temporary and unlikely to overlap due to the early stage of development for the DDC and Orkney-Caithness cable. However, should progress be made and construction works were to coincide, the magnitude of construction impacts such as substrate, habitat and species loss and increased suspended sediment could be increased. This could have a greater impact on benthic species.

8.102 Operational impacts relate to the combined footprint of the DDC and Project areas occupied by turbines, platforms and associated moorings and infrastructure. The activity from these sites combined may increase the operational impacts on benthic ecology such as habitat damage, EMF or thermal load, hydrodynamic changes or introduction of marine non-native species. The location of export cables, and the burial or use of protection material used could mitigate this impact. However the combined project footprint remains small, therefore cumulative impacts are not anticipated to be significant.

Brims Tidal Array, Brims Ness

8.103 The planning application and Environment Statement have not yet been submitted for the Brims project; however it is of sufficient distance (approximately 36 km) from the Dounreay Trì Project such that significant cumulative impacts on benthic ecology are not likely to occur.

MeyGen, Inner Sound

8.104 Impacts on Benthic Ecology from the MeyGen project were all assessed as not significant (refer to the Environmental Statement on the Marine Scotland Licensing page: http://www.gov.scot/Topics/marine/Licensing/marine/scoping). Due to the small Project footprint, relative to the wider available suitable benthic habitat and lack of sensitive species and habitat in the area, as well as the distance between the Project and MeyGen (approximately 40 km) there are unlikely to be cumulative effects associated with the Project and the MeyGen site.

DP Energy, Westray South and Scotrenewables, Lashy Sound

8.105 Due to the small Project footprint, relative to the wider available suitable benthic habitat; as well as the distance between the Project and both Westray South (approximately 83 km) and Lashy Sounds sites (approximately 93 km) there are unlikely to be cumulative effects associated with the Project.

8.15 Summary and Conclusions

- No significant impacts to Benthic and Shellfish Ecology have been identified in the assessment of potential impacts at any stage of the Project construction, operation, and maintenance or decommissioning;
- Two potentially significant impacts were identified in the process of impact assessment; Damage to habitat or species due to pollution from routine and accidental discharges; Introduction of marine non-natives as a result of vessel movement or through use of subsea infrastructure as stepping stones;
- These impacts will be mitigated through general project commitments. As a result of this mitigation, the impacts' significance were assessed as minor; and
- Where there is potential for overlap of Project infrastructure or construction activity with proposed developments in the area, i.e. SHE-T Orkney-Caithness interconnector and HIE'S DDC for offshore floating wind, these will be mitigated through consultation and collaboration with developers to ensure there is no significant conflict or disruption to activities.

Table 8-28 Summary of residual impacts

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Substrate, habitat and species loss due to placement of infrastructure (cables, mooring, anchors)	Low	Medium	Minor
Increased suspended sediment and turbidity due to installation of subsea infrastructure	Low	Low	Minor
Release of radioactive particles present in sediment into wider environment as a result of disturbance of sediment	Negligible	Low	Negligible
Operations and Maintenance			
Hydrodynamic changes leading to scour around subsea infrastructure	Low	Medium	Minor
Damage to habitat or species due to pollution from routine and accidental	Low	Medium	Minor

Potential Impact	Magnitude	Vulnerability	Overall Significance
discharges			
Introduction of marine non-natives as a result of vessel movement or through use of subsea infrastructure as stepping stones	Low	Medium	Minor
Creation of habitat for benthic fauna through colonisation of subsea infrastructure	Positive (Low)	Low	Positive (Minor)
Impact to benthic communities from any thermal load or EMF arising from the cables during operation	Low	Medium	Minor
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase	N/A	N/A	Negligible

9 Fish Ecology

9.1 Introduction

9.1 This chapter describes the fish ecology within and around the offshore Project Site as defined in Chapter 4: Project Description and shown in Figure 9-1.

9.2 The potential effects that the Project may have on fish ecology in the 'Study Area' (see Section 9.2) are identified and assessed and, where required, the mitigation measures which will be implemented to prevent, reduce or offset any potential adverse effects.

9.3 The high level ecology of the fish community in the vicinity of the Project) is described considering spawning and nursery ground usage, elasmobranch species (sharks and rays; with the exception of basking sharks which are considered in Chapter 10: Marine Mammals, Turtles and Basking Sharks), migratory fish species and fish species of nature conservation interest. The offshore Site is considered to be the offshore area delineated in Figure 9-1.

9.4 Related issues including benthic and shellfish ecology, and commercial fisheries are covered in Chapter 8 and 12 respectively. The Habitats Regulations Appraisal (refer to Appendix 2.1) considers potential impacts on Natura sites designated for fish species.

9.2 Study Area

9.5 The offshore site (the 'Site') comprises a 5 km by 5 km offshore area located approximately 6 km from the north coast of Scotland in the Pentland Firth and an export cable corridor running from the Site to the coast immediately to the west of the Dounreay fenceline (see Figure 9-1).

9.6 The Site and export cable corridor are situated within The International Council for Exploration of the Sea (ICES) sub-area rectangle 46E6 which includes the north east coast of Scotland from Strathy Point to Duncansby Head and the south-west region of the Orkney Islands (as shown in Figure 9-1). ICES is a global organisation which coordinates oceanic and coastal monitoring and research, and advises international commissions and governments on marine policy and management issues. Fisheries effort and landings data (volume and value) are reported by defined statistical rectangles (geographical areas) to Marine Scotland and ICES.

9.7 For the purposes of this assessment, this ICES rectangle boundary will be used as the assessment boundary and referred to as the 'Study Area'. The reason for this is that fish species are highly mobile and data is collected by regulators using this boundary as guide. The ICES rectangles are identified as that which extends over 1° longitude by 30’ latitude. ICES rectangle 46E4 is an area of approximately 3,240 km (Malcolm *et al.*, 2010; See Figure 9-1).

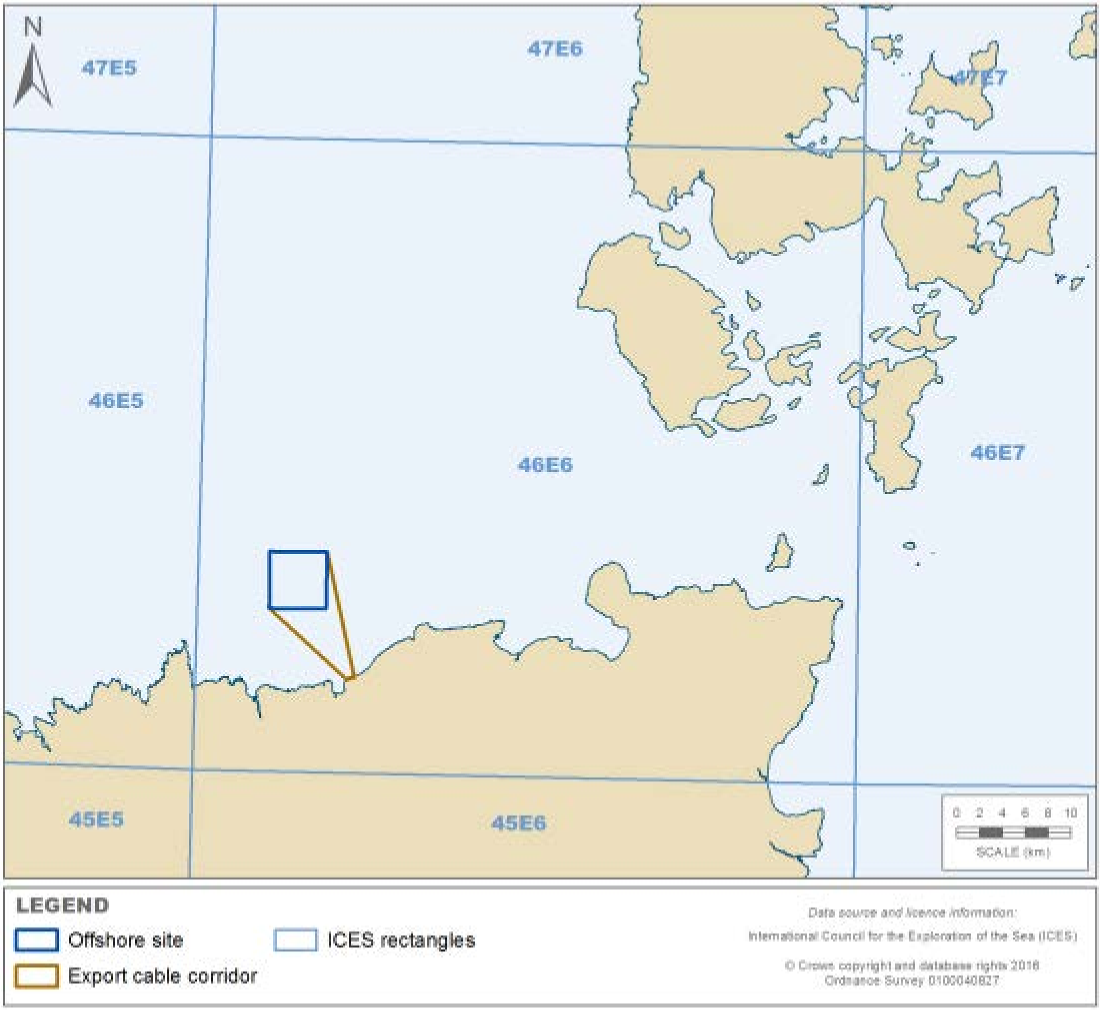

Figure 9-13 Offshore site and export cable corridor within ICES Rectangle 46E6 (Study Area).

9.3 Legislation and Guidance

9.8 The following relevant legislation and guidance relating to fish ecology was used in the preparation of this chapter.

9.9 Conservation importance of fish species will be deduced using the following pieces of legislation and guidance:

- European Council Directive on the Conservation of Natural Habitats and of Wild Flora and Fauna (EU Habitats Directive 92/43/EEC) 1992;
- Wildlife & Countryside Act 1981 (as amended);
- Nature Conservation (Scotland) Act 2004;
- Priority Marine Features (PMFs);
- OSPAR Convention;
- IUCN Red List of Threatened Species
- UK Biodiversity Action Plan (BAP);
- Scottish Biodiversity Strategy; and
- Caithness Biodiversity Action Plan.

9.10 Designated sites were also considered as part of the impact assessment. The following legislation were used to guide this assessment:

- The Habitats Regulations 1994 (as amended in Scotland); and
- Marine and Coastal Access Act (2009) and Marine (Scotland) Act (2010).

9.4 Sources of Information

9.11 A review was undertaken of the existing literature and data relevant to fish ecology in the Study Area and this was used to give an overview of the existing environment. The major data sources used in the preparation of this chapter are listed in Table 9-1.

Table 9-29 Additional sources of information

Source	Content
Marine Scotland Science (MSS)	MSS Landings Data 2014
Marine Scotland Science	Fish and Shellfish Stocks 2015 Edition
Marine Scotland's National Marine Plan Interactive	Spatial data on spawning and nursery grounds of fish and on conservation zones
Joint Nature Conservation Committee (JNCC)	Taxon Designations database of Conservation Designations
JNCC	Details of Protected sites (http://jncc.defra.gov.uk/page-4)
Scottish Natural Heritage (SNH) (SNH, 2014)	Priority Marine Features in Scotland's Seas
Coull *et al.*, 1998	Fisheries Sensitivity Maps in British Waters
Ellis *et al.*, 2012	Mapping Spawning and nursery areas of species to be considered in Marine Protected Areas (Marine Conservation Zones)
Faber *et al.*, 2007	Scottish Marine SEA: Environmental Report Section C Chapter C7: Fish & Shellfish
Marine Scotland (Godfrey *et al.*, 2014)	Depth use and movements of homing Atlantic salmon (*Salmo salar*) in Scottish coastal waters in relation to marine renewable energy development
Marine Scotland Science (Malcolm *et al.*, 2010)	Review of migratory routes and behaviour of Atlantic salmon, sea trout and European eels in Scotland's coastal environment: implications for the development of marine renewables
National Biodiversity Network	Information on species ecology and behaviour (accessed

9.5 Consultation

Pre-application consultation

9.12 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2nd February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date, and included the following relevant information:

9.13 Dounreay Site Restoration Limited (DSRL) Senior Environmental Specialist:

- Confirmed that beach surveys are carried out approximately every two weeks per month, throughout the year with surface driven detectors but no ploughing is undertaken;
- Seabed monitoring has ceased; and
- The Dounreay foreshore is monitored with sediment sampling and water sampling carried out several times per month.

9.6 Scoping Responses

9.14 The following stakeholder responses have been received specifically relating to this chapter.

Table 9-30 Summary of scoping responses

Consultee	Comment	Relevance / Cross Reference
Scottish Government Planning	**Loss of or damage to seabed habitat or species** from the placement of drag anchors onto the seabed, movement across the seabed during the operational phase, installation of pin piling, burial of the export cable beneath the seabed and at landfall, addition of scour protection to the seabed, the presence of vessels (e.g. anchoring, discharges, etc.), accretion of sediment around anchors, and scouring and abrasion caused by moving mooring lines should also be discussed in the ES. This should also include the potential for impacts on species, notably fish nursery and spawning.	See Sections 9.11 and 9.12
Scottish Government Planning	**Noise and vibration** from site operations can have a wide range of knock-on effects, particularly during the construction stage from activities such as pin piling, the placement of drag anchors and mooring lines, the physical presence of vessels and construction equipment onshore. There is also likely to be potential for effects during decommissioning. The ES should consider the potential for disturbance and displacement of fauna, particularly marine fauna (i.e. seals, cetaceans, basking sharks, salmonids).	See Sections 9.11 and 9.12

Consultee	Comment	Relevance / Cross Reference
Scottish Government Planning	**Impacts to seabed sediments and onshore soils** from spill or leakage of pollutants should also be discussed, particularly during the construction and decommissioning stage (e.g. from vehicles, vessels, storage of chemicals onsite). The ES is expected to provide detail on mitigation measures, such as avoiding/managing spills and leaks, and the development of emergency response plans.	See Chapter 4: Project Description, Project Commitments
Scottish Government Planning	The ES should discuss the potential for **thermal changes and electromagnetic field (EMF)** impacts associated with cabling and grid connection infrastructure, including the risks that this could pose for fauna in Scoping Direction: Dounreay Trì Floating Wind Demonstration Project 6 Scottish Government Planning and Architecture Division the marine environment and fauna and human health in coastal and onshore areas.	See Section 9.12
Scottish Government Planning	There may be potential for the development and it's above water and subsurface infrastructure to create **artificial habitats** for birds and marine organisms (i.e. shellfish, seaweed). For example, the ES could discuss whether the presence of mooring lines, support structures and drag anchors could create such habitats, and consider the use of above water structures by birds for roosting and undertaking foraging in the vicinity of the development. The ES could discuss the potential for long-term habitat change, and changes in foraging opportunities, and proposals for monitoring any such effects.	See Section 9.12
Scottish Government Planning	The ES should include the identification and assessment of **cumulative impacts** that may occur in proceeding with the development. In particular, it should discuss the potential for impacts on marine mammals and migratory fish associated with an increased number of barriers affecting species movement (i.e. device arrays, construction vessels/equipment, etc.), on seabirds, and on nearby communities.	See Section 9.16 Projects for cumulative impact assessment agreed with Marine Scotland Licensing Operations Team (MS-LOT)

Consultee	Comment	Relevance / Cross Reference
SEPA	We highlight the need to consider Priority Marine Features, which were developed under the Marine (Scotland) Act 2010 and are recognised as species of importance to Scotland. Whilst we agree that there are no Marine Protected Areas present in the vicinity of the development, this doesn't mean there will not be any Priority Marine Features, and this needs to take into consideration in subsequent survey work and in finalising layouts. Consideration should also be given to the National Marine Plan.	See Section 9.9
Scottish Natural Heritage (SNH)	For the assessment of potential impacts in the marine environment, we recommend using the guidance produced by the Chartered Institute of Ecology and Environmental Management. (Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (2010) http://www.cieem.net/ecia-guidelines-marine-)	Noted.
SNH	Mitigation and monitoring We advise that, within the ES, a schedule of commitments is provided with regard to proposed mitigation. Furthermore, we advise that the applicant provides a draft Environmental Mitigation and Monitoring Plan (EMMP) as part of the ES. The proposed EMMP should provide details on mitigation measures and monitoring studies to be undertaken.	See Chapter 4: Project Description, Project Commitments
SNH	Cumulative and in-combination effects Our advice with regard to cumulative and in-combination assessment is that other projects and plans which should be included are agreed in consultation with the Regulators.	See Section 9.16 Projects for cumulative impact assessment agreed with Marine Scotland Licensing Operations Team (MS-LOT)
SNH	It is considered unlikely that the proposed Dounreay Trì project will have any potential adverse impacts on any Nature Conservation MPAs.	See Section 9.9

Consultee	Comment	Relevance / Cross Reference
SNH	Priority Marine Features (PMFs) Consideration should also be given to the present or absence of PMFs within the development site. These should be specifically referenced and an account of the presence, extent and quality (e.g. abundance, patchiness, density, % live/dead, and species richness) of the PMF in that location should be provided. The assessment of potential impacts and any consideration of mitigation options should also give particular consideration to PMFs, if identified. A list of PMFs can be found at: www.snh.gov.uk/protecting-scotlands-nature/safeguarding-biodiversity/priority-marine-features/.	See Section 9.9
SNH	The site overlaps with, but occupies very small portions of, potential spawning and nursery habitats for various commercial fish species. There are also likely to be various marine fish PMFs relevant to the proposed development location and with some sensitivity to some of the possible pressures. In all cases, however, the scale and nature of any impacts are sufficiently small and/or temporary that we can reasonably consider there to be no significant impacts upon the national, regional or population-level status of these species. Neither is a proposal of this size likely to add markedly to cumulative impacts on marine fish or shellfish.	Noted as part of the baseline assessment (9.9), impact assessment (9.10) and assessment of cumulative impacts (9.16)
SNH	Assessment of impacts of habitats loss or change should include scour protection materials.	See Sections 9.11 and 9.12
SNH	Assessment of potential impacts from EMF should pay particular heed to scientific uncertainties in reaching appropriate conclusions. Cumulative impact considerations may be relevant for EMF, given the proximity to the proposed Dounreay Floating Wind Deployment Centre and the Caithness to Orkney interconnector.	See Section 9.15
SNH	Ghost fishing by lost gear that could become entangled with cables or mooring lines is indicated for being 'scoped-out'. While we welcome the commitment to regular monitoring and removal of any caught gear, we suggest that the potential impact remains scoped-in to ensure that such measures are carried forward through the EIA process in to the EMP.	See Section 9.12

Consultee	Comment	Relevance / Cross Reference
SNH	The potential for suitable substrates for sandeels is noted and we support the suggestion to seek further advice from Marine Scotland. We consider it unlikely that the scale of the proposal warrants any field-survey to support this or other aspects of the assessment for marine fish and shellfish.	See Section 9.9
SNH	Noise It is stated (section 4.18) that six or more anchors will hold the platform in position. Drag embedded anchors are preferred for all of the mooring lines. However two or more pin piles may be required, but will only be considered if drag anchors are unsuitable. Utilising drag embedded anchors instead of pin piling would be useful noise mitigation. If piling is not to be undertaken, it would be possible that there would not be significant effects on diadromous fish from impacts arising from noise – however, the EIA should set out and evaluate this. If piling is to be undertaken, the EIA should consider the possible impacts arising from this, including consideration of timing.	Noted. Piling will not occur as part of this project.
SNH	EMF The landfall point for the export cable is proposed to be Sandside Bay. There are no SACs for diadromous fish or freshwater pearl mussel flowing into Sandside Bay, however, as stated above, the north coast of Scotland is understood to be potentially an important route for migrating Atlantic salmon. We should advise that the export cable should be buried to a depth of 1.5 m in shallow waters (defined as below 20 m by Gill & Bartlett, 2010) where possible. The Department of Energy and Climate Change (DECC) recommends that cables be buried to at least 1.5m, depending on the suitability of the substrates (DECC, 2011, National Policy Statement for renewable Energy Infrastructure (EN-3). Presented to Parliament pursuant to section 5(9) of the Planning Act 2008). Whilst cable burial would not be expected to reduce the extent of the emission field for EMF, it would increase the distance between the cable and the water column.	See Section 9.12

Consultee	Comment	Relevance / Cross Reference
SNH	Sedimentation Table 12-1 indicates (page 218) (See Scoping Report) that the effects of increased sedimentation on fish are scoped out. There is a lack of published literature relating to critical levels for diadromous fish of exposure to suspended sediments in the marine environment. However, it is apparent that many species of diadromous fish (including Atlantic salmon) appear to be capable of migrating through and surviving high suspended solid concentrations in estuarine environments (although they are likely to try to avoid areas of high suspended solids). Diadromous fish species are present, or have been recorded, in many estuaries regarded as being at the higher end of the turbidity scale and some of these sites have been designated as a Special Area of Conservation for migratory fish species. It could be considered unlikely that increased turbidity arising from development of the Dounreay wind farm would be of a level to have significant adverse impacts on diadromous fish, but this should be demonstrated in the EIA.	See Section 9.11

Consultee	Comment	Relevance / Cross Reference
SNH	Other species of conservation interest The scoping report has briefly (page 52) alluded to other fish species of conservation interest. Paragraph 7.53 recognises that European eel and sea trout are likely to be present in the area. We welcome the inclusion of these two species in the EIA. European eel is a conservation priority due to a 95 % drop in its population over the last 20 years; it is considered by ICES to merit emergency action and is listed as 'critically endangered' on the IUCN Red list. Very little is known about their migration pathways – either as juveniles or adults. A report from Marine Scotland Science (Malcolm *et al*. 2010) reviews the data available in relation to European eel migration routes and behaviour. A report from SNH (Gill and Bartlett, 2010) considers the effects of renewables-related noise and EMF on European eels. Sea trout support a number of fisheries in Scotland. Many of these fisheries have undergone significant declines in the last 25 years and this was a reason for the addition of the species to the UKBAP priority list. Sea trout is also a host species for fresh water pearl mussel. The report from Marine Scotland Science also reviews the data available in relation to sea trout migration routes and behaviour. SNH's report considers the effects of renewables-related noise and EMF on sea trout.	See Sections 9.9 and 9.10

9.7 Assessment Methodology

9.15 The overarching approach to the environmental assessment is described in Chapter 5: Environmental Impact Assessment Methodology. To support this, the following is a description of the specific criteria which have been used to evaluate the impacts of the proposals on fish ecology. The assessment has considered what, if any, impact these potential environmental changes are likely to have on fish ecology in the Site and export cable corridor (see Section 9.2). The EIA Guidelines (Marine) from the Chartered Institute of Ecology and Environmental Management (CIEEM, 2010) have been used as a guide for this assessment.

Design envelope considerations

9.16 As described in Chapter 5: Environmental Impact Assessment Methodology the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

9.17 To ensure the assessment adequately covers all potential variations in the design, the 'worst' case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy. The design envelope parameters below are the worst case scenario for this habitat.

9.18 Table 9-3 describes the Design Envelope parameters specific to fish ecology.

Table 9-31 Design envelope parameters specific to fish ecology

Design Envelope Parameter	Value / Description
Vessels used during construction, operation, maintenance and decommissioning	2 cable installation vessels; DP Fall-pipe Vessel & Crew transfer vessel 5 platform installation vessels; 4 anchor handling tugs and 1 a dive support vessel Crew vessels, crew transfer vessels and O&M vessels for operation and maintenance 1 barge (scour protection installation and decommissioning)
Parameters of drag anchors (including dredging)	Maximum 16 anchors (9 m by 9 m). 100 m disturbance per anchor Anchors will be dragged to penetrate 10 m - 15 m into the seabed.
Scour Protection	It is likely that no scour protection will be required However if it is required, rock will be used of 0.06-0.65 diameter. Height 2 m above seabed and the footprint would extend no more than 20 m from each anchor.
Parameters of clump weight (including dredging)	50 m by 50 m 600 tonnes Dredging 70 m by 70 m area to depth of 5 m and fill in with gravel to create level plinth. Clump weight will rest on seabed during installation before being raised off the seabed. During operation, clump weight will be suspended in the water beneath the platform.
Export Cable (including Dynamic cable)	Maximum footprint: 0.11 km^2. Cable will be buried up to 2 m where possible. Estimated 20 % (2.8 km) cable will not be buried and will require cable protection. Where seabed conditions prohibit the burial of the cable, rock dumping may be required to protect the cable. Dynamic cable 250 m long with "lazy-wave" configuration.

Design Envelope Parameter	Value / Description
Parameters of mooring lines	The mooring system shall consist of up to 8 mooring lines which are anchored to the seabed. The mooring lines shall pass through the clump weight. The mooring lines are most likely to be chain, steel wire or a combination thereof. Offshore grade mooring chains of 100 mm to 160 mm diameter may be used.

9.19 Impacts in the decommissioning phase will include temporary disturbance from the removal of the export cable and platform anchors will be comparable to those impacts assessed in the construction and operational phases (Section 9.10.2 and 9.10.3). If the export cable is left *in situ* the potential impacts will be reduced further.

Methods of prediction

9.20 Potential ***effects*** are identified and the significance of ***impact*** is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions.

9.21 A matrix approach has been used as a tool to inform the impact assessment, while expert judgement has also been used following best practice, best available scientific understanding and relevant EIA guidance (SNH, 2013; CIEEM, 2010).

9.22 Significance is attributed using the following attributes:

Magnitude of effect

9.23 Magnitude of Effect is based on the following four criteria:

- Spatial extent;
- Duration;
- Frequency; and
- Severity.

Table 9-32 Assessment of magnitude of effect

Category	Description
High	Effect is widespread covering entire project footprint and surrounding area. Effect is Permanent (during lifetime and following decommissioning of project). Effect will be repeated or continuous; causing major loss or major alteration to key elements of the baseline conditions such that the post-development character / composition / attributes will be fundamentally changed.
Medium	Effect is confined to project footprint. Effect is long-term (during the project lifetime). Effect will be a common occurrence causing medium damage to fish species. Loss or alteration to one or more key elements / features of the baseline conditions such that post-development character / composition / attributes

Category	Description
	will be partially changed.
Low	Effect is highly localised and medium-term or temporary. Effect will be Intermittent causing low damage to fish species, with high recoverability. Minor shift away from baseline conditions; change arising from the loss / alteration will be discernible but underlying character / composition / attributes of the baseline condition will be similar to the pre-development situation.
Negligible	Limited or indiscernible extent of effect. Effect is short-term or temporary. One off/one time effect causing indiscernible or slight change to fish species or habitat.

Vulnerability of Receptor

9.24 The vulnerability of the receptor is also taken into account and is attributed according to the following characteristics:

- Adaptability;
- Tolerance;
- Recoverability; and
- Value.

Table 9-33 Assessment of vulnerability of receptor

Category	Description
High	No capacity for receptor to avoid or adapt to an effect. No capacity for receptor to tolerate or absorb effect. No capacity to recover to baseline conditions. High level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).
Medium	Very little capacity for receptor to avoid or adapt to an effect. Very little capacity for receptor to tolerate or absorb effect. Very little capacity to recover to baseline conditions. Medium level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).
Low	Limited capacity for receptor to avoid or adapt to an effect. Limited capacity for receptor to tolerate or absorb effect. Limited capacity to recover to baseline conditions. Low level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).
Negligible	Receptor has capacity to avoid or adapt to an effect. Receptor has capacity to tolerate or absorb effect or will not be affected. Receptor has full capacity

Category	Description
	to recover to baseline conditions. Negligible level of conservation status or keystone species, rarity (e.g., how much of it exists relative to the potential area impacted) and worth (e.g., it's socio-economic, cultural and amenity value).

Significance of impact

9.25 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact. The significance of impact is based on best practice and expert judgement. Any impacts of 'moderate' or above are considered significant, in accordance with EIA guidance (SNH, 2013; CIEEM, 2010). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor (see Chapter 5: Environmental Impact Assessment Methodology for full details).

Table 9-34 Significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

9.8 Data Gaps and Uncertainties

9.26 The information presented in this baseline description of the Study Area (see Section 9.9) specifically in reference to spawning and nursery grounds is primarily based on information from Ellis *et al.*, (2012) and Coull *et al.*, (1998). It should be recognised that these publications give a general indication of these grounds and not precise boundaries.

9.27 The spawning times of the species discussed is also largely based on these two publications. Other sources have also been used for verification (information from Marine Scotland, SNH, and JNCC). As is acknowledged in all publications used, these spawning times are subject to variation and usually dependent on external environmental factors such as currents and water temperature.

9.28 It is recognised that there are knowledge gaps in the understanding of the ecology and behaviour of most species discussed. This is particularly evident for migratory species such as Atlantic salmon. While the most recent data available has been used in this description, there are gaps in the knowledge of the exact migratory routes. Despite this, there is still sufficient data to establish a robust baseline to inform the impact assessment.

9.29 There are also gaps in the knowledge of avoidance behaviour of fish as a result of ambient noise. Despite this, the noise introduced into the environment from the construction activities of the project is not considered to be significant (see Section 9.11.1).

9.9 Description of the Current Environment

9.30 The purpose of this section is to provide a description of those fish species of conservation importance, economic value and those which are particularly abundant in the Study Area. This description of the current environment is established from a comprehensive desk based study and consultation with key stakeholders. The objective of this section is to present the best available understanding of the current baseline for fish species including key spawning and nursery grounds, migration routes and their contribution to local biodiversity and wider food webs. The following fish groups are considered:

- Diadromous migratory fish species;
- Pelagic species;
- Demersal species; and
- Elasmobranch species (excluding basking sharks which are considered in Chapter 10: Marine Mammals).

Designated sites

9.31 There are no Special Areas of Conservation (SACs) for fish located overlapping with the Project Site; however, the rivers Thurso, Naver and Borgie, located 17 km, 23 km and 24 km from the Site (see Figure 9-2), respectively, are all designated as SACs for their importance to Atlantic salmon *Salmo salar* (JNCC, 2015c).

9.32 The River Thurso SAC is designated for the primary protection of Atlantic salmon (JNCC, 2015e). River Naver SAC is designated for the primary protection of Atlantic salmon and freshwater pearl mussel *Margaritifera margaritifera* (JNCC, 2015f). River Borgie SAC is designated for the primary protection of freshwater pearl mussel, with Atlantic salmon as an additional qualifying feature of the SAC (JNCC, 2015d).

9.33 The North-west Orkney MPA, a Nature Conservation Marine Protected Area (MPA), is located 33 km to the north of the Site (see Figure 9-3). This MPA is an area of importance for sandeels, fish that burrow into the sand to escape from predators (Holland *et al.*, 2005). Sandeels are a key source of food for a range of marine wildlife, including many types of larger fish and seabirds. This MPA does overlap with the Study Area (ICES Rectangle 46E6; see Figure 9-1). However, given the distance of the Site from the MPA (33 km) and the fact that there are no vessel routes linking the Site with the MPA, it is unlikely that there would be any impact on this MPA from the Project during construction, operation and decommissioning. This impact has been scoped out.

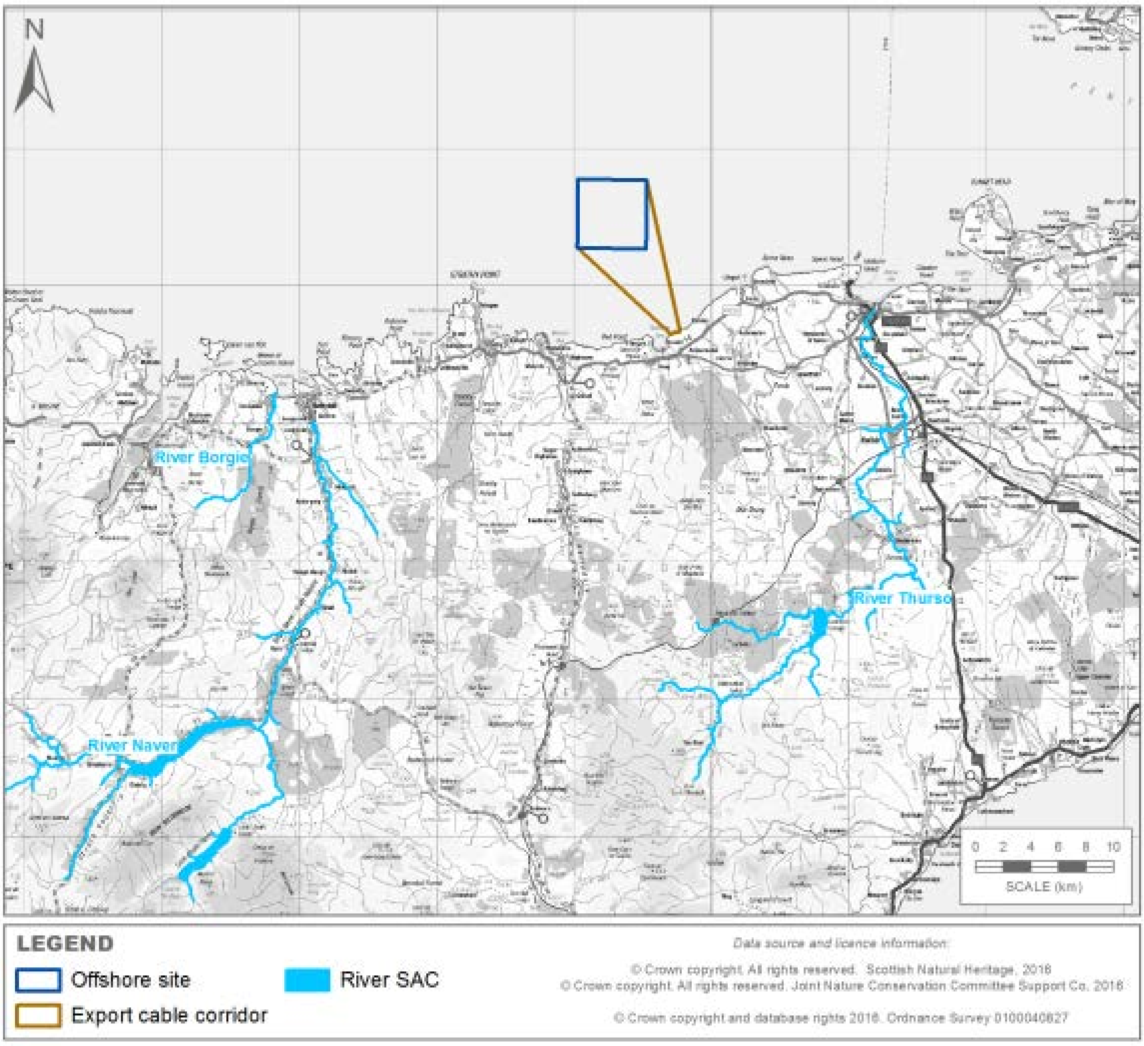

Figure 9-14 SACs at Rivers Thurso, Naver and Borgie in relation to Site

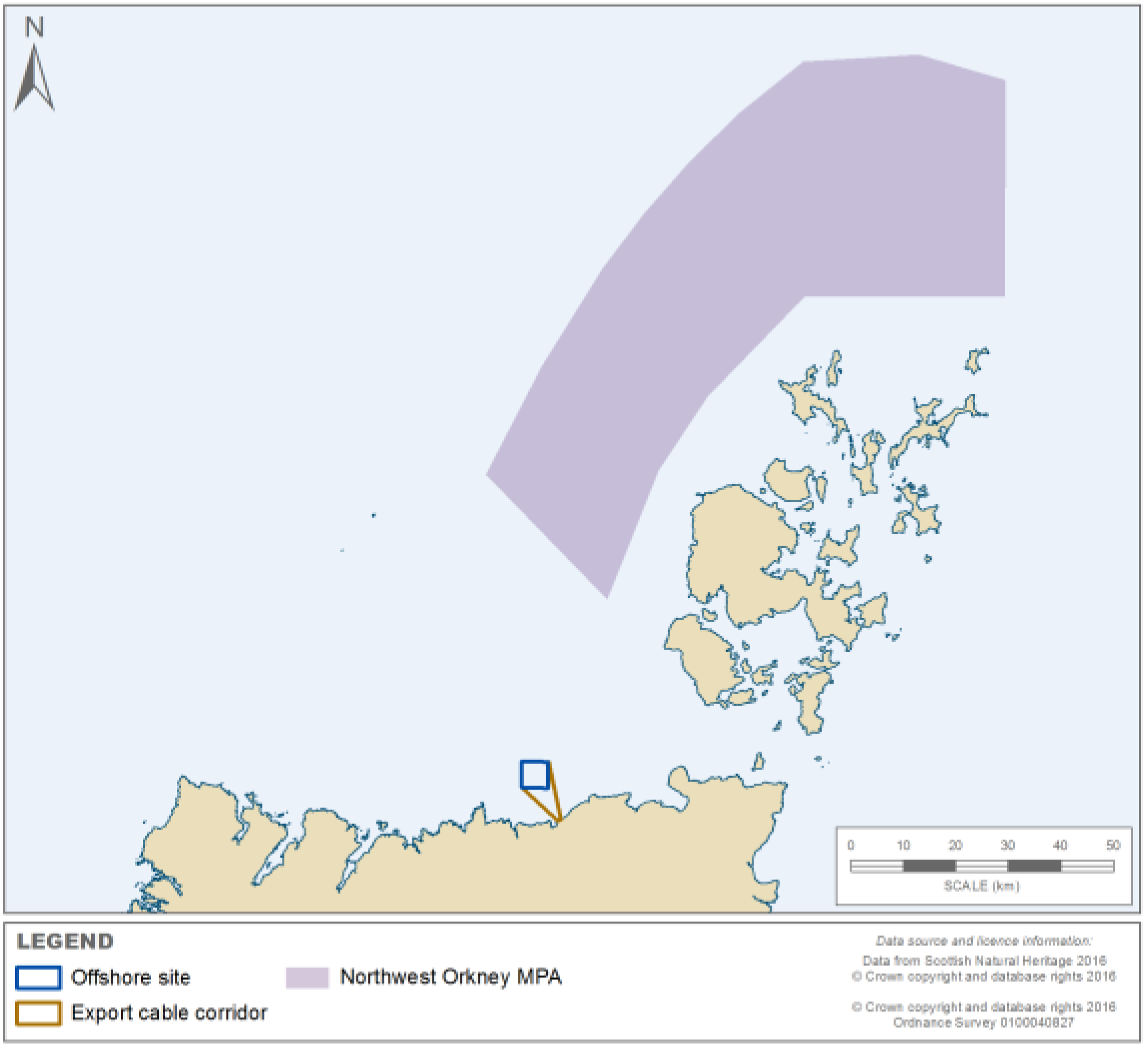

Figure 9-15 Northwest Orkney MPA in relation to Site

Species of conservation importance

9.34 This baseline description prioritises those species which are protected by conservation legislation (see Section 9.3). Those species which are considered to be of commercial importance are discussed in Chapter 12: Commercial Fisheries. Those species protected by the SACs described above are of primary conservation importance in the Study Area. Fish species of conservation importance include those listed in Annex II of the Habitats Directive, IUCN Red List (IUCN, 2015), OSPAR List of Threatened and/or Declining Species and Habitats (OSPAR, 2008), UK List of Priority Habitats and Species (JNCC, 2015a), Scottish List of Priority Marine Features (SNH, 2014) or the Scottish Biodiversity List (Scottish Government, 2013). Commercial value of species has also been taken into consideration. Commercial value has been deduced using the landings data recorded by Marine Scotland Science (2014).

Diadromous fish species

9.35 Diadromous species describes species that migrate between freshwater and marine environments to spawn. The most common type is anadromous species which migrate from a marine to a freshwater environment to spawn, while catadromous species spend most of their life in freshwater, moving to a marine environment for spawning. Atlantic salmon and sea trout are two anadromous species that are widely distributed in Scottish waters.

9.36 Atlantic salmon and freshwater pearl mussel are protected by three SACs located within 25 km of the Site (see Section 9.9.1). Both sea trout and Atlantic salmon are host to species of freshwater pearl mussel, which is protected under the Habitats Directive (1992), the IUCN Red List (2015, Endangered), the UK List of Priority Habitats and Species (JNCC, 2010), the Scottish Biodiversity List (Scottish Government, 2013), and the Wildlife and Countryside Act (1982). Sea trout and Atlantic salmon must be given special consideration at the Site. European Eel *Anguilla anguilla* is also considered here as a diadromous species of conservation importance. It is a catadromous species, present in this Study Area and is listed as critically endangered on the IUCN's Red List of Threatened Species (IUCN, 2015). Diadromous species such as salmon, sea trout, and European eels are able to detect electromagnetic fields (EMFs), but are only likely to use them for navigational purposes during migration (Gill & Bartlett, 2010). Although they do not possess specialist receptor cells like elasmobranchs, they contain magnetically sensitive material within their skeletal structure which allows them to derive direction from the Earth’s geomagnetic field. It has been suggested that EMFs may have an impact on the local behaviour of eels and possibly salmonids if their migration route takes them directly over the path of a cable, especially where water depths are less than 20 m (Gill, *et al.* 2012). Such an effect could result in avoidance behaviour, delaying the migration of salmonids and eels. However, studies have shown widely variable results, and therefore the extent of the effect of EMFs on migratory fish is currently unclear (Gill & Bartlett, 2010).

Atlantic Salmon

9.37 In addition to the SACs mentioned above (see Paragraph 9.31), Atlantic salmon (*Salmo salar*) is also protected by the Habitats Directive (1992), the OSPAR List of Threatened and/or Declining Species and Habitats (2008), The Scottish Biodiversity List (Scottish Government, 2013), The Conservation of Habitats and Species Regulations (2010), the Scottish list of Priority Marine Features (SNH, 2014) and the UK list of Priority Habitats and Species (JNCC, 2015a).

9.38 Wild salmon are an extremely important species in Scotland (Armstrong *et al.,* 2015). They are a food source for birds, otters and sea mammals (Howson *et al.*, 2012) and a key species for fisheries (commercial and recreational). Salmon feed on sandeels, krill and herring (SNH, 2015b).

9.39 Adult salmon return to the same river in which they were born to spawn. The number of adult salmon making this journey is declining. There has been a general reduction in numbers of salmon returning throughout their range because of a reduction in sea survival, with spring running salmon, only occurring in some rivers, particularly severely affected. Another reason is the proximity of salmon farms to wild populations, which increases competition for resources and spreads disease at a higher rate (Howson *et al.*, 2012, Heard, 2007). However, there are other pressures on salmon in these river habitats which are identified by SNH (2015a) as the primary pressures on the wild salmon populations in these SAC areas. These pressures include forestry management, over-grazing, forestry and agricultural operations and game and fisheries management.

Table 9-35 Primary pressures on Atlantic salmon in SACs River Thruso, River Borgie and River Naver (SNH, 2015a)

SAC	Primary Pressures
River Thurso	Forestry Management Over-Grazing

SAC	Primary Pressures
River Borgie	Forestry Operations Agricultural Operations Games of Fisheries Management
River Naver	Forestry Operations Game or Fisheries Management

9.40 The Rivers Naver, Borgie and Thurso support high quality salmon populations which produce slower-growing juveniles which mature slower than other populations further south, as a result of the cooler ambient water temperature in these habitats (JNCC, 2015c).

9.41 The spawning season takes place in autumn and winter. After spawning, adult salmon return to offshore feeding grounds (Faber *et al.*, 2007). The spawn hatch in spring (although this is dependent on water temperature) (SNH, 2015b). The freshwater life stage lasts between 1 and 3 years before the smolts return to the offshore marine feeding grounds (Malcolm *et al.*, 2013, Godfrey *et al.*, 2014). There is a lack of information about the behaviour of post-smolt salmon in Scottish waters (Malcolm *et al.*, 2013). After 1-3 years, the mature salmon then return to their natal river to spawn for the first time (JNCC, 2015c, Godfrey *et al.*, 2014). The salmon populations that are protected by these three SACs are multi-sea winter salmon that spend more than one year at sea before returning to the river to spawn, and also one-sea winter salmon (grilse).

9.42 The migration from the marine offshore feeding grounds and the freshwater spawning ground is an extremely important stage in the life cycle of the salmon population, and it is important that this is protected and not disturbed (Malcolm *et al.*, 2013). There is a lack of information available on the exact migratory routes of Atlantic salmon. A study conducted by Godfrey *et al.*, (2014) revealed that migrating salmon spend an average of 75 % of their time at depths of 0-5 m. They also tend to dive, although the depth of diving behaviour is extremely variable (between 13 and 256 m) (Godfrey *et al.*, 2014). It has been suggested that this variation in diving behaviour is due to predator avoidance, thermoregulations, feeding, or to read the sensory cues of the water column in search of the home river (Godfrey *et al.*, 2014).

9.43 Most salmon will only make this journey once, it is estimated that 95 % of salmon will not survive the journey back to sea after spawning (SNH, 2015b).

Sea Trout

9.44 Sea trout (*Salmo trutta*) is also a UK Biodiversity Action Plan (UK BAP) Priority Species (JNCC, 2010) and on the Scottish list of Priority Marine Features (SNH, 2014). Sea trout are an important prey species for marine mammals and many bird species (Howson *et al.*, 2012). Sea trout prey on small crustaceans, molluscs and small fish such as sprat, sandeel and herring (Howson *et al.*, 2012).

9.45 Sea trout have undergone severe decline in recent years, but the reason for this is unknown (Howson *et al.*, 2012). It is likely to be due to a combination of factors such as water pollution, barriers to migration, spread of disease (sea lice) from increased salmon farming and climate change (Howson *et al.*, 2012).

9.46 Sea trout migrations are much more localised than Atlantic salmon as they tend to stay in coastal locations for the majority of their time in the marine environment although some older fish may migrate offshore to feeding grounds (Faber *et al.*, 2007). Similar to salmon, trout also return to the marine environment after spending a variable amount of time in their freshwater environment. They reach sexual maturity in the marine environment and return to their natal river environment to spawn. In contrast to salmon, trout may also return to freshwater in the winter.

9.47 The spawning season takes place between October and January. The juveniles remain in the freshwater environment for two years or longer in some locations. The migration of smolt downstream to the marine environment usually takes place between April and June (SNH, 2015c)

European Eel

9.48 As well as being listed as critically endangered by the IUCN Red List (2015), the European eel (*Anguilla anguilla*) is also on OSPAR's List of Threatened and/or Declining Species and Habitats (2008), the UK List of Priority Habitats and Species (JNCC, 2015a), the Scottish Biodiversity List (Scottish Government, 2013) and the list of Scottish PMFs (SNH, 2014).

9.49 Populations experienced significant decline in recent years and the population size is thought to be less than 10 % of the 1980 levels. This is the case for populations all over Europe (Howson *et al.*, 2012).

9.50 European eel spend the majority of their life in freshwater, and are widely distributed in Scottish rivers (Malcolm *et al.*, 2010). They undergo a long migration to spawn in the Sargasso Sea (Howson *et al.*, 2012, Malcolm *et al.*, 2010). The spawning season tends to be in late summer and early autumn (peak timing is August- October), although this has been recorded to be extremely variable and dependent on environmental conditions such as water temperature (Malcolm *et al.*, 2010). The adults swim at average depths of 10 m, and spend very little time on the seabed (Malcolm *et al.*, 2010).

9.51 The larvae then return to European seas and metamorphose to "glass" eels (Malcolm *et al.*, 2010). The first juvenile eels arrive back in the Study Area in November (Malcolm *et al.*, 2010), however this can be variable. At the next stage of development, the juveniles are called "yellow eels" (Malcolm *et al.*, 2010). At this stage, some migrate upstream and return to freshwater (Ellis *et al.*, 2012), some remain in the marine environment, and some move back and forth between the two (Malcolm *et al.*, 2010).

Pelagic species of conservation importance

9.52 Pelagic fish inhabit the water column above the continental shelf, including the near surface.

- Atlantic Herring *Clupea harengus*
- Atlantic Mackerel *Scomber scombrus*
- European Sprat Sprattus sprattus
- Horse Mackerel Trachurus trachurus

9.53 The primary pelagic fish species of conservation importance in this Study Area are Atlantic herring *Clupea harengus*, and Atlantic mackerel *Scomber scombrus*. These two species are also important commercial fishery species in the Study Area (Marine Scotland Science, 2014; See Chapter 12: Commercial Fisheries). There are other species of conservation importance found in this area such as European sprat *Sprattus sprattus* and horse mackerel *Trachurus trachurus* (Coull *et al.*, 1998; see Table 9-8 for summary of pelagic species including conservation importance and presence of spawning or nursery areas within the Study Area).

Atlantic Herring

9.54 Atlantic herring is listed on the Scottish PMF list (SNH, 2014, JNCC, 2014) and on the Scottish Biodiversity List (Scottish Government, 2013). Herring spend most of their life offshore, but use inshore gravel areas with high water flow for spawning. The Study Area includes low intensity herring nursery ground (Ellis *et al.*, 2012, See Figure 9-4). Herring are divided into five different stocks around the British Isles. This area is part of the Orkney/ Shetland stock (Aires *et al.*, 2014). The North Sea stock is dominated by autumn spawners, usually from August to October (Barreto & Bailey, 2015). The nursery areas of this stock extend widely beyond the Study Area, throughout the entire area of Orkney and Shetland (Ellis *et al*., 2012, see Figure 9-4). Herring are an important commercial species in this area of Scotland (see Chapter 12: Commercial Fisheries), and also provide an important food source for larger predatory animals such as larger fish, marine birds and mammals.

Atlantic Mackerel

9.55 Atlantic mackerel is listed on the Scottish PMF list (Howson *et al.*, 2012) and on the Scottish Biodiversity List (Scottish Government, 2013). The mackerel in the Study Area are part of the Western stock. This stock covers a large area of the north and west coast of Scotland, the north, west and south coast of Ireland, the south northwest of England and the north and west coast of France (Barreto & Bailey, 2015). The western stock undergoes long distance movement between spawning areas and feeding grounds. This stock spawns between March and July. The Study Area is not part of the spawning grounds of the mackerel stock, but this is a low intensity nursery area for juveniles (Ellis *et al.*, 2012, See Figure 9-4). This nursery ground extends throughout the entire west coast of Scotland. Juvenile mackerel grow quickly, with over half of all females reaching sexual maturity (M_{50}) by the age of two years (Barreto & Bailey, 2015). Mackerel feed primarily on small crustacean and juvenile fish, and are also an important food source for larger predators.

Sprat

9.56 The Study Area is a spawning ground for sprat (see Figure 9-5; Coull *et al.*, 1998). This spawning ground covers the entire north, west and part of the east coast of Scotland (Coull *et al*., 1998). Sprat spawn between May and August. The nursery area covers the entire east coast of Scotland (Coull *et al.*, 1998).

Horse Mackerel

9.57 Horse mackerel is on the Scottish PMF list (SNH, 2014). This area is not a known spawning area and there is no evidence of spatially defined nursery grounds (Ellis *et al.*, 2012).

Table 9-36 Most common pelagic fish species found in Study Area with defined spawning and nursery grounds (Coull *et al.,* 1998 and Ellis *et al.,* 2012). Conservation importance according to SNH (2014), Scottish Government (2013)

Species	Spawning Ground	Nursery Ground	Conservation Importance
Herring	Aug-Oct		Scottish Priority Marine Features Scottish Biodiversity List
Mackerel			Scottish Priority Marine Features Scottish Biodiversity List
Sprat	May-Aug		
Horse Mackerel			Scottish Priority Marine Features
Key	Spawning Grounds	Nursery	

Species	Spawning Ground	Nursery Ground	Conservation Importance
		Grounds	

Demersal species

9.58 Demersal fish are found on or above the seabed. The demersal species of conservation importance that are present in the Study Area described by Ellis *et al.*, (2012) and Coull *et al.*, (1998) are listed below.

- Sandeel Ammodytidae marinus;
- Haddock Melanogrammus aeglefinus;
- Cod Gaddus morhua;
- Lemon sole Microstomus kitt;
- Blue whiting Micromesistius poutassou;
- Monkfish (anglerfish) *Lophius piscatorius*;
- Whiting Merlangius merlangus;
- Saithe Pollachius virens;
- Plaice Pleuronectes platessa;
- Hake Merluccius merluccius;
- Ling Molva molva.

9.59 Haddock *Melanogrammus aeglefinus* is also listed in the top 10 commercially important fish species in these ICES rectangles (Marine Scotland Science, 2014).

9.60 Megrim *Lepidorhombus whiffiagonis* and grey gurnard *Eutrigla gurnardus* are also listed in the top 10 commercially important fish species in this ICES rectangle (Marine Scotland Science, 2014).

Sandeel

9.61 The North West Orkney MPA is designated for the protection of sandeel. This MPA is 33 km to the north of the Site and overlaps with the Study Area (ICES sub-area rectangle 46E6; See Figure 9-3 and Figure 9-1). Predicted EUNIS (EU Nature Information System) habitat data supports this showing that there is suitable habitat for sandeel within the Site (McBreen *et al.*, 2011). Although there are five known species in Scottish waters, 90 % of the population consists of the lesser sandeel *Ammodytes marinus* (Faber *et al.*, 2007).

9.62 Ellis *et al.*, (2012) documents the Study Area as a spawning site for sandeel (Figure 9-4). This spawning site extends throughout the Orkney and Shetland waters and the majority of Scottish coastal waters (Ellis *et al.*, 2012). Sandeel spawn from October to February and lay their eggs on sandy substrate (Coull *et al.*, 1998, Faber *et al.*, 2007). The dominant habitat type observed within the offshore area was slightly rippled fine sand area with patches of scattered gravel, pebbles, cobbles and occasional boulders on sand are also observed, mainly in the south western corner of the Site. Two dominant seabed biotopes (JNCC, 2015g) were recorded in the offshore area, SS.SSa.CFiSa (circalittoral fine sand) and SS.SMx.CMx (circalittoral mixed sediment) (see Chapter 8: Benthic and Shellfish Ecology for more detail). During the spawning season, the adults remain in the sediment, only emerging to spawn (Holland *et al.*, 2005). The Study Area has also been documented as a low intensity nursery area (Ellis *et al.*, 2012, See Figure 9-4). This nursery area spans the entire east coast of Britain and part of the west coast of Scotland.

9.63 Sandeel is also on the UK List of Priority Habitats and Species (JNCC, 2015a), the Scottish Biodiversity List (Scottish Government, 2013) and the List of Scottish PMFs (SNH, 2014). Sandeel are also an important species for commercial fishing and provide an important food source for larger fish, seabirds such as puffins and marine mammals (JNCC, 2013).

Haddock

9.64 Haddock is the most important commercial finfish species in this area (Marine Scotland Science, 2014) and is listed as vulnerable in the IUCN Red List (2015). The Study Area is a nursery area of unknown intensity for haddock (Coull *et al.*, 1998, Figure 9-5).

Cod

9.65 Cod is also listed as vulnerable on the IUCN Red List (2015). It is on the OSPAR List of Threatened and/or Declining Species and Habitats (2008), and on the UK List of Priority Habitats and Species (JNCC, 2015a). The Study Area is a low intensity nursery area for juvenile cod (Ellis *et al.*, 2012, See Figure 9-4). Cod juveniles are demersal and seem to show a preference for rocky substrate (Faber *et al.*, 2007).

Lemon Sole

9.66 The Study Area has been documented as a spawning area and nursery area for lemon sole (Coull *et al.*, 1998, Figure 9-5). The spawning and nursery area covers the entire east coast of Britain, Orkney and Shetland waters and part of the west coast of Scotland.

9.67 Lemon sole spawn from April to September in this area. The eggs are buoyant and remain in the water column for several weeks before hatching (van Damme *et al.*, 2011). The eggs move to deeper water as they develop (Faber *et al.*, 2007).

Blue Whiting

9.68 Blue whiting is on the UK List of Priority Habitats and Species (JNCC, 2015a), the Scottish Biodiversity List (Scottish Government, 2013) and the Scottish PMFs (SNH, 2014). The Study Area has been identified as a high intensity nursery site for blue whiting (Ellis et al., 2012, See Figure 9-4).

Monkfish

9.69 The Study Area is a high intensity nursery area for monkfish (Ellis et al., 2012, Figure 9-4). Monkfish are pelagic at the juvenile stage, which can last for a prolonged period (Faber et al., 2007). Monkfish are also on the UK List of Priority Habitats and Species (JNCC, 2015a) and the Scottish Biodiversity List (Scottish Government, 2013).

Whiting

9.70 The Study Area is a low intensity nursery area for whiting (Ellis et al., 2012, Figure 9-4). Juvenile whiting remain in the nursery area for 1-2 years (Faber et al., 2007). Whiting are on the UK List of Priority Habitats and Species (JNCC, 2015a), the Scottish Biodiversity List (Scottish Government, 2013) and the Scottish PMFs (SNH, 2014).

Saithe

9.71 Saithe is on the list of Scottish PMFs (SNH, 2014). The Study Area is a nursery area of unknown intensity for saithe juveniles (Coull *et al.*, 1998, See Figure 9-5). Saithe juveniles remain in the nursery area for 2-3 years before migrating to deeper waters (Faber *et al.*, 2007).

Plaice

9.72 Plaice is on the UK List of Priority Habitats and Species (JNCC, 2015a) and the Scottish Biodiversity List (Scottish Government, 2013). Plaice juveniles show a preference for sandy substrate. They remain in the nursery ground for about a year (Faber *et al.*, 2007). There is no evidence of plaice spawning grounds or nursery grounds overlapping with the Study Area.

Hake

9.73 Hake is on the UK List of Priority Habitats and Species (JNCC, 2015a) and the Scottish Biodiversity List (Scottish Government, 2013). The Study Area is a nursery area of low intensity for hake juveniles (Ellis *et al.*, 2012, Figure 9-4).

Ling

9.74 Ling is on the UK List of Priority Habitats and Species (JNCC, 2015a) and the Scottish Biodiversity List (Scottish Government, 2013). The Study Area is a nursery area of low intensity for ling juveniles (Ellis et al., 2012, Figure 9-4).

Table 9-37 Most common demersal fish species found in Study Area with defined spawning and nursery grounds (Coull *et al.,* 1998 and Ellis *et al.,* 2012). Conservation importance according to IUCN (2015), SNH (2014), JNCC (2015a), Scottish Government (2013) and OSPAR (2008)

Species	Spawning Grounds	Nursery Grounds	Conservation Importance
Sandeel	Nov- Feb		UK List of Priority Habitats and Species Scottish Biodiversity List
Haddock			IUCN Red List (vulnerable)
Cod			IUCN Red List (vulnerable) OSPAR List of Threatened and/or Declining Species and Habitats UK List of Priority Habitats and Species Scottish Biodiversity List
Lemon Sole	Apr- Sept		
Blue Whiting			UK List of Priority Habitats and Species Scottish Biodiversity List
Monkfish			UK List of Priority Habitats and Species Scottish Biodiversity List
Whiting			Scottish Priority Marine Features UK List of Priority Habitats and Species Scottish Biodiversity List
Saithe			Scottish Priority Marine Features
Plaice			UK List of Priority Habitats and Species Scottish Biodiversity List
Hake			UK List of Priority Habitats and Species Scottish Biodiversity List
Ling			UK List of Priority Habitats and Species Scottish Biodiversity List
Key	Spawning Grounds	Nursery Grounds	

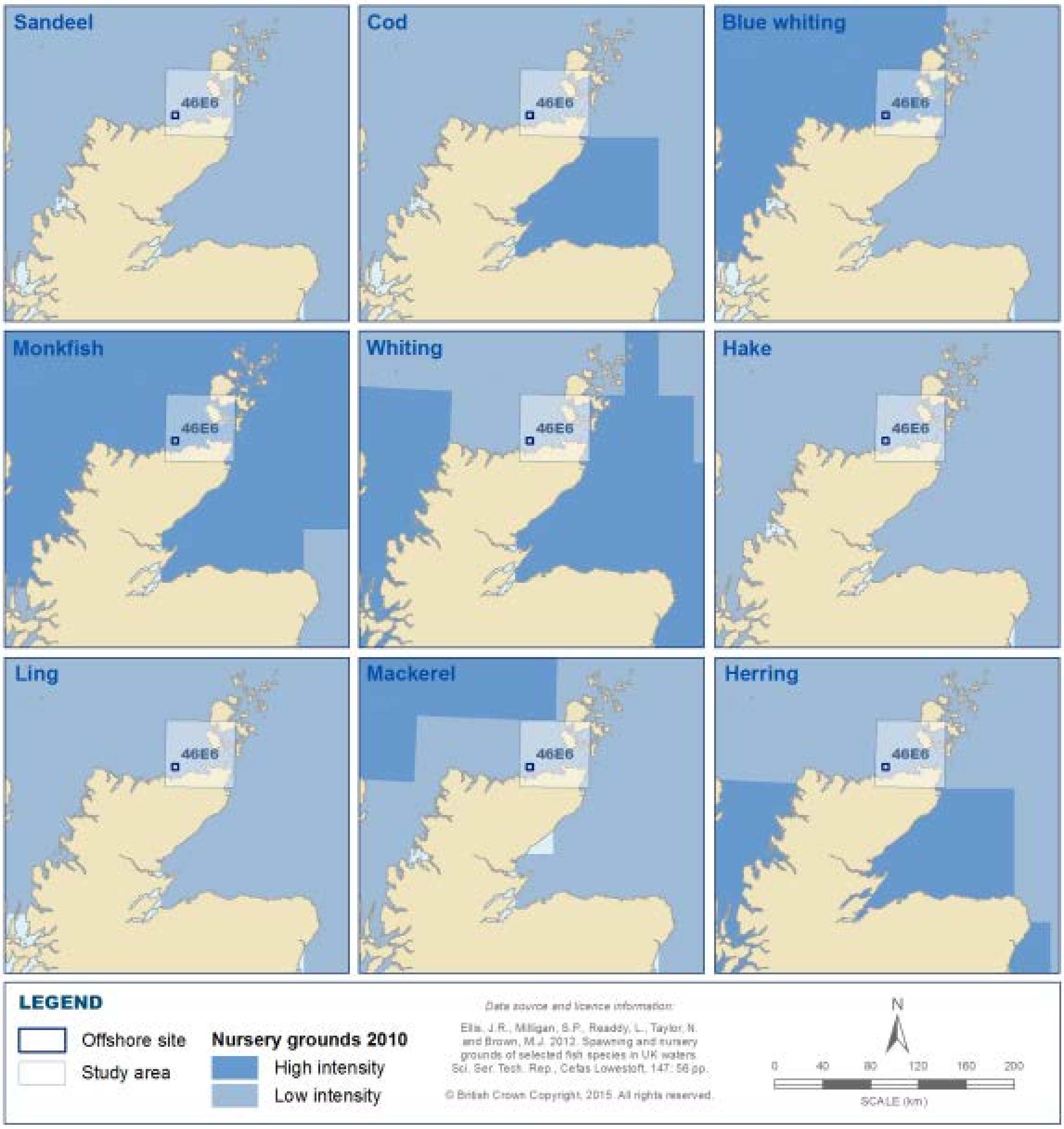

Figure 9-16 Summary of spawning and nursery grounds in Study Area (Ellis *et al.,* 2012)

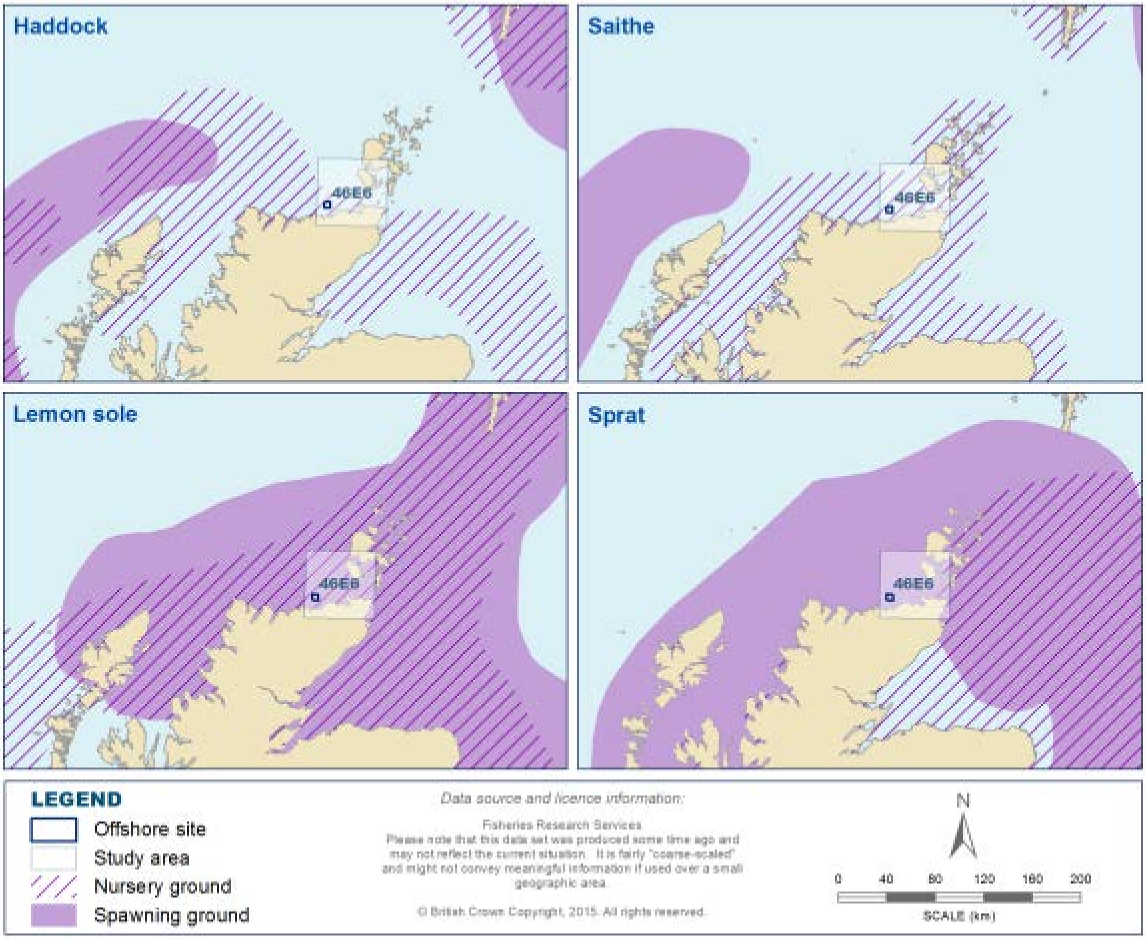

Figure 9-17 Summary of spawning and nursery grounds in Study Area (Coull *et al.,* 1998)

Elasmobranch species

9.75 Shark and ray (elasmobranch) species are particularly sensitive to changes in their environment because they are slow growing, and have relatively low reproduction rates due to late sexual maturity and low numbers of offspring. This results in low population recovery from mortality events or fishing pressure. There is little distribution data available on this group.

9.76 There is evidence that elasmobranch species are particularly sensitive to changes in electromagnetic field as they possess sensory structures known as the ampullae of Lorenzini which allow them to sense electric fields in the marine environment. The introduction of anthropogenic EMF into the marine environment may alter the foraging behaviour of elasmobranchs, ultimately resulting in increased energy expenditure.

9.77 EMF can be detected by some elasmobranch species from tens of metres away. Gill *et al.*, (2009) conducted a study on the reaction of elasmobranch species to EMF and found that there was a change in behaviour in thornback ray within the EMF of an operating cable. The study concluded that the response appears to be species specific but is not predictable.

9.78 Although some studies have suggested the potential use of electrosense in navigation and orientation by elasmobranchs (Klimley, 1993), the mechanism allowing them to do this is uncertain. More commonly known is elasmobranchs' ability to use their electrosense to find concealed prey items. Laboratory studies indicate that sharks and rays rely heavily upon this sense to feed (Kajiura & Holland, 2002). This sense is only effective over small ranges, up to a few 10s of centimetres in natural conditions (Tricas & Gill, 2011). Tricas *et al.* (1995) provided evidence that this electrosense was also important in the mating behaviour of some elasmobranchs, and that round stingray males were able to detect buried females up to 1m away. Hence electrosensory cues may increase reproductive success. Detection of potential predators has also been demonstrated as a response from the electrosense of elasmobranchs. Juvenile skates have been found to detect the bioelectric field of egg predators such as molluscs, teleost fish and other elasmobranchs (Tricas *et al.* 1995). Clearly electroreception is fundamental to the success of elasmobranch species. Many species of sharks and rays use shallow coastal waters as nursery grounds. Tricas & Gill (2011) hypothesise that cables running through these areas could cause a change in juvenile elasmobranch distribution; however this concern is currently untested. Overall the data available concerning EMF effects upon elasmobranchs are sparse, and only a few species have been studied.

9.79 The Site and export cable corridor is not within a recorded spawning area for elasmobranch species, although it is thought there could be some overlap between spawning grounds and nursery grounds (Ellis *et al.*, 2012).

9.80 According to landings data (Marine Scotland Science, 2014), the species with the highest landing rates in the Study Area are spotted ray *Raja montagui* and thornback ray *Raja clavata*. There are a number of other species likely to be present in the Study Area according to Ellis *et al.*, (2012) and Marine Scotland (Marine Scotland, 2015) and these are listed below.

- Common Skate *Dipturus batis*;
- Tope Shark *Galeorhinus galeus*;
- Spotted Ray *Raja montagui*;
- Porbeagle Shark *Lamna nasus;*
- Sandy Ray Leucoraja circularis.
- Spurdog *Squalus acanthias*;
- Thornback Ray *Raja clavata;*
- Blue Shark *Prionace glauca*;
- Portuguese Dogfish *Centroscymnus coelolepis*;

Common Skate

9.81 The species of highest conservation concern is the common skate. It is listed as critically endangered on the IUCN Red List (2015). It is also listed on the OSPAR List of Threatened and/or Declining Species (2008), the list of Scottish PMFs (SNH, 2014), the UK List of Priority Habitats and Species (JNCC, 2015a) and the Scottish Biodiversity List (Scottish Government, 2013).

9.82 Common skate is now considered to be split into two separate species; blue skate *Dipturus cf. flossada* and flapper skate *Dipturus cf. intermedia*. As it has been traditionally referred to as one species, it can be known as a species complex for the purposes of assessment (Howson *et al.*, 2012). Common skate is the largest European skate and was historically fished intensively in the British Isles (Howson *et al.*, 2012). Its distribution has been extremely reduced as a result of overfishing (commercial and recreational), and recorded female site fidelity for egg laying makes it unlikely for repopulation in areas of extinction (Howson *et al.*, 2012). It is now limited to western and northern Scottish waters.

9.83 The Study Area is a low intensity nursery area for common skate (Ellis *et al.*, 2012; see Table 9-10) for a summary of the most common species found in the Study Area and their recorded nursery site presence in the Study Area, as well as their conservation status). This low intensity nursery area covers the entire north and west coast of Scotland, extending to the west coast of Ireland (Ellis *et al*., 2010).

Spurdog

9.84 Spurdog *Squalus acanthias* is listed as vulnerable according to the Red List (IUCN, 2015) and listed on the UK list of Priority Habitats and Species (JNCC, 2015a). Spurdog is also on the list of Scottish PMFs (SNH, 2014) and the OSPAR List of Threatened and/or Declining Species and Habitats (2008). The Study Area is a high intensity nursery site for juvenile spurdog (Ellis *et al.*, 2012). The nursery areas cover the entire west coast of Scotland and much of the north coast (Ellis *et al*., 2010).

Tope shark

9.85 Tope shark *Galeorhinus galeus* is also listed as vulnerable on the Red List (IUCN, 2015) and is listed on the UK list of Priority Habitats and Species (JNCC, 2015a). The Study Area is a low intensity nursery site for tope shark (Ellis *et al.*, 2012).

Thornback Ray

9.86 Thornback ray *Raja clavata* is listed as near threatened on the IUCN's Red List (2015). It is also on the OSPAR List of Threatened and/or Declining Species (2008) and the Scottish Biodiversity List (Scottish Government, 2013). The Study Area is a low intensity nursery site for thornback ray (Ellis *et al.*, 2012). This nursery area is restricted to inshore waters covering the north coast of Scotland. There have also been low intensity nursery sites recorded in the coastal waters of the Irish Sea and the English Channel (Ellis *et al*., 2010).

Spotted Ray

9.87 Spotted Ray *Raja montagui* is on the OSPAR List of Threatened and/or Declining Species and Habitats (2008). The Study Area is a low intensity nursery site for spotted ray (Ellis *et al.*, 2012). This low intensity nursery area covers much of the west, north and east coasts of Scotland (Ellis *et al*., 2010).

Other species of conservation importance

9.88 Blue shark *Prionace glauca*, porbeagle shark *Lamna nasus*, Portuguese dogfish *Centroscymnus coelolepis*, and sandy ray *Leucoraja circularis* may also be present in the Study Area(Marine Scotland, 2015),. None of these species have been recorded to have spawning or nursery areas in the Study Area. They are protected by conservation legislation which is detailed in Table 9-10.

Table 9-38 Most common elasmobranch species found in Study Area with defined spawning and nursery grounds (Ellis *et al.,* 2012). Conservation importance according to IUCN (2015), SNH (2014), JNCC (2015a), Scottish Government (2013) and OSPAR (2008)

Species	Spawning Ground	Nursery Ground	Conservation Importance
Common Skate			IUCN Red List (critically Endangered) Scottish Priority Marine Features OSPAR List of Threatened and/or Declining Species and Habitats UK List of Priority Habitats and Species Scottish Biodiversity List
Spurdog			IUCN Red List (vulnerable) Scottish Priority Marine Features OSPAR List of Threatened and/or Declining Species and Habitats UK List of Priority Habitats and Species
Tope Shark			IUCN Red List (vulnerable) UK List of Priority Habitats and Species
Thornbac k Ray			IUCN Red List (near Threatened) OSPAR List of Threatened and/or Declining Species and Habitats Scottish Biodiversity List
Spotted Ray			OSPAR List of Threatened and/or Declining Species and Habitats
Blue Shark			IUCN Red List (near threatened) UK List of Priority Habitats and Species
Porbeagle Shark			IUCN Red List (vulnerable) OSPAR List of Threatened and/or Declining Species and Habitats UK List of Priority Habitats and Species
Portugue se Dogfish			IUCN Red List (near threatened) OSPAR List of Threatened and/or Declining Species and Habitats UK List of Priority Habitats and Species
Sandy Ray			UK List of Priority Habitats and Species
Key	Spawning Grounds	Nursery Grounds	

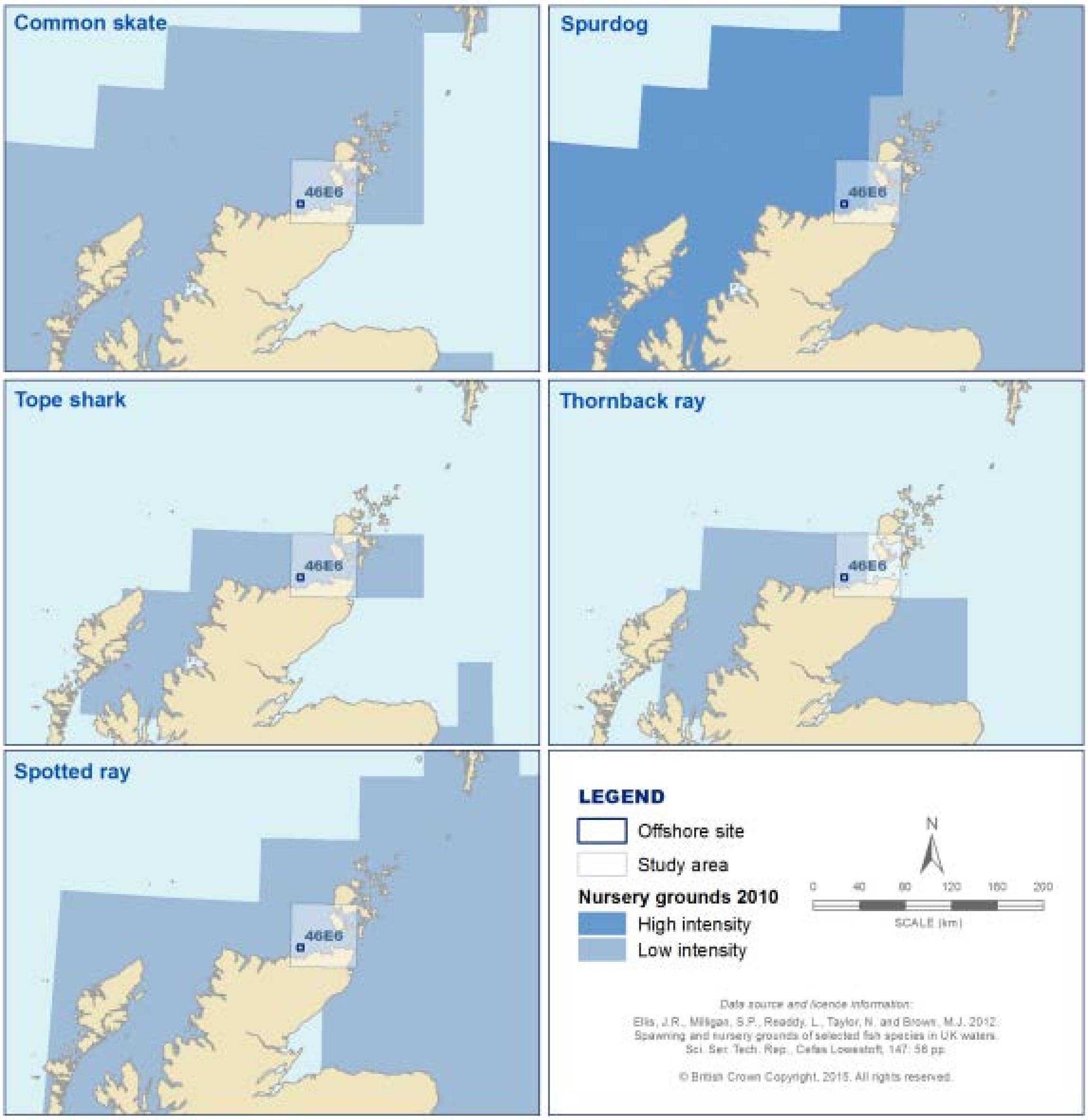

Figure 9-18 Summary of spawning and nursery grounds of elasmobranchs in Study Area, (Ellis et al., 2012)

Shellfish species

9.89 The only species on the Scottish List of PMFs that have been documented in the Study Area are European spiny lobster *Palinurus elephas* and ocean quahog *Arctica islandica*. These are discussed in Chapter 8: Benthic and Shellfish Ecology. Freshwater pearl mussel is the only shellfish species of conservation concern that is discussed in this chapter as its lifecycle is directly dependent on Atlantic salmon and sea trout.

Freshwater Pearl Mussel Margaritifera margaritifera

9.90 The freshwater pearl mussel is distributed in the rivers Naver and Borgie (see Paragraph 9.31; 23 km and 24 km from the Site respectively). The freshwater pearl mussel is protected under the Habitats Directive (1992), the IUCN Red List (2015, Endangered), the UK List of Priority Habitats and Species (JNCC, 2010), the Scottish Biodiversity List (Scottish Government, 2013), and the Wildlife and Countryside Act (1982).

9.91 The freshwater pearl mussel population declines have been caused by overfishing, pollution, acidification, organic enrichment, siltation, river engineering and declining salmonid stocks (JNCC, 2015b). The species does not reach reproductive maturity until 12 years old (JNCC, 2015b).

9.92 Atlantic salmon and sea trout *Salmo trutta* are host species for freshwater pearl mussel. The larvae of the mussel live on the gills of the juvenile salmon and sea trout during their first year of life. This causes no harm to the fish (SNH, 2015d). The Project is highly unlikely to have a direct effect on freshwater pearl mussel, but as their lifecycle is dependent upon Atlantic salmon and sea trout, any effect the Project may have on these species may have an indirect effect on freshwater pearl mussel.

9.10 Identification of Potential Impacts

9.93 The following impacts have been established through scoping and the consultation process as requiring assessment as part of the EIA.

Potential impacts in the construction phase

- Disturbance or damage to sensitive species due to underwater noise generated from construction activities;
- Direct habitat loss due to disturbance of spawning and nursery grounds during the installation of export cables and placement of anchors on seabed; and
- Effects of increased sedimentation / smothering on fish during placement of anchors and export cable.

Potential impacts in the operations and maintenance phase

- Habitat loss of spawning and nursery grounds due to presence of anchors and export cable on the seabed;
- Effects of thermal changes and electromagnetic fields (EMF) from subsea and dynamic cables on sensitive species;
- Effects of operational noise on sensitive species;
- Fish aggregation around the floating structure and associated infrastructure;
- Entanglement with mooring lines and dynamic cables;

Potential impacts in the decommissioning phase

- Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.

9.11 Impact Assessment - Construction Phase

Disturbance or damage to sensitive species due to underwater noise generated from construction activities

9.94 It is known that some species of fish use vocalisations during spawning (Brantley & Bass, 1994), as well as for tracking prey, avoiding predators, navigation and communication (Hawkins and Myrberg, 1983). It is possible that large magnitudes of noise could mask these vocalisations, reducing the potential for successful reproduction. However this is a topic which has not been well researched. Cod is reported to be particularly sensitive to marine noise, which can cause avoidance or attraction behaviour in the species (Faber *et al.*, 2007).

9.95 There will be a period of dredging in the area to a depth of 5 m. The area to be dredged will be 70 m by 70 m. This will be followed by a period of 3 months in which the clump weight, a maximum of 16 drag anchors, and the platform will be installed. This activity will create marine noise.

9.96 The drag anchors will be buried at a depth of 10 m to 15 m in the seabed. The export cable will be buried at a depth of up to 2 m. This will likely be done by a cable plough, although jetting or vertical injection may be used where necessary. This will require one cable installation vessel and dive support. There will be noise created by the presence of installation vessels and through construction activities as described above.

9.97 A lack of available data surrounding the noise signature of different vessels means that the extent of the impact cannot be fully defined, although a 25m tug vessel has been found to produce sound levels of 170 dB re 1 µPa at 1m (Richardson *et al.* 1995). Export cable installation will require a special cable laying vessel which is likely to be working within the cable route corridor for up to three months. Nedwell *et al.* (2003) suggest that the total noise level produced by cable laying activities in clean sandy / gravelly sediments is approximately 178dB re 1µPa at 1m.

9.98 Information regarding the effects of subsea noise on fish from the installation and operation of marine renewable deployments is sparse (Gill & Barlett, 2010). Most research has been focused upon sound resulting from piling activities which has been reported to result in fish mortalities in several species including salmonids (Popper *et al.* 2005). As there is no piling activity in the Project, the noise during construction is not likely to cause physical damage to fish, but may invoke a behavioural response such as avoidance. The spatial extent in which avoidance behaviours are likely to occur is currently unknown, as are the levels of noise that would be required to mask vocalisations associated with mating. However, as the spatial extent of the Project is small, and there is a large surrounding area of similar habitat, it is reasonable to assume that if these vocalisations were being masked, fish would move out of the zone of effect to an area that is less affected.

9.99 The openness of the area and the amount of similar habitat surrounding the platform makes this possible and unlikely to cause a large increase in energy expenditure. As a result, the vulnerability of the receptor is considered low, as is the magnitude of the effect. The overall significance of this impact is minor.

Direct habitat loss due to disturbance of spawning and nursery grounds during the installation of export cables and placement of anchors on seabed

9.100 Disturbance of the seabed could result in loss of deposited eggs or larvae and spawning habitat. This disturbance will occur from the placement of anchors and scour protection, installation of the export cable, and temporary placement of the clump weight on the seabed. An area of 70x70 m will be dredged down to 5 m and filled in with gravel so that the clump weight (50x50 m) can be temporarily laid on the seabed until the installation of the platform. The clump weight will then be installed so that it hangs from the platform and does not touch the seabed. Such activity may be significant if a large proportion of available spawning ground is disturbed or lost. A trench will be dug in the cable corridor 8 m wide and 2 m deep along the length of the cable (6- 13.8 km). Each of the 16 anchors will have a seabed area take of 1,260 m^2.

9.101 The Study Area may provide a spawning area for herring, sprat, sandeel and lemon sole (see Section 9.9.5 and 9.9.6). It is a nursery area for herring, mackerel, sandeel, haddock, cod, lemon sole, blue whiting, saithe, hake, ling, common skate, spurdog, thornback ray and spotted ray (see Table 9-8 and Table 9-10). Specifically, it has been reported that herring eggs are sensitive to suspended sediment, and smothering or substratum loss are likely to be detrimental if the material is not moved by current (Faber *et al.*, 2007). Sprat has medium sensitivity levels to increased suspended sediment as a result of disturbance (Faber *et al.*, 2007). It is likely that sandeel and their eggs are vulnerable to the impact of smothering and substratum loss (Faber *et al.*, 2007).

9.102 The seabed conditions in the Project Site are typical of moderate energy, wave exposed sediments on near-shore open ground as described in Chapter 8: Benthic and Shellfish Ecology. The presence of sand ripples across the study area suggests existing seasonal sediment movements, likely to be associated with an interaction of wave action and tidal currents. Sediments are predominantly sandy gravel but with varying proportions of fine sand, gravel, pebbles and cobbles patchily distributed; there is only a very small proportion of mud (see Section 9.9). Analysis of existing fishing activities indicates light trawling activity for scallops (see Chapter 12: Commercial Fisheries).

9.103 Construction activities are scheduled to take place in quarter 2 of 2018. There is the potential for construction works to overlap with lemon sole spawning which occurs in April-September (Table 9-8 and Figure 9-4)**.** Sandeel spawn in winter therefore sandeel spawning is unlikely to be affected by construction activities (Figure 9-5). The bottom disturbing activities associated with this project are 70 m by 70 m dredged area below the platform, less than 0.002 km^2 for anchors and 0.11 km^2 for the export cable. The overall footprint of the Project on the seabed is small, with worse case predictions of less than 0.2 km^2. This is a maximum possible value and considers the area of scour caused by movements of mooring chains on the seabed. The overall area of search is 25 km by 25 km. Therefore the actual footprint of the Project is just 0.45 % of the total Site.

9.104 As has been stated previously, the Site lies within a spawning area for herring, sprat, sandeel and lemon sole. It is a nursery site for fourteen species. As has been described in the baseline section, these species' spawning and nursery areas extend widely beyond the Study Area, covering large portions of the Scottish and UK waters (Coull *et al*., 1998, Ellis *et al*., 2012).

9.105 In summary, given the location and footprint of the proposed project, the existing levels of disturbance and the distribution of similar habitat in the surrounding area, the magnitude of the impact and the vulnerability of the receptor are considered low. It is unlikely that the platform will have a significant detrimental effect upon available spawning or nursery grounds or have effects at the population level. The significance of this impact is minor.

Effects of increased sedimentation / smothering on fish during placement of anchors and export cable.

9.106 The installation of all structures placed on the seabed (anchors, export and dynamic cables, scour protection), will cause some temporary disturbance to the seabed and result in the suspension of sediment. Ploughing will be used to bury the export cable where seabed bathymetry allows, although jetting or vertical injection may be used where local sediments require.

9.107 Smothering has the potential to cause physiological damage to fish by blocking feeding and respiratory apparatus or by burying them beyond a level from which they can recover.

9.108 Sediments are predominantly sandy gravel but with varying proportions of fine sand, gravel, pebbles and cobbles patchily distributed; there is only a very small proportion of mud (see Section 9.9), hence suspended particles will spend only a small amount of time in suspension.

9.109 Any burial resulting from settling sediment is likely to be restricted to a thin layer in keeping with the small amount of fine particles present in the seabed sediments that will enter into suspension during construction activities. Fish are mobile organisms and will most likely be able to avoid the area of sedimentation or move away after sedimentation. The Site, export cable corridor and wider surrounding area are dynamic environments indicating that the individuals present in the area will be adapted to this dynamic habitat and will be able to recover from a sedimentation event.

9.110 Low proportions of fine sediment in the Site and export cable corridor suggest that the amount of suspended sediment resulting from construction activities will be small. As a result, there is little potential for a smothering effect to occur. The vulnerability of the receptor is assessed as low, together with a low magnitude effect; suggest that this impact will be of minor significance.

9.12 Impact Assessment - Operations and Maintenance Phase

Habitat loss of spawning and nursery grounds due to presence of anchors and export cable on the seabed

9.111 There is potential for spawning grounds to be impacted as a result of changes to the seabed in the area of anchors and export cable. The presence of anchors, scour protection and cable will remove some of the available habitat that is currently used as spawning and nursery grounds for numerous species (see Section 9.9.5 and 9.9.6). The bottom disturbing activities associated with this project are a 70 m by 70 m dredged area below the platform, less than 0.002 km^2 for anchors and 0.11 km^2 for the export cable.

9.112 As stated above, the Site and export cable corridor are sited within known spawning grounds for herring, sprat, lemon sole and sandeel. The Site is also within known the nursery area for fourteen species (See Table 9-8, and Table 9-10 and Figure 9-4 and Figure 9-5).

9.113 As these spawning and nursery grounds extend widely beyond the Site, the proportion of spawning and nursery ground that will be removed by the project is very small in relation to the available spawning and nursery grounds.

9.114 In summary, given the location and footprint of the proposed project and the distribution of similar habitat in the surrounding area, it is unlikely that the platform will have a significant detrimental effect upon available spawning or nursery grounds or have effects at the population level. The magnitude of the impact is therefore considered to be low. The vulnerability of the receptor is also low and therefore the significance of this impact is minor.

Effects of thermal changes and electromagnetic fields (EMF) from subsea and dynamic cables on sensitive species

EMF

9.115 A number of fish species are able to detect EMFs, and use them for various different reasons. The export cable carrying electricity away from the turbines will emit low frequency electromagnetic fields (EMFs). The introduction of anthropogenic EMF into the marine environment may alter the behaviour of elasmobranchs and the migratory behaviours of salmonids and eels, ultimately resulting in increased energy expenditure.

9.116 The export cable will be in contact with the seafloor for a maximum length of 13.8 km, but it is likely that 80 % of this will be buried to a depth of 1-2 m leaving a maximum of 2.8 km unburied. In addition, a selection of the "lazy-wave" S-shape dynamic cabling configuration adds a further 250 m length of cable; 20 % (50 m) of which may in contact with the sea floor.

There will also be an inter-array cable linking the two turbines which will be integrated into the top-side of the platform.

9.117 The export cable will be a 33 kV cable conforming to the industry standard specification which includes shielding technology to prevent the direct emission of electric fields (E fields). The magnetic component (B field) of the EMF however will not be contained and will penetrate the surrounding environment (Boehlert & Gill, 2010). Previous studies suggest that the magnitude of these emissions in a 33kV cable is in the order of 1.5 μT, a value much lower than the 30 to 70μT range that is produced naturally by the earth (Gill *et al.* 2005). B fields produced by AC cables have a rotational component which induces an indirect E field (iE field). Similarly, an iE field can be produced by the movement of water or an organism through the B field.). A report produced for the Department of the Interior in the USA indicated that the magnetic field produced is perpendicular to the direction of the cable; meaning that a water current or an organism moving through the B field parallel to the cable will not produce an iE field (Tricas & Gill, 2011). Both fields dissipate rapidly from the source; therefore effects are confined to a local area of seabed.

9.118 The export cables used in this project are expected to transmit power to shore via an AC system, which typically produces an external alternating magnetic field at frequencies of 50 – 60 Hz. Elasmobranch fish display highest sensitivity to alternating electric fields with frequencies of 1 – 10 Hz. They will respond to a wider bandwidth of frequencies (0.01 – 25 Hz) but much stronger field intensity is required, hence direct sensitivity of elasmobranchs to weak 60 Hz electric fields is likely to be very low to nil (New & Tricas, 1997; Bodznick *et al*. 2003). Modelling studies on the other hand indicate that these fields could indeed be detected but only from very close ranges, and experimental studies have indicated that mild behavioural changes were induced when AC power cables were powered on (Gill *et al*. 2009).

9.119 The area of seabed covered by the export cable is very small (0.11 km^2) providing only a limited area of possible effect. If dynamic cables are arranged in the lazy S configuration, roughly 50 m of dynamic cable will be in contact with the seabed, negligibly increasing the area. Available data suggest that prey detection and attack is focused upon low frequency sources of less than 10 Hz. In order to provoke a response from higher frequencies a much stronger field is required, and that would not be provided by the export cables.

9.120 Most migratory salmonids swim within the top 5 m of the water (Godfrey *et al*., 2014); therefore they would not be affected by EMF emitted from the seabed. Eels however migrate at various depths throughout the water column therefore are more likely to encounter the export cable EMF. The small proportion of the water column affected by the EMF, the relatively small area that the export cable covers and the location of the cable suggests that only a small number of eel would encounter the EMF. A study carried out by Marine Scotland (Orpwood et al., 2015) indicated that there was no evidence of a difference in movement as a result of EMF nor were there any observations of changes in behaviour in the eels.

9.121 The dynamic cable will span the entire water column as it connects the export cable to the platform. Migratory fish are more likely to encounter EMFs produced by this cable. In a study conducted by Marine Scotland (Armstrong et al., 2015), there was no significant impacts encountered in behaviour or salmon when in presence of an EMF.

9.122 In addition, the export cable will be buried to a depth of up to 2 m where seabed conditions permit. Studies have shown that this reduces the impact of EMF on fish ecology. For example, A 33 kV cable carrying a current load of 530 A buried 1.5 m below the surface in clean sand has been modelled to produce an iE field which has the maximum strength of 40 μVm^{-1} in the seabed (Gill, 2005). Both iE and B fields dissipate rapidly from the source, so by moving them below the seabed, impact is largely reduced (Tricas & Gill, 2011).

9.123 Although, burial of the cable is effective at moving the source away from the water/seabed interface; however the B field still propagates through the sediment, although its effect is reduced. This reduces the area in which water and movement can induce an iE field. As a result, burial may reduce the proportion of the water affected by EMFs.

9.124 Although there is likely to be portions of the cable that cannot be buried due to the properties of the seabed (it is estimated that 20 % of the cable will not be buried). This will mean that a portion of the cable EMF emission will not be dampened through burial. The dynamic cable in the lazy S configuration (250 m long) will not be buried, and 20 % of this will come into contact with the seabed due to movement of the platform. The portion of the cable that is not buried will be protected using rock placement.

9.125 Due to the small expected magnitude of EMFs produced by these cables a significant effect is not predicted. Any change in swimming behaviour from either EMF is likely to occur on a small scale. The potential effect of export cable EMFs in shallower waters will be reduced by the use of industry standard shielding. The copper or aluminium conductors will be covered by an insulation of polyethylene or ethylene propylene rubber. The insulation is contained within an insulation screen, a lead alloy sheath. The potential for interactions between migratory fish and EMFs is therefore relatively low.

9.126 As a result of this, the vulnerability of the receptor is assessed as medium. The magnitude of the impact is assessed as low, and the overall significance of the impact is therefore minor.

Thermal Load

9.127 When electric energy is transported, a certain amount gets lost as heat energy. This increases the temperature of the cable surface and therefore increases the temperature of the surrounding environment (OSPAR, 2009a). There will be heat released from the export cable which has the potential to increase the temperature in the surrounding sediment and water (Boehlert & Gill, 2010). There has been limited research into this effect and the potential impact on the benthic community is therefore unknown (Boehlert & Gill, 2010).

9.128 There has been only one field study carried out so far to test the effects of operational buried cables on the surrounding environment. This study did not provide conclusive results due to a lack of data. The rise in temperature did not exceed 1.4°C in 20 cm depth above a 166 MW cable.

9.129 Although the effects of this impact are largely unknown, the magnitude of this project is small. The burial of the cable will mitigate this impact for macrofauna such as fish. As a result of this, the vulnerability of the receptor in relation to this impact is considered to be medium. The magnitude of this impact is low, therefore overall the significance of the impact is assessed as minor.

Effects of operational noise on sensitive species

9.130 Sources of operational noise will include movement of the platform and turbines during generation and wave slap and other water movements against the platform. Continuous (mechanical) and intermittent (e.g. bangs, squeaks and jingling associated with moorings) noises are likely during operations, and sound pressure levels and the frequency of intermittent noises are likely to increase with sea state. Sound pressure levels relative to ambient (background) noise at different sea states are uncertain. There will also be occasional noise from use of vessels for maintenance activities. During operation and maintenance the impacts of noise will be of less magnitude that predicted for the installation activities; as there will be fewer vessels in the area and no cable laying or dredging activity.

9.131 Noise generated by the floating structure may result in avoidance of the area of species such as salmonids and trout. Cod are reported to be particularly sensitive to marine noise, which can cause avoidance or attraction behaviour in the species (Faber *et al.*, 2007). This has the potential to delay migration and increase energy expenditure. Operational noise generation will effectively be continuous, occurring at all times of the year, including times of salmon, sea trout (post-smolt and adult) and eel migration.

9.132 Current available information indicates that, as for construction vessel noise, injury or death of fish is unlikely to occur as a result of operational noise. The majority of research has been conducted in offshore wind farms where the presence of solid foundations is an impact of larger magnitude than the impact of anchors and moorings.

9.133 Small scale avoidance behaviour is a more likely consequence of this impact. Given the openness of the area, and the fact that there will be a single structure, small in size and the context of existing vessel traffic (See Chapter 13: Shipping and Navigation) the effect of operational noise on sensitive species behaviour is considered unlikely to be significant.

9.134 As a result of these factors, the magnitude of the effect is considered to be low. However due to a level of uncertainty of the impact of noise on fish ecology, the vulnerability of the receptor is considered to be medium. The significance of impact is assessed to be minor.

Fish aggregation around the floating structure and associated infrastructure

9.135 Floating structures and associated moorings have the potential to act as artificial reefs and fish aggregation devices (FADs), attracting fish from the surrounding area and concentrating them into a smaller area.

9.136 The surface of any hard structure placed in the marine environment will become fouled by marine organisms, creating new habitat and exhibiting an artificial reef effect. If these artificial reefs attract fish, the structure becomes known as a fish aggregation device). It is thought that FADs concentrate fish stock in a particular area rather than increasing productivity (Inger *et al.* 2009). There is evidence, however, to suggest that hard structures acting as artificial reefs provide food and refuge, and therefore may increase the productivity of an area if associated with FADs (Langhamer & Wilhelmsson, 2009; Wilhelmsson *et al.* 2006; Linley *et al.* 2007).

9.137 FADs have been used by fishermen around the globe for centuries to increase catch, and can lead to the over exploitation of stocks. However the placement of marine renewable energy arrays in the marine environment will exclude fishing from the footprint of the array. This may have the opposite effect, providing a refuge for fish and alleviating fishing pressure, helping rebuild fish populations in the wider area. There are also potential implications for fish-eating birds and marine mammal predators that may be attracted to aggregations of potential prey species of fish. These impacts are addressed in Chapter 10: Marine Mammals, Turtles and Basking Sharks and Chapter 11: Ornithology.

9.138 With no antifouling treatments applied to platform, mooring lines or dynamic cable, biofouling will occur upon all of these surfaces. If it is not possible to bury the cable along the entire cable route, there will also be cable protection methods used (rock placement) which would add to this impact. The productivity of artificial reefs is related to their size and the structural complexity (Sherman *et al.* 2002). The proposed array will only provide a small area for colonisation by biofouling organisms, with a maximum seabed footprint of less than 0.002 km^2 from anchors and less than 0.02 km^2 from the platform. The surfaces provided by the platform, anchors and mooring lines for colonisation will be made up of materials that possess a low structural complexity, hence the artificial reef effect of the array is likely to be small, and is unlikely to significantly increase the productivity of the area. As a result, fish production in the area is unlikely to increase significantly as a result of the array.

9.139 However a FAD effect is likely to occur. The number of species and assemblage size attracted to these FADs is related to the size of the FADs themselves, with larger structures attracting larger numbers of fish (Witt et al., 2012). The area provided by the proposed array for fish aggregation is relatively small.

9.140 Although relatively little is known about how FADs work, it is unlikely that the array will cause a large aggregation of fish. The magnitude of this impact is considered to be low and the vulnerability of the receptor is low. Hence it is unlikely that this will have a significant effect on local fish populations. The significance of this impact is considered to be minor.

Entanglement with mooring lines and dynamic cables

9.141 There is a potential risk of entanglement of fish, particularly migratory or basking shark, with mooring lines and dynamic cables. This risk is considered low for fish, however the risk to basking shark will be considered further in Chapter 10: Marine Mammals, Turtles and Basking Sharks.

9.142 Mooring lines will be present throughout the water column, connecting the platform to anchors on the seafloor; therefore they pose a risk of entanglement to fish. The worst case scenario will use 8 mooring lines. Intra turbine cables will be fixed to the platform and therefore do not present an entanglement risk. A dynamic cable will also be present in the water column, connecting the platform to the export cable. This cable must be slack to allow for the movement of the platform, as will the mooring lines. It is possible for lost fishing gear to become entangled in the mooring lines or dynamic cable and cause a ghost-fishing effect.

9.143 Given the small scale of the array, this impact will not be highly significant. However there is a risk of entanglement over the course of the Project lifetime. The magnitude of this impact is medium and the vulnerability of the receptor is considered to be medium. The significance of this impact is considered to be moderate.

9.13 Mitigation Measures

9.144 Project commitments relevant to fish ecology listed below. For full list of Project commitments, see Chapter 4: Project Description.

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Specific mitigation

9.145 Measures listed below will be implemented specifically to minimise impacts on fish ecology.

Table 9-39 Mitigation measures specific to fish ecology

Ref	Title	Description
FE01	Routine inspection of moorings and cables	Routine inspections of mooring lines and cables will be undertaken, helping ensure that all infrastructure remains in place and in good condition. This will also ensure that any debris such as fishing gear caught in mooring system/cables is detected.
FE02	Removal and reporting of debris (including fishing gear) from moorings and cables	Debris detected during routine inspections which is deemed to pose a risk to marine wildlife will be removed at the earliest possible opportunity. A notification system will be established with the MCA to ensure the developers are aware of any fishing gear lost in the vicinity of the project. The developers will also inform the MCA of any fishing gear removed from moorings and other project structures. Details will be listed within the CEMD.

9.14 Residual Effects

9.146 All impacts were assessed as not significant except for one. Dounreay Trì Limited are committed to reducing impacts wherever possible and so the above mitigation has been applied to all assessed impacts, regardless of assessed significance thus reducing impact significance of all impacts to negligible or minor i.e. not significant.

Entanglement with mooring lines and dynamic cables

9.147 To further reduce the risk of entanglement Dounreay Trì Limited has systems in place to detect damaged or compromised mooring lines and cables (see Project Commitments; Chapter 4: Project Description). Routine inspections of mooring lines and cables (Mitigation measure FE01) will ensure that any damage is detected and repaired at the earliest opportunity reducing risk of entanglement. This will ensure that all infrastructure remains in place and in good condition. This will also ensure that any debris such as fishing gear caught in mooring system/cables is detected. Debris that is detected during routine inspections which is deemed to pose a risk to marine wildlife will be removed at the earliest possible opportunity (Mitigation measure FE02). In addition, as part of the Project commitments (see Project Commitments; Chapter 4: Project Description) a notification system will be established with the MCA to ensure that the developers are aware of any fishing gear lost in the vicinity of the Project. The developers will also inform the MCA of any fishing gear removed from moorings and other project structures. Further details of this will be listed within the CEMD (GM2).

9.148 As a result of the mitigation measures, the magnitude of this impact is reduced to low. Therefore the overall significance of this impact is minor.

9.15 Cumulative Effects

9.149 There is potential for cumulative impacts to arise from the project of a number of other projects in the nearby area (See Chapter 5: Environmental Impact Assessment Methodology for map of developments in nearby area):

- SHE-T, The Orkney-Caithness interconnector cable;
- HIE Dounreay demonstration centre (DDC);
- Brims Tidal Array, Brims Ness;
- MeyGen, Inner Sound;
- Scotrenewables, Lashy Sound; and
- DP Energy, Westray South.

9.150 The consideration of projects that could result in potential cumulative impacts is assessed based on the results of the impact assessment, together with expert judgement of the specialist consultants.

The SHE-T Orkney-Caithness interconnector cable and HIE Dounreay demonstration centre

9.151 There is potential for cumulative impacts to arise from the development of the Project, the Orkney-Caithness interconnector cable and the DDC. However, there is limited information available about these projects, therefore it is difficult to fully assess the extent of potential impacts.

9.152 Construction impacts will be temporary and unlikely to overlap due to the early stage of development for the DDC and Orkney-Caithness cable. However, should progress be made and construction works were to coincide, the magnitude of construction impacts such as noise and habitat loss could be increased. This could have a greater impact on fish.

9.153 Operational impacts relate to the combined footprint of the DDC and project areas occupied by turbines, platforms and associated moorings and infrastructure. The impact from these sites combined could increase the operational impacts on fish ecology such as habitat loss of spawning and nursery grounds, EMF, noise, FAD effect and entanglement. The location of export cables, and their burial or protection material used could mitigate this impact. However the combined project footprint remains small, and therefore cumulative impacts are not anticipated to be significant.

Brims Tidal Array, Brims Ness

9.154 The planning application and Environment Statement have not yet been submitted for the Brims project; however it is of sufficient distance from the Dounreay Trì Project (approximately 36 km) such that significant cumulative impacts on fish ecology interests are not likely to occur.

MeyGen, Inner Sound

9.155 Impacts on fish ecology from the MeyGen project were all assessed as not significant or positive (Refer to the Environmental Statement on the Marine Scotland Licensing page: http://www.gov.scot/Topics/marine/Licensing/marine/scoping). Due to the small Project footprint, relative to the wider available suitable fish habitat, as well as the distance between the Project and MeyGen (approximately 40 km) there are unlikely to be cumulative effects associated with the Project and the MeyGen site.

Scotrenewables, Lashy Sound and DP Energy, Westray South

9.156 Due to the small Project footprint, relative to the wider available suitable habitat for fish; as well as the distance between the Project and both Westray South (approximately 83 km) and Lashy Sounds sites (approximately 93 km) there are unlikely to be cumulative effects associated with the Project.

9.16 Summary and Conclusions

- No significant impacts to fish ecology have been identified in the assessment of potential impacts at any stage of the Project construction, operation, and maintenance or decommissioning;
- One potentially significant impacts were identified in the process of impact assessment; Entanglement with mooring lines and dynamic cables. This impact will be mitigated through general project commitments as well as mitigation specific to fish ecology. As a result of this mitigation, the impact's significance was assessed as minor; and
- Where there is potential for overlap of Project infrastructure or construction activity with proposed developments in the area i.e. SHE-T Orkney-Caithness interconnector and HIE'S DDC for offshore floating wind, these will be mitigated through consultation and collaboration with developers to ensure there is no significant conflict or disruption to activities.

Table 9-40 Summary of residual impacts

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Disturbance or damage to sensitive species due to underwater noise generated from construction activities	Low	Low	Minor
Direct habitat loss due to disturbance of spawning and nursery grounds during the installation of export cables and placement of anchors on seabed	Low	Low	Minor
Effects of increased sedimentation / smothering on fish during placement of anchors and export cable	Low	Low	Minor
Operations and Maintenance			
Habitat loss of spawning and nursery grounds due to presence of anchors and export cable on the seabed	Low	Low	Minor
Effects of thermal changes and electromagnetic fields (EMF) from subsea and dynamic cables on sensitive species	Low	Medium	Minor

Potential Impact	Magnitude	Vulnerability	Overall Significance
Effects of operational noise on sensitive species	Low	Medium	Minor
Fish aggregation around the floating structure and associated infrastructure	Low	Low	Minor
Entanglement with mooring lines and dynamic cables	Low	Medium	Minor
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	N/A	N/A	N/A

10 Marine mammals, basking sharks and turtles

10.1 Introduction

10.1 The chapter describes the marine mammals, basking sharks and turtles present at the project site and assesses the potential impacts on these species that may arise from the construction, operation and decommissioning phases of the offshore elements of the Dounreay Trì Project. The offshore project site comprises of the floating turbines and associated structures and moorings, and the offshore export cable (Figure 1-1). For details of the Project description used within this assessment refer to Chapter 4: Project Description. The study area for marine mammals, basking sharks and turtles extends beyond the offshore project site due to the mobility and wide ranging nature of these species. Therefore, the study area for marine mammals extends to the local populations/management units to which the species found in the Project area belong.

10.2 This chapter is structured to describe the assessment methodology specific to marine mammals, basking sharks and turtles followed by a description of the species present in the study area in order to inform which species were taken forward for impact assessment. The impact assessment includes the potential impacts on marine mammals arising from the development of the proposed Dounreay Trì Project, during the construction, operation and maintenance and decommissioning phases. The mitigation measures which will be implemented to minimise any potential impacts are described and included in the impact assessments.

10.3 This chapter is informed by data collected during site specific surveys commissioned specifically for the Project. This consisted of aerial video surveys for marine mammals and other large megafauna.

10.4 Related issues including changes in benthic and shellfish ecology are covered in Chapter 8: Benthic and Shellfish Ecology and changes in fish ecology are covered in Chapter 9: Fish Ecology.

10.2 Guidance and Legislation

10.5 This section outlines the legislation, policy and guidance that is relevant to the assessment of the potential impacts on marine mammals associated with the construction, operation and decommissioning of the Project. In addition, other national, regional and local policies are considered within this assessment where they are judged to be relevant.

International Legislation and Policy

Habitats Directive

10.6 All cetaceans and marine turtles are listed under Annex IV and Schedule II of the EU Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive) as European Protected Species (EPS) requiring a system of strict protection. In addition, harbour porpoise (*Phocoena phocoena*), bottlenose dolphins (*Tursiops truncatus*), grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina)* are afforded additional protection under Annex II as species of Community Interest whose conservation requires the designation of Special Areas of Conservation (SACs). Both grey seals and harbour seals are also listed under Annex V of the Habitats Directive, which require any exploitation to be managed.

Bern Convention

10.7 Both grey seals and harbour seals are listed under Appendix III of the Bern Convention and Annexes II and V of the Habitats Directive as species whose conservation may require the designation of SACs.

National Legislation and Policy

The Habitats Regulations

10.8 In Scotland the Habitats Directive is transposed through the Conservation of Habitats and Species Regulations 2010 (in relation to reserved matters) and the 1994 Regulations. The Conservation (Natural Habitats, &c.) Regulations (1994, as amended in 2007) implement the Habitats Directives in territorial waters out to 12nm. The Habitat Regulations provide protection for designated sites, known as Natura 2000 sites. The designated Natura 2000 sites include Special Areas of Conservation (SACs), candidate Special Areas of Conservation (cSAC) and Special Protection Areas (SPAs).

10.9 The Habitats Regulations and the Offshore Marine Regulations make it an offence to injure or disturb any European Protected Species within territorial waters. A disturbance is considered to be any activity that likely impairs their ability to survive, breed, reproduce, rear young, or migrate and any activity that is likely to affect the local distribution or abundance of the species.

10.10 If the risk of injury or significant disturbance cannot be reduced to negligible levels with mitigation, then an EPS licence is required. In Scotland, offshore EPS licencing is managed by Marine Scotland. The Scottish Government and SNH have provided guidance on definitions and rationale for interpretation of the deliberate and reckless disturbance offences (Marine Scotland, 2014). Licenses are granted if 1) the reason for the license relates to one of the specified purposes listed in Regulation 44(2) of the Conservation (Natural Habitats) Regulations 1994 (as amended), which includes renewable energy purposes, 2) there is no satisfactory alternative way to reduce injury or disturbance risk and 3) the action authorised must not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range (Regulation 44(3)(b)).

Marine (Scotland) Act, 2010

10.11 Under section 117 of the Marine (Scotland) Act (2010), Marine Scotland, in consultation with SMRU, produced a list of specific seal haul-out sites for additional protection from intentional or reckless harassment. A total of 194 haul out sites were designated under The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 in June 2014.

10.12 Under the Nature Conservation (Scotland) Act, no disturbance to basking sharks is allowed.

Wildlife and Countryside Act, 1981

10.13 All cetacean species, basking sharks and turtles are protected within the 12 mile territorial waters under Schedule 5 of the Wildlife and Countryside Act 1981. This Act makes "deliberate disturbance" an offence. Parts 2 and 6 of the Nature Conservation (Scotland) Act 2004 provide amendments to the Wildlife and Countryside Act by strengthening the protection of threatened species (including cetaceans) to include "reckless" acts.

UK Post-2010 Biodiversity Framework, 2012

10.14 The UK Biodiversity Action Plan (UK BAP) was published in 1994 as a response to the 1992 Rio de Janeiro Convention on Biological Diversity. The UK BAP identifies biological resources in the UK and plans for their conservation. This was succeeded by the UK Post-2010 Biodiversity Framework in 2012 in response to the Convention on Biological Diversity's Strategic Plan for Biodiversity 2011-2020 (published in 2010) and the EU Biodiversity Strategy (published in 2011). The UK Post-2010 Biodiversity Framework describes how the UK can meet the Aichi Biodiversity Targets. The UK BAP identified priority species that are the most threatened and require conservation. These UK BAP priority species include the cetacean, seal and marine turtle species present in UK waters as well as basking sharks[4]. This list of priority species is still used to inform statutory lists of priority species in the UK, as required by Section 2(4) of the Nature Conservation (Scotland) Act 2004.

Scottish Priority Marine Features

10.15 Scottish Natural Heritage (SNH), the Joint Nature Conservation Committee (JNCC) and Marine Scotland have developed a priority list of marine species in Scottish waters in order to help Scotland deliver marine nature conservation targets as outlined in the Marine Nature Conservation Strategy. This list of Priority Marine Features was adopted by the Cabinet Secretary in 2014. The list aims to focus future conservation action and marine planning, identify areas of research needed and promote an approach to marine nature conservation advice. The Priority Marine Features include the cetacean and seal species present in Scottish waters[5] as well as basking sharks [6].

Scottish Biodiversity List

10.16 The Scottish Biodiversity List contains a list of animals that Scottish Ministers consider to be of principal importance for Scottish biodiversity conservation. This list includes the various marine mammal species present in Scottish waters, but identifies certain marine mammal species for which conservation action is needed[7]. These marine mammal species requiring conservation action include: common, Risso's, white-beaked and bottlenose dolphins, minke whales, killer whales, harbour porpoise, both species of seal, four species of marine turtle and basking sharks.

Other Sources of Information

10.17 A detailed review of the existing literature and data relating to marine mammals in the Project Area was undertaken. The major data sources used in the preparation of this chapter are listed below in Table 10-1.

Table 10-41 Sources of marine mammal data reviewed.

Source	Content
APEM aerial survey data	Digital photographs from aerial surveys conducted in the Pentland Firth & Orkney Waters area between 2012 and 2013.
SCANS II aerial cetacean surveys	Aerial surveys for cetaceans conducted in July 2005.
SMRU Seal haul out data	Counts of hauled out harbour and grey seals around

[4] http://jncc.defra.gov.uk/page-5167

[5] http://www.snh.gov.uk/docs/A1007918.pdf

[6] http://www.snh.gov.uk/docs/A1007918.pdf

[7] http://www.gov.scot/Topics/Environment/Wildlife-Habitats/16118/Biodiversitylist/SBL

Source	Content
	the UK.
SMRU seal density maps - Jones et al. (2013)	Predictions of the at-sea density of seals around the UK.
SMRU seal telemetry data	Telemetry data from 265 grey seals and 292 harbour seals tagged around the UK between 1988 and 2012.
Cetacean Atlas - Reid et al. (2003)	Distribution descriptions for 28 cetacean species known to have occurred in UK waters. Data obtained from the Joint Cetacean Database.
Management Units - IAMMWG, (2015)	Details of the management units and abundance of cetacean species in UK waters.
SCOS (2015)	The latest scientific information provided to the NERC appointed Special Committee on Seals by the Sea Mammal Research Unit.
JNCC Report 543 - Evans et al. (2015)	Average sightings and count rates for harbour porpoise and bottlenose dolphins from shore-based watches around the UK.
SNH Report 419 - Evans et al. (2011)	Assessment of the abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney waters, using data from 12 sources.
JNCC Report 544 - Heinänen and Skov (2015)	Joint Cetacean Protocol data modelled to assess and identify areas of relatively high harbour porpoise density.
Scotland's Marine Atlas - Baxter et al. (2011)	Sightings of marine turtles in Scotland between 1989 and 2009 using data from the British Isles and Republic of Ireland TURTLE database.

Field Surveys

10.18 This chapter is supported by data collected during site specific survey to inform the Project. The following specific surveys have been undertaken and used to inform this assessment:

10.19 Aerial surveys were conducted monthly between January and December 2015. The surveys were conducted by HiDef Aerial Surveying Limited and provided high resolution digital video of birds and marine mammals. The surveys consisted of strip transects that were placed 1 km apart within the Dounreay Trì project area and within a 2 km buffer around the site (Figure 10-1). Surveys were conducted using an aircraft equipped with four HiDef Gen II cameras with sensors set to a resolution of 2 centimetres Ground Sample Distance. This provided a combined sampled width of 500 m (Irwin, 2015). The survey methods were presented to SNH whom agreed they were appropriate for the site (SNH, 2015).

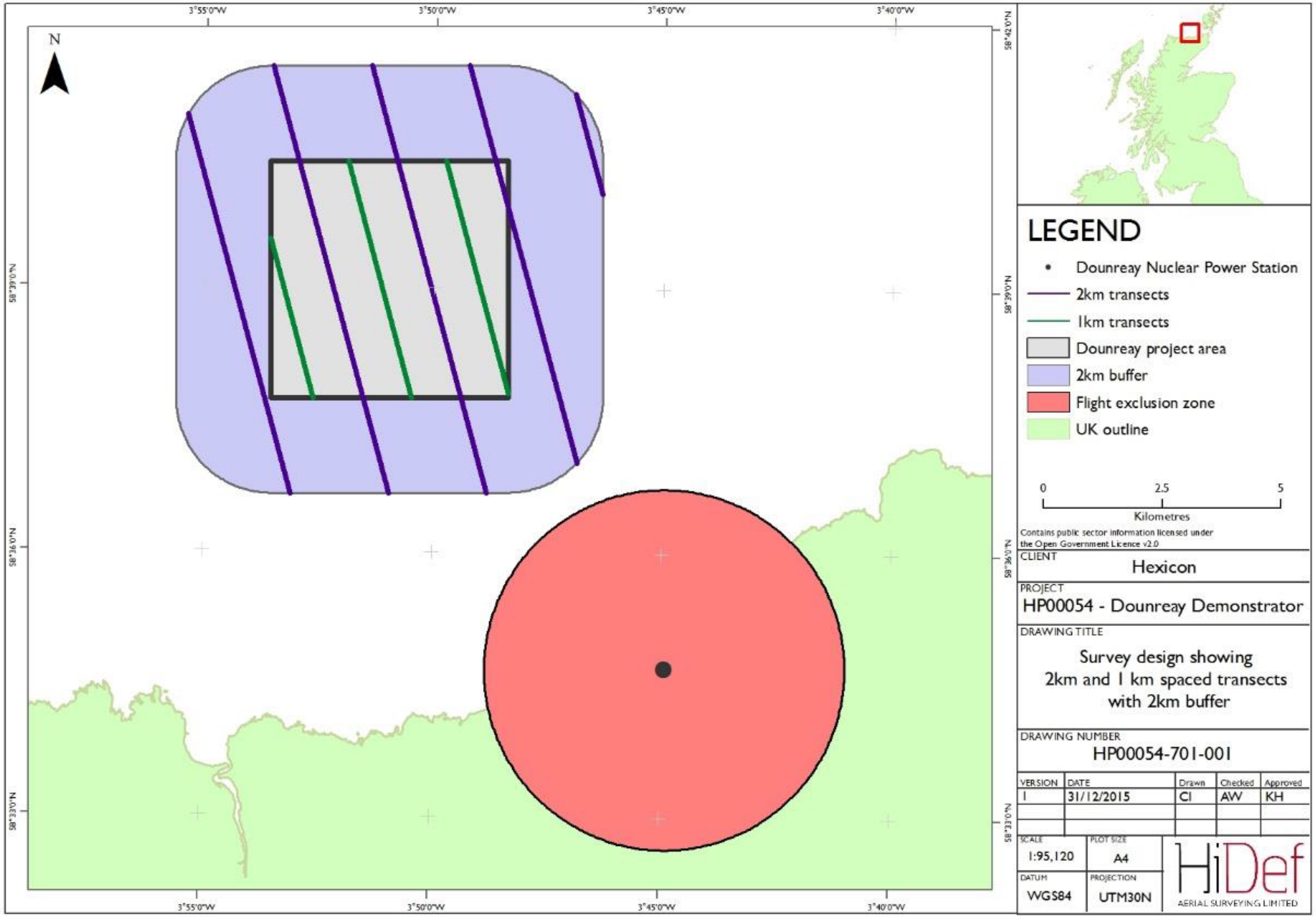

Figure 10-1 Survey design for the aerial bird and marine mammal surveys conducted around the Dounreay Trì project area between January and December 2015

Consultation

10.20 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date.

Scoping Feedback

10.21 The following stakeholder responses have been received specifically relating to this chapter.

Table 10-42 Summary of scoping responses

Consultee	Comment	Relevance / Cross Reference
Scottish Government Planning	The potential for increased collision risk with other marine users and marine fauna should be addressed in the ES. In particular, the risk of injury resulting from collision of vessels, marine mammals and basking sharks with installation vessels.	See Section 10.6
Scottish Government Planning	The ES should include the identification and assessment of cumulative impacts that may occur in proceeding with the development. In particular, it should discuss the potential for impacts on marine mammals.	See Sections 10.6 and 10.7.
Scottish Natural Heritage (SNH)	For the assessment of potential impacts in the marine environment, we recommend using the guidance produced by the Chartered Institute of Ecology and Environmental Management. (Guidelines for Ecological Impact Assessment in Britain and Ireland: Marine and Coastal (2010) http://www.cieem.net/ecia-guidelines-marine-)	Noted.
SNH	Mitigation and monitoring We advise that, within the ES, a schedule of commitments is provided with regard to proposed mitigation. Furthermore, we advise that the applicant provides a draft Environmental Mitigation and Monitoring Plan (EMMP) as part of the ES. The proposed EMMP should provide details on mitigation measures and monitoring studies to be undertaken.	See Chapter 4: Project Description, Project Commitments
SNH	In our response of the 11th February 2016 we provided advice in relation to the 12 month HiDef aerial surveys for seabirds and marine mammals. The results of the surveys show low numbers of marine mammals, indicating that some species are likely to be present at some time. Given the low numbers, it is not possible to identify any spatial or temporal patterns of marine mammal distribution.	Noted.

Consultee	Comment	Relevance / Cross Reference
SNH	We agree that the key/priority species considered should be grey seal, harbour seal and harbour porpoise, but would remind the applicant that all cetacean species will need to be considered under EPS legislation (as indeed they are proposing). Minke whale is not mentioned in the scoping report, but in the survey final report it is stated that minke whale is likely to be one of the most numerous species (although none were recorded in any in the surveys). As well as referring to the modelled at-sea seal data, it might be useful to look at the seal telemetry data – e.g.http://www.snh.org.uk/pdfs/publications/commissioned_reports/441.pdf, as this may help to infer whether or not there is connectivity with SACs.	Noted. See Sections 10.6, 10.7 and 10.9.
SNH	Disturbance from vessels during operation is scoped in, but not during construction. At this stage, we advise to scope this in for both construction and operation – it can then be assessed in the EIA, especially if the applicant has a better idea of likely vessel movements by then. We agree that the risk is likely to be relatively low, but it is best to show that it has at least been considered.	See Section 10.7
SNH	Noise impacts could include, for example, geophysical surveys, activities associated with cable-laying (trenching, jetting, etc.), and any seabed preparation that may be required (dredging?). While the noise levels from these individual activities may be expected to be lower than from piling, it is still possible that there may be some disturbance, especially when considered cumulatively.	See Sections 10.6, 10.7 and 10.9.

Consultee	Comment	Relevance / Cross Reference
SNH	There are a couple of references to the SNCA (2012) guidance on corkscrew seal injuries. We should inform the applicant that this advice has now been replaced, due to further evidence which suggests that adult male grey seals are responsible for at least some of these injuries. We now consider the risk of mortality due to ducted propellers to be low. The relevant wording from the guidance states: "Based on the latest information it is considered very likely that the use of vessels with ducted propellers may not pose any increased risk to seals over and above normal shipping activities and therefore mitigation measures and monitoring may not be necessary in this regard, although all possible care should be taken in the vicinity of major seal breeding and haul-out sites to avoid collisions."	Noted.
WDC	Although interested, unfortunately WDC don't have the capacity to respond to this currently.	Noted.

10.3 Assessment Methodology

10.22 The overarching approach to the assessment is described in Chapter 5: EIA Methodology. To support this, the following is a description of the specific criteria which are used to evaluate the impact on marine mammals.

10.23 The project description is set out in Chapter 4. Design assumptions about the project envelope (the Design Envelope) are summarised in Section 10.4.

Marine Mammal Design Envelope

10.24 As described in Chapter 5: Assessment Methodology, the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst-case scenario for that specific receptor.

10.25 In the case of marine mammals underwater noise and collision/entanglement has the potential to cause the greatest impact. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

10.26 Table 10-3 describes the Design Envelop parameters specific to marine mammals.

Table 10-3 Design Envelop parameters specific to marine mammals.

Potential Effect	Design Envelope Parameter	Value/description
Collision/	Mooring lines	All mooring lines are composed of steel chain

Potential Effect	Design Envelope Parameter	Value/description
entanglement causing Physical injury / mortality		(stud less type). Mooring Line Diameter: 100-160 mm. Mooring line length: 800m **Vertical Clump Line:** • Line Configuration – Always Taut • Tension ~ 100 Metric Ton **Catenary Lines:** • Line Configuration – Semi-taut to taut (may be slack) • Tension ~ 20 Metric Ton • Up to 8 lines
Underwater Noise causing Behavioural Disturbance, Displacement, Physical Injury, Mortality	Construction Activities, Vessel Activity, Operation and Maintenance	**Construction Activities:** • Install cable (buried by ploughing - possible jetting or vertical injection, or rock cover) • Install moorings (drag embedment anchors) • Tow and hook up platform • Scour and cable protection if necessary (rocks) • Commissioning Cable installation (1 week in Q2 2018) • 1 medium size Cable laying vessel • 1 dive support vessel Positioning of mooring (1 week in Q2 2018) • 1 AHTS vessel • 1 flat deck barge and tug Platform tow (3 days in Q2 2018) • up to 4 AHTS vessels Platform connection (5 days in Q2 20182) • 4 AHTS vessels • 1 dive support vessel • 1 workboat Scour Protection (if necessary, Q3 2018) • 1 Dynamically Positioned Fall-pipe Vessel • 1 crew boat Commissioning (1 month - Q3 2018) • 1 crew boat **Operation and Maintenance:**

Potential Effect	Design Envelope Parameter	Value/description
		Turine Maintenance • Crew vessels • Possible side scan sonar for inspections • Pressure washers for cleaning Offshore wind turbines • Underwater noise generated by 2 turbines
Vessel Collisions causing Physical injury / mortality	Vessels	Cable installation (1 week in Q2 2018) • 1 medium size Cable laying vessel • 1 dive support vessel Positioning of mooring (1 week in Q2 2018) • 1 AHTS vessel • 1 flat deck barge and tug Platform tow (3 days in Q2 2018) • up to 4 AHTS vessels Platform connection (5 days in Q2 20182) • 4 AHTS vessels • 1 dive support vessel • 1 workboat Scour Protection (if necessary, Q3 2018) • 1 Dynamically Positioned Fall-pipe Vessel • 1 crew boat Commissioning (1 month - Q3 2018) • 1 crew boat Turbine Maintenance • Crew vessels

Methods of Prediction

10.27 For marine mammals, potential ***effects*** are identified and significance of ***impact*** is assessed for each stage of the project lifecycle and significance attributed relative to the background conditions.

10.28 The methodology is as described in Chapter 5: Assessment Methodology.

10.29 Significance is attributed using the following attributes:

Magnitude of Effect

10.30 Magnitude of Effect is based on the following four criteria:

- Spatial extent (geographic range);
- Duration (how long the effect lasts);

- Frequency (how often the effect occurs); and
- Severity (the degree of change).

10.31 The definition of magnitude of an impact varies depending on the severity of the impact on an individual and the number of individuals affected. For example, a severe impact affecting only a few individuals may have the same overall impact for the population as a less severe impact affecting many individuals.

10.32 For marine mammals the characteristics defining the magnitude of an impact are described as follows:

Table 10-4 Description of the Magnitude of Effect categories used for marine mammal impact assessment.

Characteristic	Categories	Description
Spatial extent	Negligible	The size of the impacted area means that it has the potential to affect <1% of the Management Unit area.
	Low	The size of the impacted area means that it has the potential to affect of population.
	Medium	The size of the impacted area means that has the potential to affect 1-5% of the Management Unit area.
	High	The size of the impacted area means that it has the potential to affect >10% of the Management Unit area.
Duration	Negligible	Very short term – effect lasts for minutes to hours.
	Low	Short term – effect lasts for days to weeks.
	Medium	Medium term – effect lasts for weeks to months.
	High	Long term – effect detectable over >one year.
Frequency	Negligible	Temporary effect.
	Low	Effect occurs intermittently throughout the construction or operational phase.
	Medium	Effect occurs throughout the construction or operational phase.
	High	Effect occurs on every day throughout the construction and operational phase.
Severity	Negligible	Survival and reproductive rates very unlikely to be impacted and therefore the population trajectory is not altered.
	Low	Survival and reproductive rates unlikely to be impacted and population trajectory unlikely to be altered.
	Medium	Survival and reproductive rates may be impacted and population trajectory may be altered.
	High	Survival and reproductive rates are impacted and population trajectory is altered.

Vulnerability of Receptor

10.33 The vulnerability of the receptor is also taken into account. Note: it is difficult to assess vulnerability in total isolation from magnitude, therefore the magnitude is assessed first which can then help inform the assessment of the vulnerability. For example, an individual animal or a population may be more likely to adapt to or tolerate a low magnitude impact than a high magnitude impact. Vulnerability is attributed according to the following characteristics:

- Adaptability (how well a receptor can avoid or adapt to an effect). High adaptability results in low vulnerability;
- Tolerance (the ability of a receptor to be either affected or unaffected). High tolerance results in low vulnerability;
- Recoverability (how well a receptor recovers following exposure to an effect). High recoverability results in low vulnerability; and
- Value (the scale of importance). High value results in high vulnerability.

Table 10-5 Description of the Vulnerability of marine mammal Receptor categories used for impact assessment

Characteristic	Categories	Description
Adaptability	Negligible	No ability to adapt behaviour so that survival and reproduction rates are affected causing a change in the population demographics (high vulnerability).
	Low	Limited ability to adapt behaviour so that survival and reproduction rates may be affected (high vulnerability).
	Medium	Some ability to adapt behaviour so that survival and reproduction rates are unlikely affected (medium vulnerability).
	High	Animal is able to adapt behaviour so that survival and reproduction rates are not affected (low vulnerability).
Tolerance	Negligible	No tolerance - Effect will cause a change in both reproduction and survival rates causing a change in the population demographics (high vulnerability).
	Low	Limited tolerance – Effect may cause a change in both reproduction and survival rates that may cause a change in the population demographics (high vulnerability).
	Medium	Some tolerance - Effect unlikely to cause a change in both reproduction and survival rates. Unlikely to cause a change in the population demographics (medium vulnerability).
	High	Animal is able to tolerate the effect without any impact on reproduction and survival rates. Not expected to cause any change in the population demographics (low vulnerability).
Recoverability	Negligible	No ability for the animal/population to recover from the effect. The impact causes changes in fitness, survival

		and/or reproductive rates. Impacts are detectable after a generation.
	Low	Limited ability for the animal/population to recover from the effect. The impact causes a small change in fitness, survival and/or reproductive rates.
	Medium	Some ability for the animal/population to recover from the effect. The impact causes limited changes in fitness, survival and/or reproductive rates.
	High	Animal is able to return to previous behavioural states/activities almost immediately. No changes in fitness or survival or reproductive rates.
Value	Negligible	No specific legal protection is afforded to the species.
	Low	Species is not a European Protected Species but is a species on Annex II requiring SAC designation or a species listed as a Scottish priority species and listed on the Wildlife and Countryside Act schedule; but there is little or no evidence of connectivity between the site and any SAC or MPA population.
	Medium	Species is not a European Protected Species but is a species on Annex II requiring SAC designation or a species listed as a Scottish priority species and listed on the Wildlife and Countryside Act schedule. Evidence of medium connectivity with an SAC or MPA population.
	High	Species is a European Protected Species and/or is a species on Annex II requiring SAC designation with evidence of high connectivity with an SAC or MPA population.

Significance of Impact

10.34 Magnitude of effect is combined with vulnerability of the receptor to produce an overall significance of impact. Those impacts assessed as moderate or major significance are considered to require mitigation measures to be applied.

Table 10-6 Matrix used to assess the overall significance of impacts on marine mammal receptors.

Vulnerability		Magnitude: Negligible	Magnitude: Low	Magnitude: Medium	Magnitude: High
Vulnerability	Negligible	Negligible significance	Negligible significance	Minor significance	Moderate significance
	Low	Negligible significance	Minor significance	Moderate significance	Moderate significance
	Medium	Minor significance	Moderate significance	Moderate significance	Major significance
	High	Moderate significance	Moderate significance	Major significance	Major significance

10.4 Description of the Current Environment

10.35 In order to understand the marine mammal use of the Project area, a desk-based review of relevant marine mammal abundance and distribution data was undertaken. This was supported by the Project-specific Field Surveys. The result of this review is a description of the abundance and distribution for each species present in the Project area. This section provides information on the marine mammal study area, the data sources reviewed and the baseline species data against which impacts can be assessed.

Study Area

10.36 The study area for marine mammals extends beyond the immediate offshore project area due to the mobility and wide ranging nature of marine mammals. Therefore, the study area for marine mammals extends to the local populations/management units to which the species found in the Project area belong.

10.37 The scoping report identified grey seals, harbour porpoise, Risso's dolphins and white-beaked dolphins as the main species to be scoped into the impact assessment, and assessed other species (such as white-sided dolphins, killer whales, common dolphins, striped dolphins, long-finned pilot whales, sperm whales, humpback whales, fin whales, northern bottlenose whales, Sowerby's beaked whales and other pinniped species) as inhabiting the Project area during only restricted parts of the year and by relatively few individuals (Dounreay Trì Ltd., 2015).

10.38 The offshore project area, consisting of the turbines and associated structure and the export cable, are situated approximately 6 km off Dounreay, Caithness, in the Pentland Firth. This is located within the Orkney and North Coast Management Region for both species of seal (SCOS, 2015), the North Sea management unit for harbour porpoise, the Celtic and Greater North Sea management unit for white-beaked and common dolphins and minke whales and the East Coast Scotland management unit for bottlenose dolphins (IAMMWG, 2015; Figure 10-2).

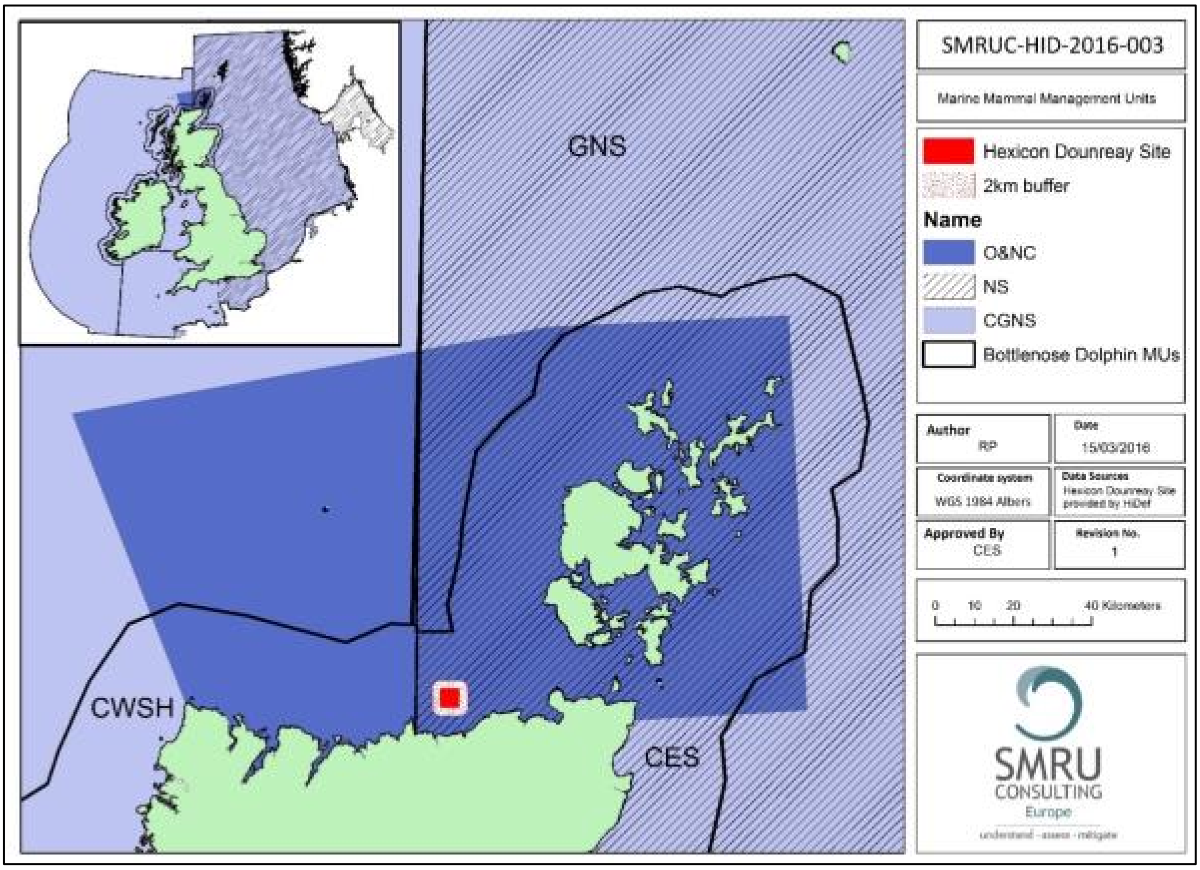

Figure 10-2 Dounreay Trì offshore site in relation to marine mammal management units.

GNS = Greater North Sea (bottlenose dolphin MU)
CES = Coastal East Scotland (bottlenose dolphin MU)
CWSH = Coastal West Scotland and Hebrides (bottlenose dolphin MU)
NS = North Sea (harbour porpoise MU)
CGNS = Celtic and Greater North Sea (white beaked dolphin, common dolphin, minke whale MU)
O&NC = Orkney and North Coast (seal MU)

10.39 Since the marine mammal species present in the Project area are likely to be part of much wider ranging populations, a larger area consisting of the Pentland Firth and Orkney Waters has been considered in this assessment. Six species of cetacean are considered to occur regularly in the Pentland Firth and Orkney Waters; these are harbour porpoise, minke whales, white-beaked dolphins, Risso's dolphins, killer whales, and bottlenose dolphins (Evans et al., 2011).

10.40 There are two SACs for seals in the Pentland Firth and Orkney waters, Faray and Holm of Fary for which grey seals are the primary reason for site selection and Sanday for which harbour seals are the primary reason for site selection (Figure 10-3). A large, well established population of breeding grey seals are located at the Fary and Holm of Fary SAC, which accounts for 9% of the annual UK grey seal pup production[8]. This SAC is approximately 90 km from the Dounreay Trì Project site. The largest group of harbour seals at any Scottish site is located at the Sanday SAC, with the breeding population at Sanday representing 4% of the UK population[9].This SAC is approximately 100 km from the Dounreay Trì Project site. There is also the Dornoch Firth and Morrich More SAC for which harbour seals are a primary reason for site selection which is located in the Moray Firth seal Management Unit and supports

[8] http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=s1364

[9] http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=S1365

approximately 2% of the UK harbour seal population[10]. This SAC is located approximately 150 km from the Dounreay Trì Project site. There is a proposed SAC for harbour porpoises in the Inner Hebrides and Minches which has been through public consultation and therefore has policy protection (Marine Scotland Science et al., 2016). The only bottlenose dolphin SAC in Scotland is the Moray Firth SAC which supports a year round resident population of approximately 130 bottlenose dolphins[11]. This northern edge of this SAC is approximately 120 km from the Dounreay Trì Project site (Figure 10-3). Basking sharks have been proposed as a protected feature of the Sea of the Hebrides proposed Marine Protected Area (pMPA)[12].

10.41 There are a total of 20 designated seal haul out sites within 50 km of the Dounreay Trì project site (Figure 10-4). Of these, six are classified as part of the North Coast Seal Management Unit while the remaining 14 are part of the Orkney Seal Management Unit. Of the total designated haul out sites, seven are designated seasonal seal haul out sites based on grey seal breeding colonies.

[11] http://jncc.defra.gov.uk/protectedsites/sacselection/species.asp?FeatureIntCode=S1349

[12] http://www.snh.gov.uk/docs/A1351902.pdf

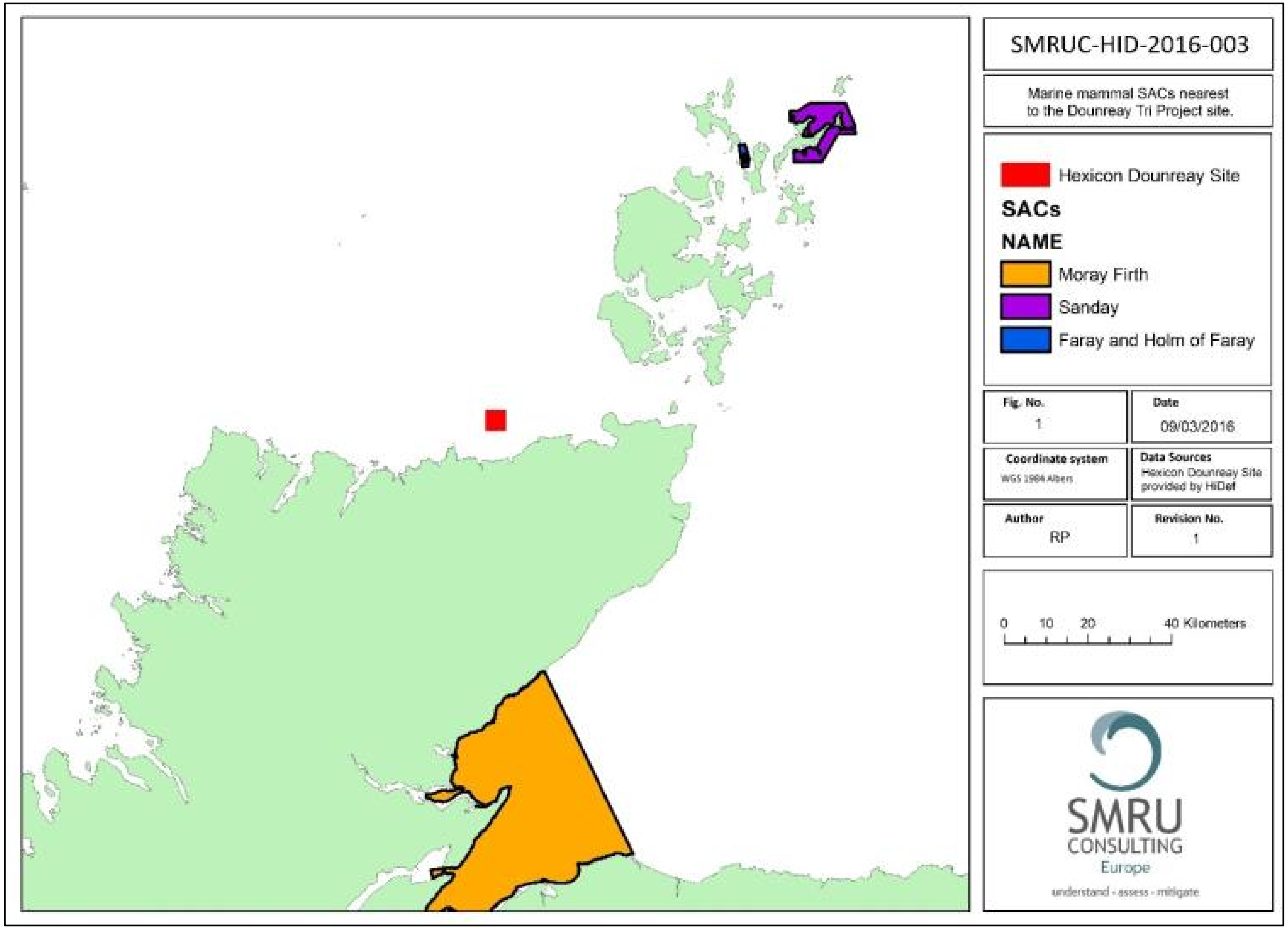

Figure 10-3 Marine mammal SACs nearest to the Dounreay Trì Project site.

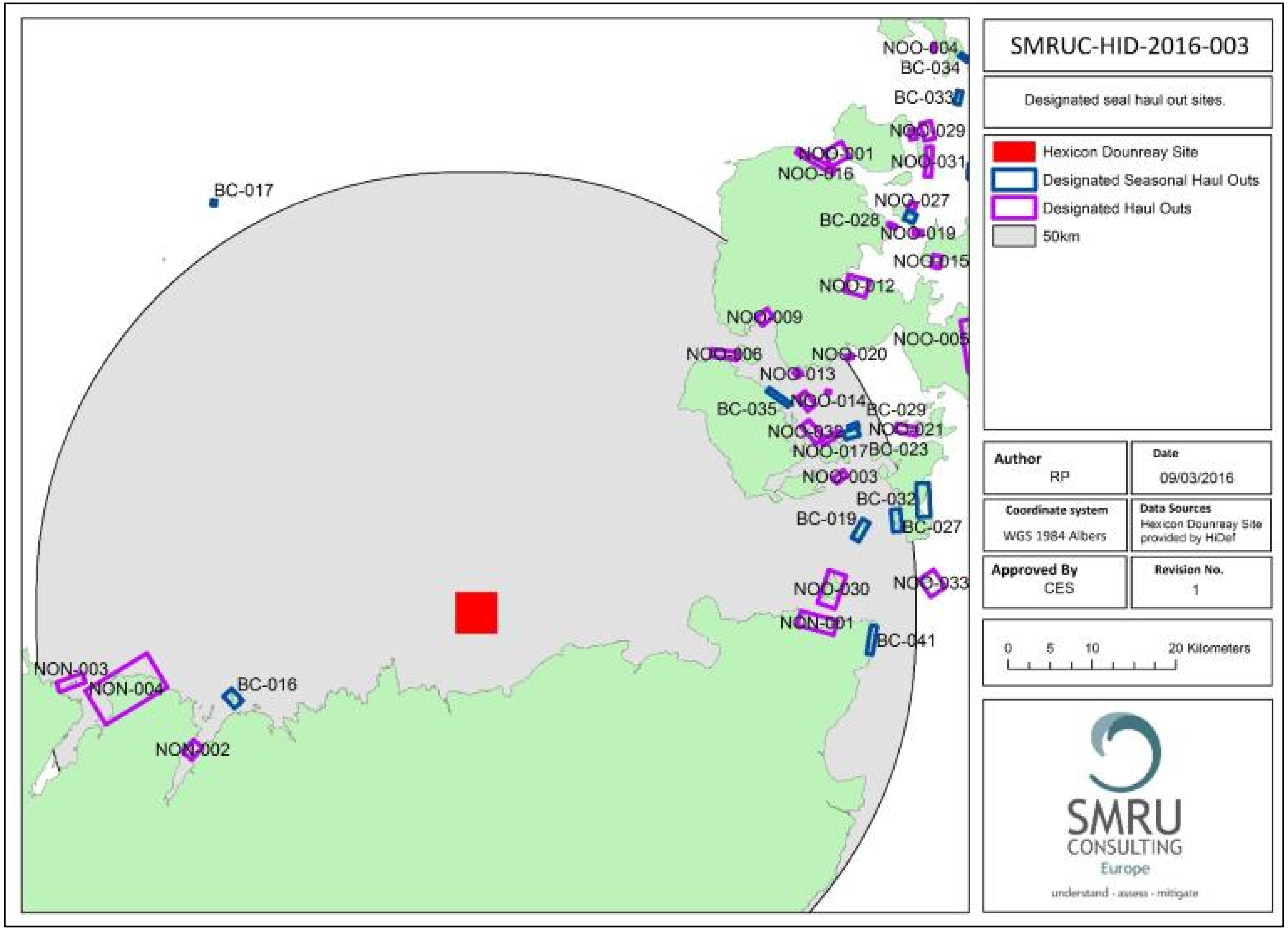

Figure 10-4 Designated seal haul out sites within 50 km of the Project site.

Data Sources

10.42 The following section describes the data sources that were reviewed and assessed to determine the abundance and distribution of marine mammal species, basking sharks and turtles in the study area.

Dounreay Aerial Surveys

10.43 The survey design is outlined in section 10.3.1. A total of 13 aerial surveys were conducted between January and December 2015; marine mammals were sighted on seven of these surveys. The total transect length flown varied slightly between surveys from 47.4 km to 49.5 km, giving a surveyed area that varied between 23.7 km^2 and 24.75 km^2. A total of 24 marine mammals identified to species were sighted.

SMRU Telemetry Data

10.44 The Sea Mammal Research Unit has deployed telemetry tags on grey seals and harbour seals in the UK since 1988 and 2001, respectively. These tags transmit data on seal locations with the tag duration (number of days) varying between individual deployments. Telemetry data are particularly useful as they provide information on seal movement patterns away from their haul out sites, provide data on the foraging behaviour of seals at sea and demonstrate connectivity between areas.

SMRU Seal Density Maps

10.45 The SMRU seal density maps were produced as a deliverable of Scottish Government Marine Mammal Scientific Support Research Programme (MMSS/001/11) in the report Jones *et al*. (2013). The maps were created in order to predict the at-sea density of seals in order to inform impact assessments. The analysis uses grey seal telemetry data from 1991-2011, harbour seal telemetry data from 1991-2012 and count data from 1988-2012 to produce UK-wide maps of estimated density with associated uncertainty. The total usage maps for grey and harbour seals combine the at-sea and hauled-out densities. The seal total usage data is obtained by assessing the available telemetry data and using patters of usage, scaled up by population level to produce estimates of mean density (Jones et al., 2013).

SMRU Count Data

10.46 The Sea Mammal Research Unit (SMRU) carries out surveys of harbour and grey seals in Scotland and on the east coast of England to contribute to NERC's statutory obligation under the Conservation of Seals Act 1970 'to provide the (UK government) with scientific advice on matters related to the management of seal populations'. These SMRU surveys are funded by NERC, SNH and Natural England and are used form the routine, statutory monitoring of seal populations around the UK.

10.47 Surveys of harbour seals are carried out during the summer months. The main population surveys are carried out when harbour seals are moulting, during the first three weeks of August. To maximise the numbers of seals on shore and to reduce the effects of environmental variables, surveys are restricted to within two hours either side of afternoon low tides on days with no rain. Grey seals are also counted on all harbour seal surveys, although this data does not necessarily provide a reliable index of population size. The counts obtained represent the number of seals that were on shore at the time of the survey and are an estimate of the minimum size of the population. They do not represent the total size of the local population since a number of seals would have been at sea at the time of the survey. It is noted that these data refer to the numbers of seals found within the surveyed areas only at the time of the survey; numbers and distribution are likely to differ at other times of the year.

APEM Aerial Survey Data

10.48 APEM conducted seven digital aerial surveys for the Pentland Firth and Orkney waters between November 2010 and August 2011. These surveys consisted of a 2 km grid survey design where an image was analysed every 2 km along transects spaced 2 km apart over the study area. A further seven surveys were conducted between March 2012 and January 2013 with an altered survey design for higher effort in near shore areas where an image was analysed every 500 m along transects spaced 2 km apart (APEM, 2013; Figure 10-5). All surveys included marine mammals at sea and seals hauled out on land.

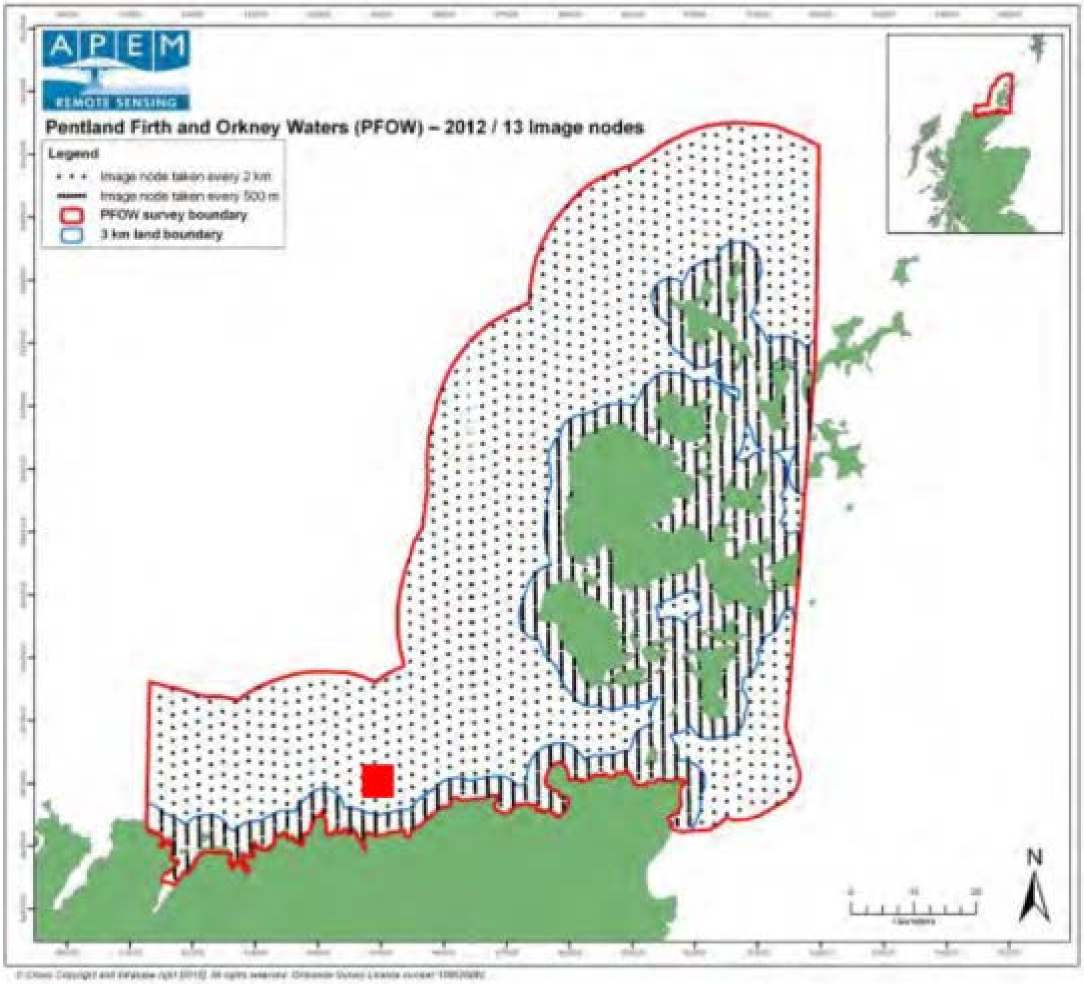

Figure 10-5 APEM aerial survey design in the Pentland Firth and Orkney Waters study area between March 2012 and January 2013 (APEM, 2013).

Note: the survey design conducted between November 2010 and August 2011 differed, with the image distance being 2 km for all areas.

10.49 The total area covered by both survey years was 5,935 km^2. The first set of surveys provided 36,795 images that were analysed. The survey area varied between surveys from 48.5 km^2 to 322.1 km^2 (APEM, 2013). The second set of surveys provided 21,681 images that were analysed (13,985 images in the near shore area and 7,696 images for the wider area). The total survey area covered in each survey varied between 95 km^2 and 144.58 km^2 (APEM, 2013).

SCANS II

10.50 The SCANS II surveys were completed in July 2005 and comprised of a combination of vessel and aerial surveys. One of the objectives of these surveys was to estimate small cetacean abundance and density in the North Sea and European Atlantic continental shelf waters. The aerial surveys involved a single aircraft method using circle-backs (or race-track) methods. During these surveys the aircraft covered a total on effort transect distance of 15,902 km across an area of 353,000 km^2 (SCANS II, 2006). The Pentland Firth and the Dounreay Trì project area are located in SCANS II survey block J which contained a total transect line length of 1,600 km giving a surveyed area of 37,477 km^2 (Burt et al., 2006).

JNCC Report 544: Areas of relatively high harbour porpoise density

10.51 Heinänen and Skov (2015) analysed 18 years of survey data from the Joint Cetacean Protocol (JCP) project. The goal of this analysis was to try to identify “discrete and persistent areas” that might be considered important for harbour porpoise with the ultimate goal of determining Special Areas of Conservation (SACs) for the species. Their approach involved constructing predictive models using corrected sightings rates analysed with respect to topographic, hydrodynamic and anthropogenic covariates and then generating predicted distribution maps of density estimates for the waters around the UK. The analysis grouped data into three subsets: 1994-1999, 2000-2005 and 2006-2011 to account for patchy survey effort and analysed summer (April-September) and winter (October-March) data separately to explore whether distribution patterns were different between seasons. The authors note that “due to the uneven survey effort over the modelled period, the uncertainty in modelled distributions vary to a large extent”.

JNCC Report 543: UK wide bottlenose dolphin and harbour porpoise likelihood of occurrence

10.52 Evans et al. (2015) reviewed data obtained from shore-watches conducted my multiple organisations13 around the UK since 1965, providing 75,000 hours of effort from 678 sites. The average sightings rate and count rate was calculated for each site and bottlenose dolphin and harbour porpoise presence was modelled using a GAM to predict the likelihood of occurrence at each site.

SNH Report 419: Abundance and behaviour of cetaceans in the Pentland Firth and Orkney waters

10.53 Evans et al (2011) collated data from 12 sources[14] to assess the abundance and behaviour of cetaceans in the Pentland Firth and Orkney waters. This combined dataset contained data obtained from opportunistic, casual and systematic surveys with data spanning thirty years from 1980 to 2010. Unfortunately, no effort data were presented in this report alongside the sightings data which prevented the calculation of density estimates for any of the cetacean species.

[13]Data sources included: Sea Watch Foundation, Irish Whale & Dolphin Group, Northern Ireland’s Department of the Environment, Manx Whale & Dolphin Watch, Marine Awareness North Wales, Gower Marine Mammal Project, Ceredigion County Council, National Oceanography Centre, Whale & Dolphin Conservation, European Marine Energy Centre, SeaTrust south & west Wales.

[14] 1) Sea Watch database of casual sightings and systematic observations 2) European Seabirds at Sea (ESAS) database 3) SCANS & SCANS II surveys 4) Marine Conservation Society database 5) Orkney Biodiversity Records database 6) North Ronaldsay Bird Observatory records 7) Fair Isle Bird Observatory records 8) EMEC land-based watches 9) Aquamarine Power land-based observations 10) John O’Groats Ferry observations across the Pentland Firth 11) Highland Ranger Service land-based observations from Caithness sites 12) Cetacean Strandings Investigation Programme (CSIP).

European Seabirds at Sea

10.54 The European Seabirds at Sea (ESAS) database consists of surveys primarily for seabirds conducted from both vessels and aircraft using a variety of methods. Since the purpose of these surveys is to collect seabird information, there is no dedicated marine mammal surveyor and so sightings are incidental only. This means that no reliable effort data for marine mammal sightings is available and sightings rates will be influenced by seabird sightings rates. Therefore, these data are an indication of presence/absence data for marine mammals only. The ESAS data for the Project area did not contain any marine mammal sightings between January and June 2015 (Dounreay Trì Ltd, 2015). The ESAS marine mammal data are included in the dataset assessed in the Cetacean Atlas (Reid et al., 2003) and in the SNH report on cetaceans in the Pentland Firth and Orkney Waters (Evans et al., 2011) and so are not considered further in isolation.

Species Accounts

10.55 The following section describes available data on the abundance and distribution of marine mammal species in the study area.

Grey Seal

10.56 Grey seals (*Halichoerus grypus*) are the larger of the two species of seal resident in UK waters. They forage at sea and haul out on land to rest, moult and breed. They are known to range widely during foraging trips, frequently travelling for up to 30 days with over 100 km between haul out sites. Approximately 38% of the worlds grey seal population breeds in the UK with 88% of these breeding in Scotland (mainly the Outer Hebrides and Orkney). Grey seal population data are assessed using pup counts during the autumn breeding season when females haul out to give birth. The most recent available UK pup production estimate is based on data from 2012 which resulted in an estimate of 56,988 pups (95% CI 56,317-57,683). This was used to produce an overall UK population estimate of 111,600 grey seals (95% CI 91,400-139,200) in 2014 (SCOS, 2015). The latest pup count in Orkney was in 2012, which resulted in a pup production estimate for Orkney of 22,926 which equates to 40% of the UK grey seal pup production. This Orkney population is considered to be stable with a population increase of <0.2% per annum since 2010 (SCOS, 2015). In the UK, grey seals are considered to have a conservation status of Favourable[15].

10.57 Seal species were sighted and identified during three of the Dounreay aerial surveys: March, June and July 2015 (Irwin, 2015). Of these five individual sightings, only three were identified to species level as grey seals. One grey seal sighting was located within the Dounreay Trì project site, while the other two were both located just on the outside of the project site, but within the 2 km buffer surveyed around the site (Figure 10-6).

10.58 Of the 265 grey seals tagged by SMRU across the whole of the UK, 34 were tagged within the Orkney and North Coast Management Unit between 1993 and 2010. Of these, only four grey seals had telemetry tracks that crossed the Dounreay Trì project area. Two of these were male adult seals (one tagged in the Farnes in 1997, the other in Abertay in 1998) and the other two were male pups (tagged in Stroma in 2010). It is obvious from these telemetry data that the Dounreay Trì project area was not an important area for these tagged seals as their tracks only show transit through the area with no evidence of foraging activities (Figure 10-7).

[15] http://art17.eionet.europa.eu/article17/reports2012/species/report/?period=3&group=Mammals&country=UK&region=#

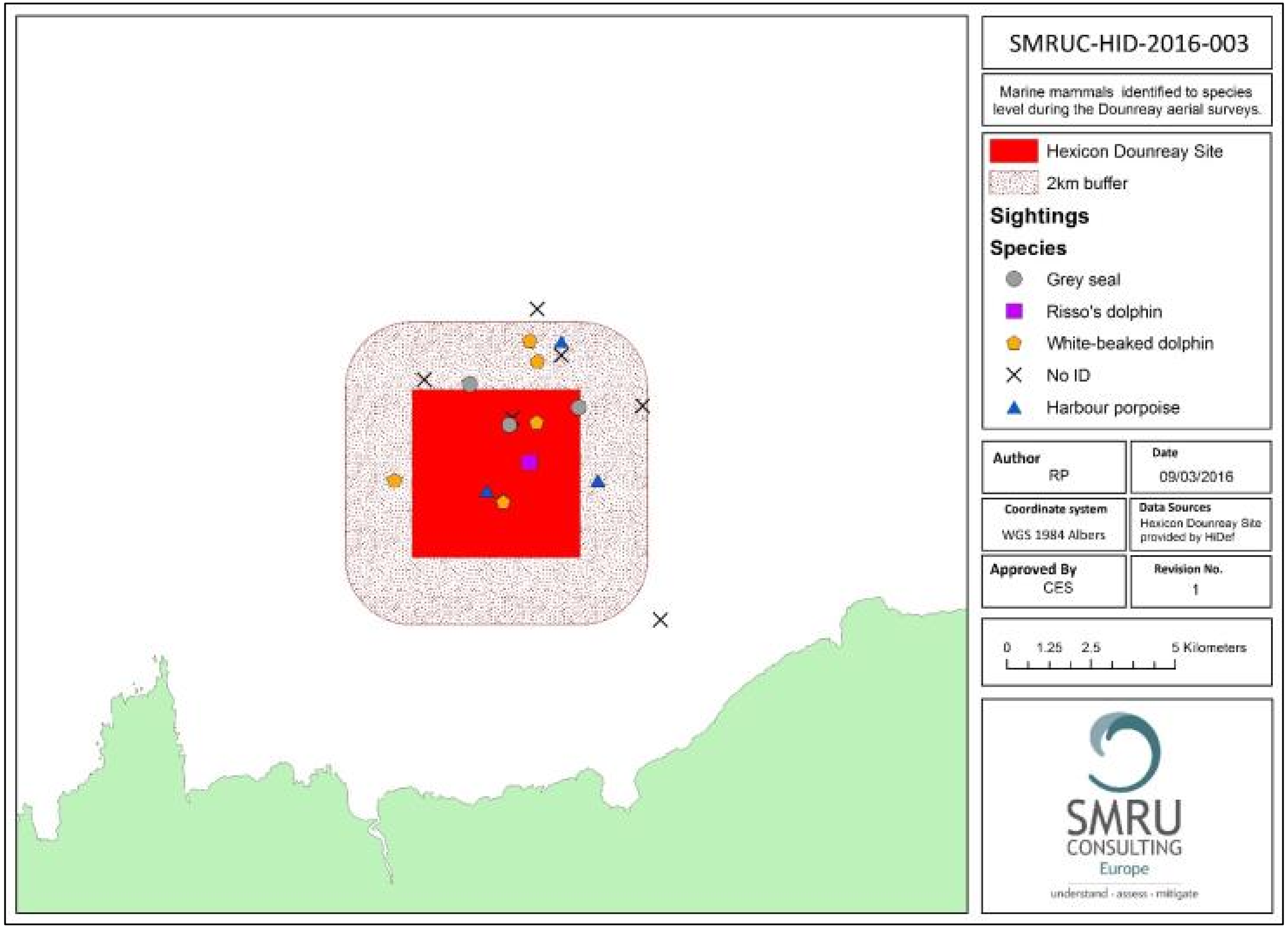

Figure 10-6 Marine mammals sighted and identified to species level during the 12 aerial surveys of the Dounreay Project Area conducted between January and December 2015.

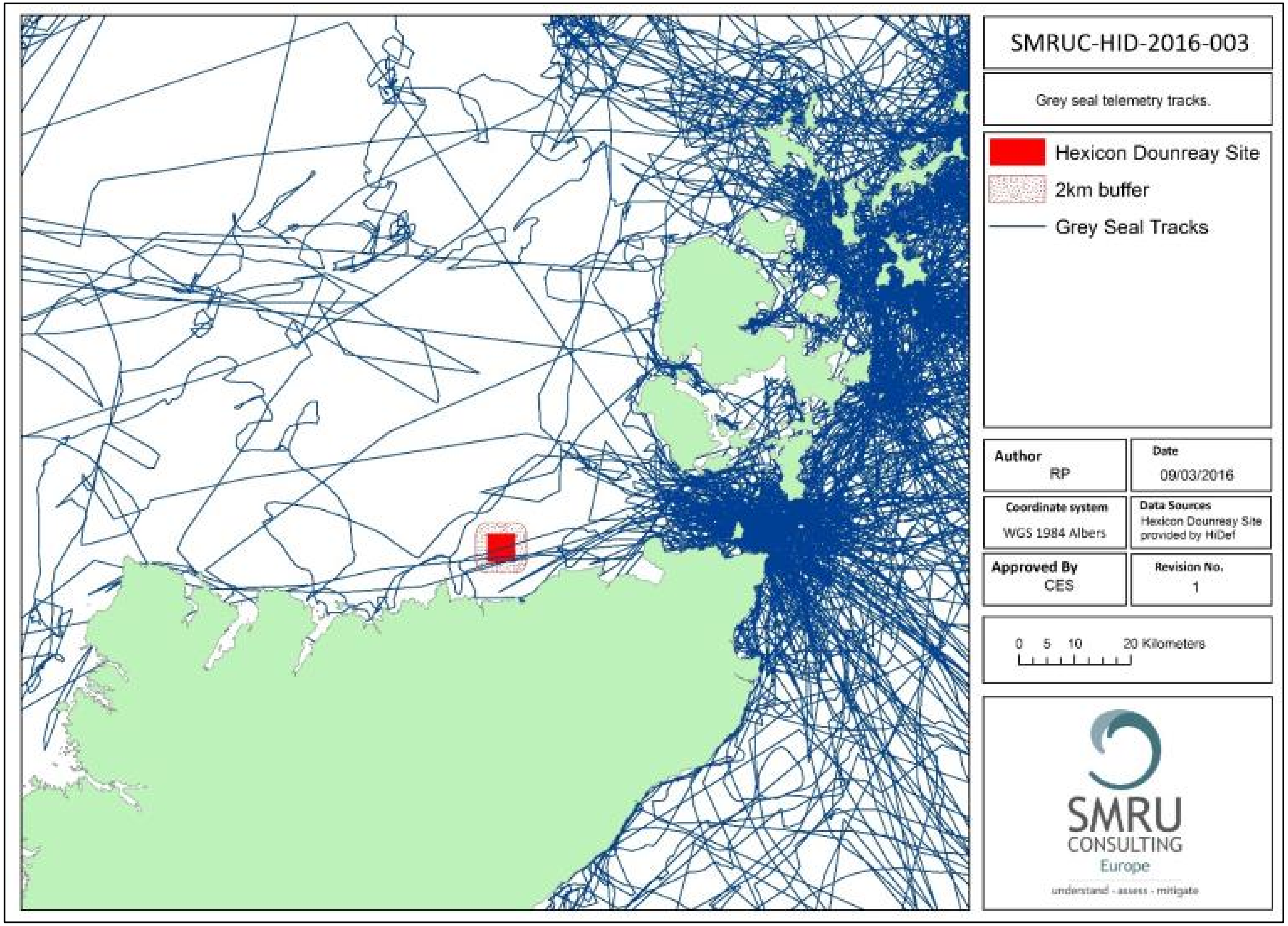

Figure 10-7 Grey seal telemetry tracks.

10.59 The grey seal usage data provides an estimate of mean density across the UK (Jones et al., 2013). The total usage data estimates between 5 and 10 grey seals per 5x5km^2 grid cell at the Project site and across most of the western side of the Pentland Firth (Figure 10-8). Clearly, grey seal usage in the Pentland Firth and Orkney Waters is concentrated in the Eastern Pentland Firth and around Orkney, in particular the eastern Orkney islands where density estimates reach >150 per grid cell. There are much lower densities of seals in and around the Project site and the western parts of the Pentland Firth.

10.60 The SMRU August seal haul out count surveys have produced 2,379 grey seal count records (obtained between 1997 and 2013) that are located within either the North Coast or the Orkney Seal Management Unit. The most recent count data for these Seal Management Units were in 2013 which recorded 458 haul outs, totalling 8,035 individual grey seals, with counts ranging between 1 and 451 at individual haul out sites (Figure 10-9). All of these sites are located within 150 km swimming distance from the Project site, which is within known grey seal foraging trip ranges (most foraging within 100 km but can feed up to several hundred kilometres offshore; SCOS, 2015). Therefore, while all grey seals in this Management Unit have the potential to transit the distances required to reach the Project area from the main haul out sites, the lack of haul outs near the Project site, combined with the usage and telemetry data, show that this does not occur to any significant degree.

10.61 During the two years of APEM aerial surveys, the most abundant marine mammal species group observed were phocid species (total count = 3,027). Of those identified to species level, grey seals were much more commonly sighted (total count = 2,592) than harbour seals (total count = 53). The only sightings of phocids near the Dounreay Trì Project area were in March 2011 where 16-24 seals of unknown species were recorded at Dunnet Head (APEM, 2013). Based on the counts obtained from these aerial surveys, the sightings rates of grey seals across the whole of the Pentland Firth and Orkney Waters survey area ranged from 0.0 animals/km^2 in December 2010 and January 2011 to 8.8 grey seals/km^2 in November 2012 (APEM, 2013). The average sightings rate for grey seals across the entire Pentland Firth and Orkney Waters survey area was 1.2 grey seals/km^2, although Figure 10-10 shows that the sightings rates for the project site were significantly lower than this.

10.62 The above information has established that grey seals are potentially present in the Project area, though there is evidence that the area doesn’t represent important habitat for the species.

10.63 As grey seals are listed as Annex II species and are listed as primary features at selected SACs, connectivity with the SAC population requires assessment. There is a grey seal SAC at Faray and Holm of Faray in Orkney which is approximately 95 km from the Dounreay Trì Project site. It is known that grey seals range far from their haul out sites, foraging in the open sea up to 30 days at a time and with most foraging occurring within 100 km of a haul out site (SCOS, 2015). Therefore, the Project site may represent the edge of the typical distance that grey seals from the SAC may forage at. There is, therefore, the potential for SAC animals to be present at the Project site, however, no tagging has been conducted at the SAC to determine this. As neither haul out counts, telemetry data or total usage suggest there is a high density of grey seals in the Project area, connectivity with the Faray and Holm of Faray SAC is likely to be limited.

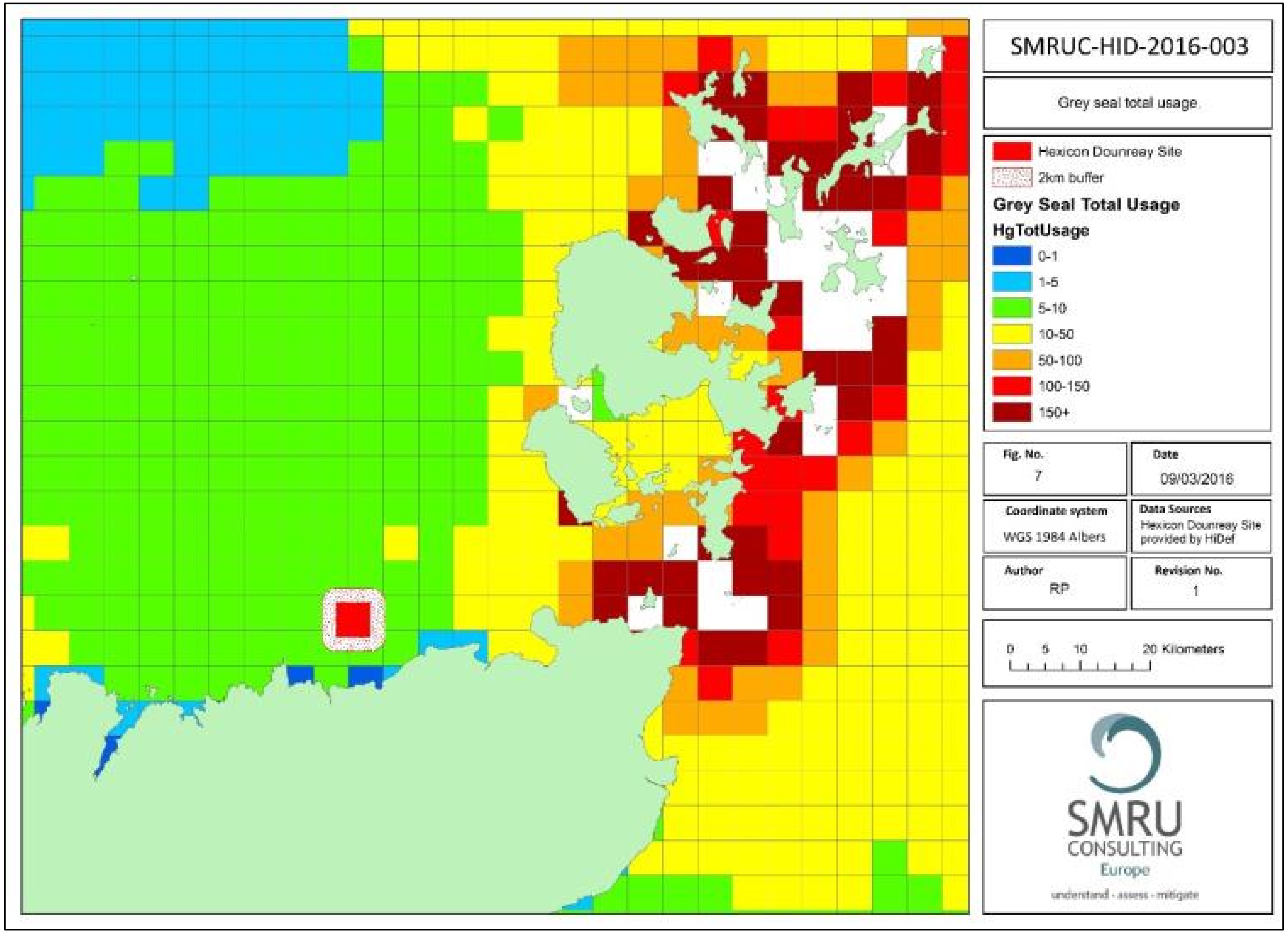

Figure 10-8 Grey seal total usage in the Pentland Firth and Orkney Waters.

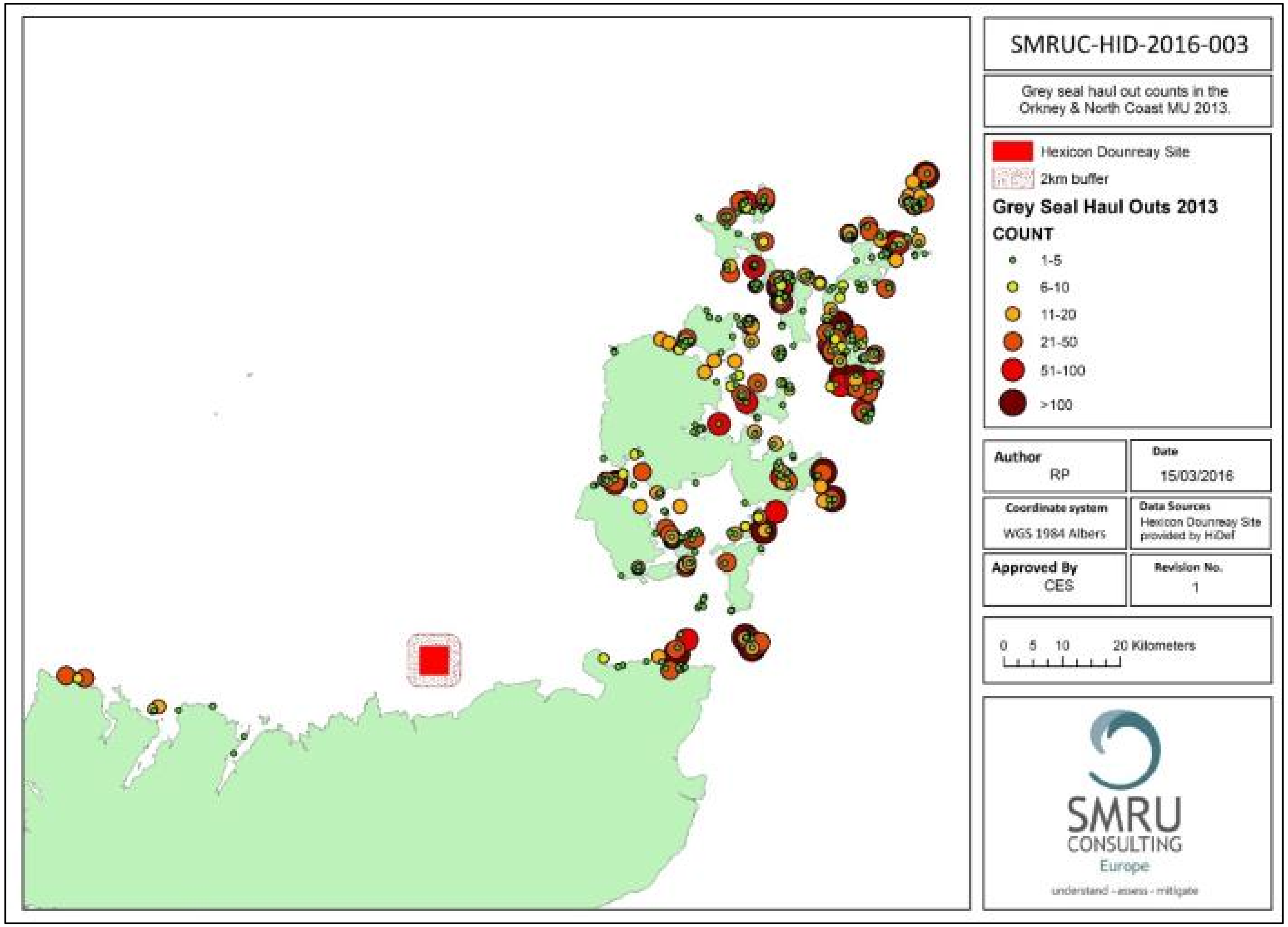

Figure 10-9 All grey seals recorded during SMRU harbour seal mount counts in the Orkney and North Coast Management Unit in 2013.

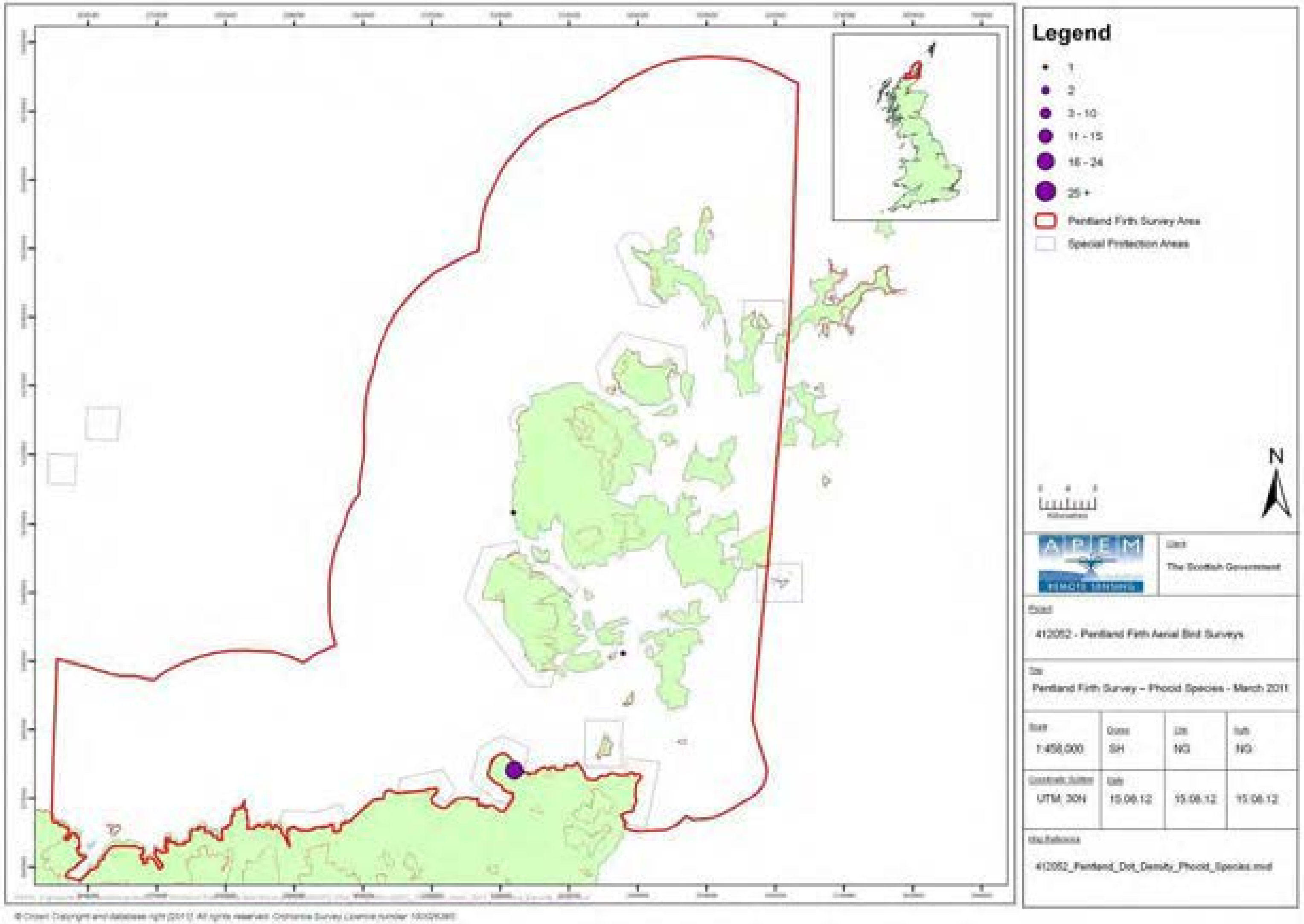

Figure 10-10 Distribution of total phocids recorded in the APEM Pentland Firth and Orkney Waters survey area March 2011 (APEM, 2013).

Harbour Seal

10.64 Harbour seals (*Phoca vitulina*) are the smaller of the two species of seal resident in UK waters. They forage at sea and haul out on land to rest, moult and breed. They are not a wide ranging as grey seals, and typically forage between 40 and 50 km from haul out sites. Approximately 30% of the European harbour seal population are found in the UK with approximately 79% of these being located in Scotland. Harbour seal population data are estimated from August moult counts which gives a minimum population size. The most recent counts were obtained between 2007 and 2014 giving a count of 29,109 harbour seals in the UK. This number was then scaled to account for the proportion of seals not hauled out at the time of the count to produce a total population estimate for the UK of 40,414 harbour seals in 2014 (95% CI 33,106-55,029) (SCOS, 2015). The harbour seal counts for the North Coast and Orkney Management Unit have been significantly decreasing since the 1988 PVD epidemic, with an annual change of -9% per annum. The most recent count in 2013 recorded only 73 and 1,865 harbour seals in the North Coast and Orkney areas respectively, in comparison to counts of 265 and 8,522 in 1997 (SCOS, 2015). This represents a 78% decline in Orkney and a 72% decline in the North Coast. As a result of the PDV epidemics in 1988 and 2002 and a lack of recovery in most populations, harbour seals in the UK have a conservation status of Unfavourable-Bad[15].

10.65 SMRU have tagged a total of 53 harbour seals in the Orkney and North Coast Management Region, however, none of these had telemetry tracks that crossed the Dounreay Trì Project site (all lines, Figure 10-11). This includes the 14 harbour seals tagged at the Gills Bay haul out site in 2011 (blue and red lines, Figure 10-11). The closest that a harbour seal telemetry track got to the Project site was 3 km (Figure 10-11). This seal was an adult male harbour seal which shows concentrations of tracks around Dunnet Head, which is indicative of foraging behaviour. It also shows movement as far west as Dounreay where is shows telemetry tracks indicative of haul out behaviour around the Crosskirk haul out site and potential foraging behaviour near to the haul out (Figure 10-12).

10.66 As part of the pre-construction marine mammal monitoring programme for the Moray Firth offshore wind farm developments (Beatrice Offshore Windfarm Ltd. and Moray Offshore Renewables Ltd.) 25 harbour seals were tagged in Loch Fleet (within the Dornoch Firth and Morich Moore SAC) to assess movement patterns (Graham et al., 2016). A total of 12 seals were tagged in September 2014 (six of each sex) and a further 13 were tagged in February 2015 (seven female, six male). The seals showed movement within the Moray Firth and as far north as the northern Orkney Island. One individual seal transited along the Northern Scotland coastline through the Pentland Firth (Figure 10-11). Analysis of the telemetry data using a state-space model (described in Russell et al., 2015) to classify travelling and portaging locations showed that in the Project area the seal showed only travelling movements with no evidence of foraging (area restricted search) in the vicinity of the Project.

10.67 The total usage data estimates between 1 and 5 harbour seals per 5x5km^2 grid cell at the Project site and across most of the western side of the Pentland Firth (Figure 10-13). Clearly, harbour seal usage in the Pentland Firth and Orkney Waters is concentrated in and around Orkney, in particular the Northern Orkney Islands, particularly around Sanday where there is a harbour seal SAC. There are much lower densities of seals in and around the Project site and the western parts of the Pentland Firth, however, these data show that there is some movement along the coastline between haul out sites.

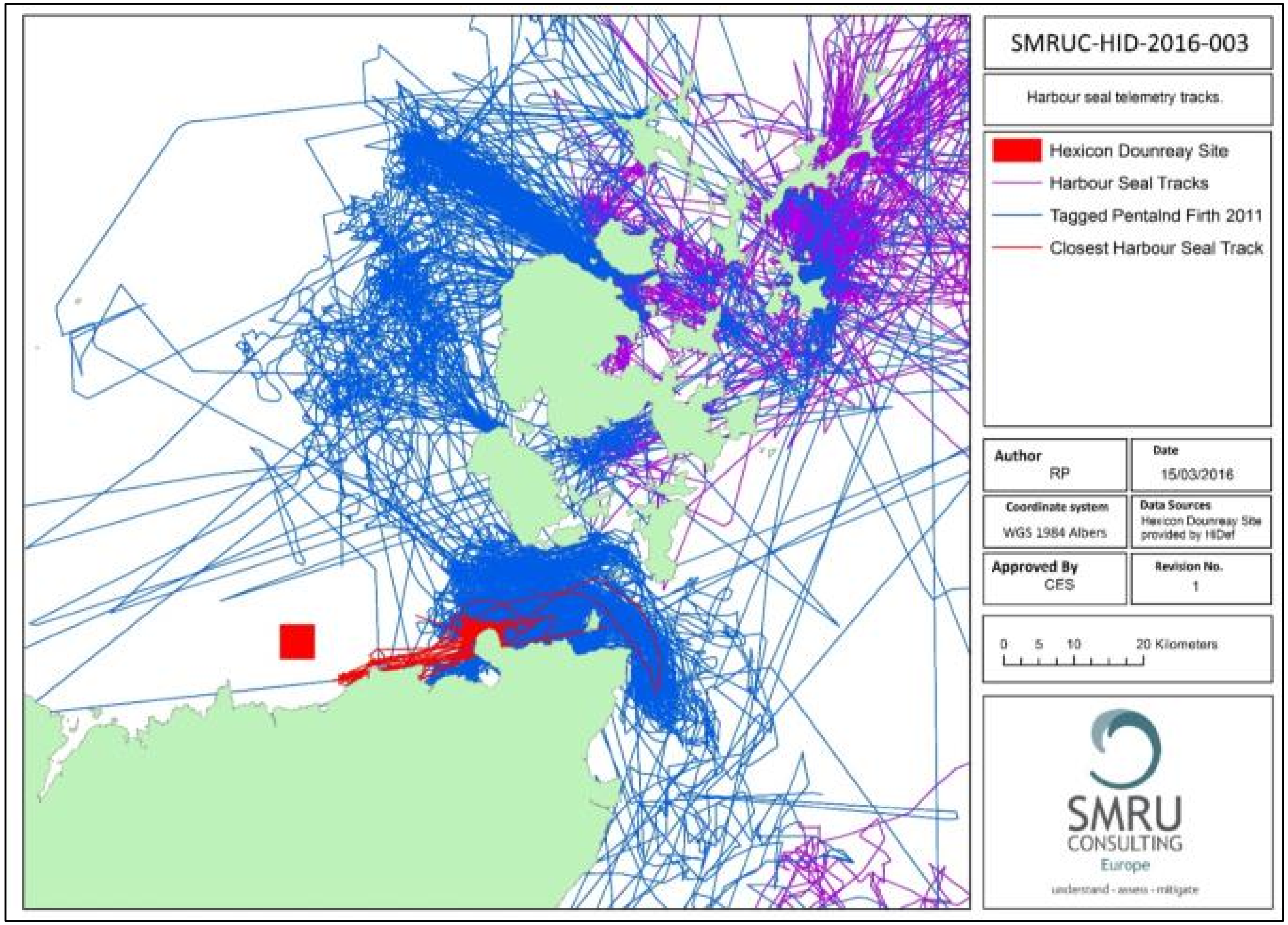

Figure 10-11 Harbour seal telemetry tracks.

Blue lines = seals tagged at Dunnet in the Pentland Firth 2011, of which red line = seal that had the closest approach to the Project site; purple lines = seals tagged at other locations in the Orkney and North Coast management region.

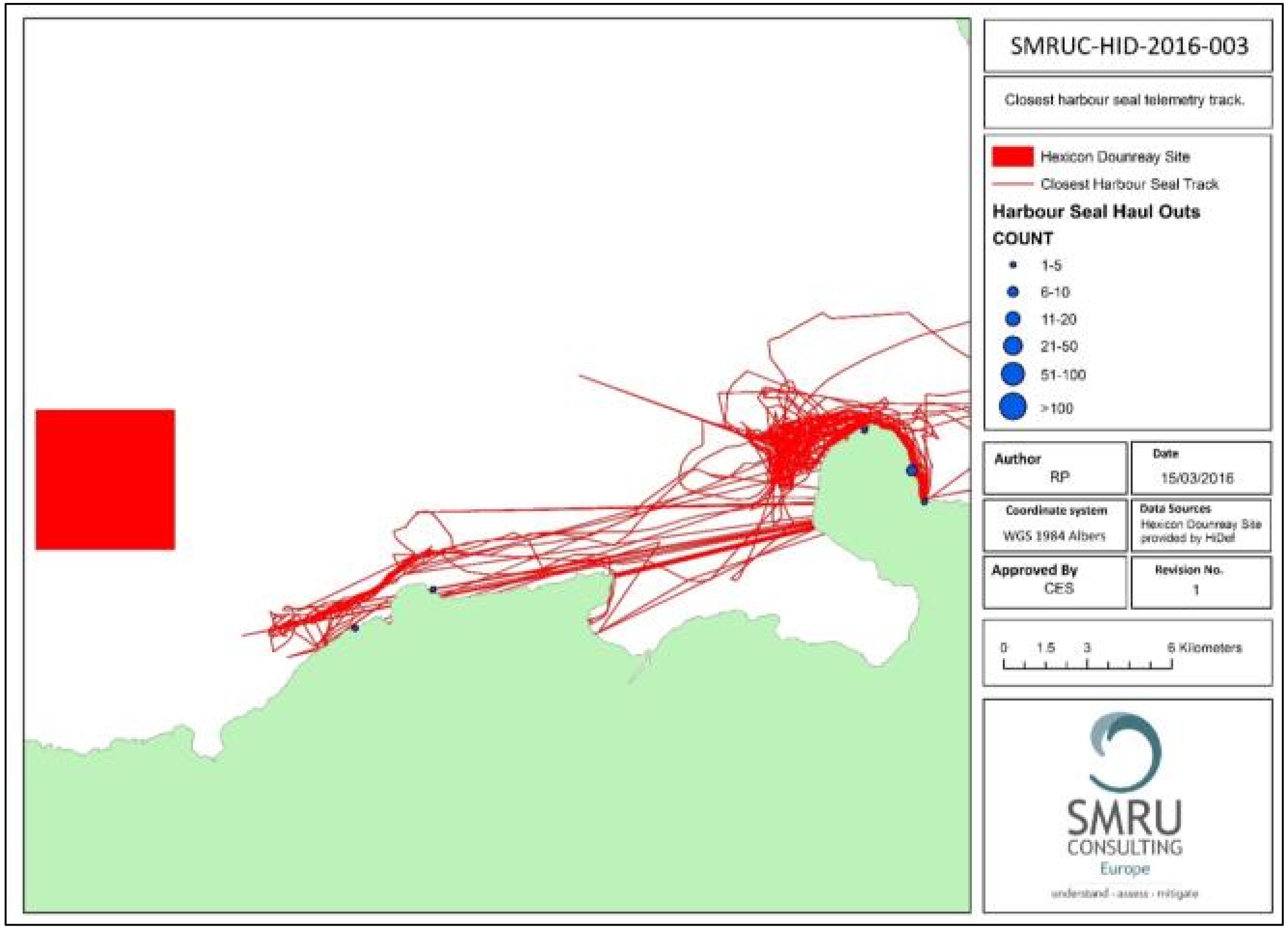

Figure 10-12 Telemetry tracks for the adult male harbour seal tagged at the Dunnet haul out site in 2011 that showed the closest approach to the Project site.

Blue dots = harbour seal haul out sites.

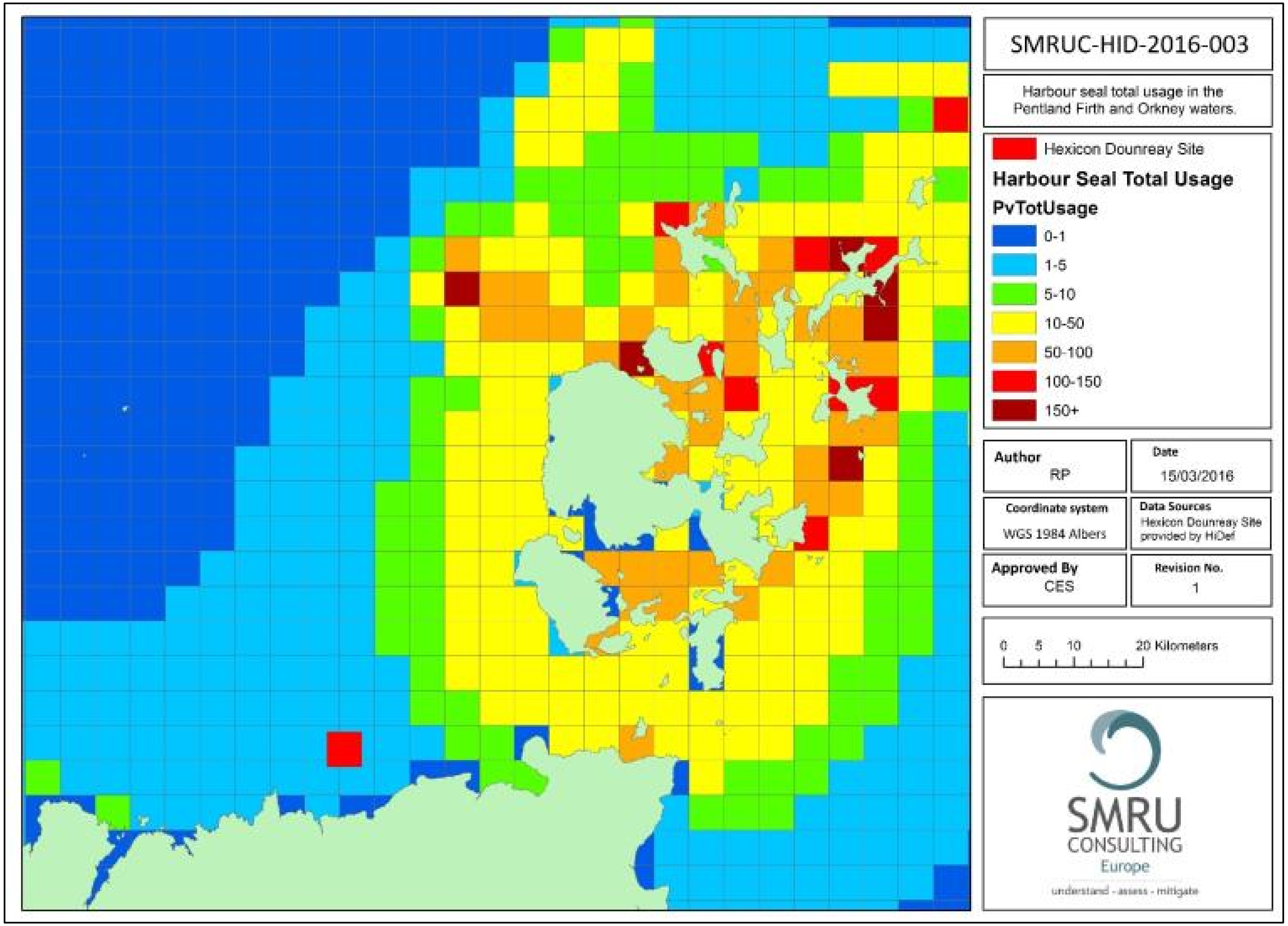

Figure 10-13 Harbour seal total usage in the Pentland Firth and Orkney Waters.

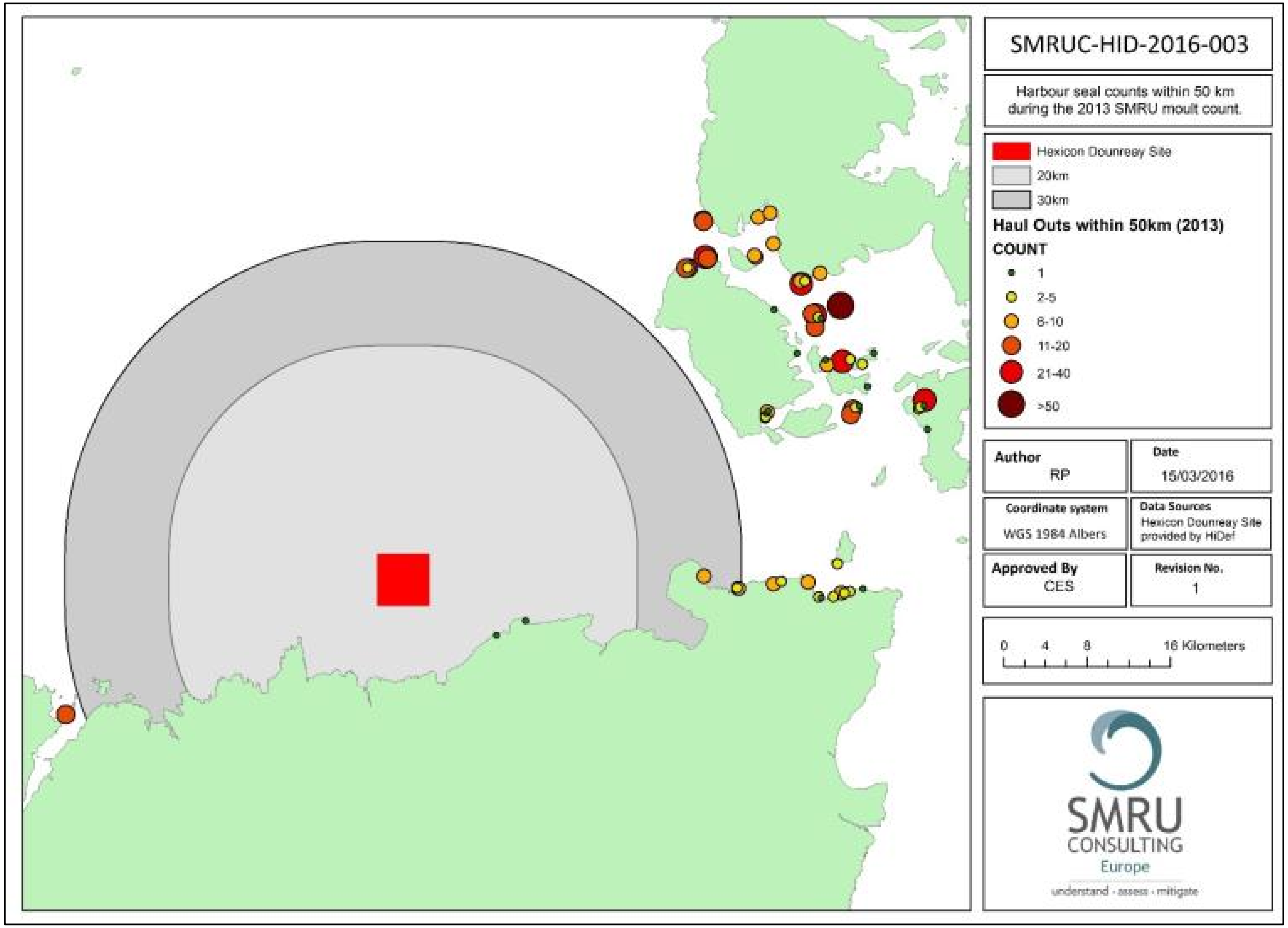

Figure 10-14 All harbour seals recorded during the 2013 SMRU harbour seal mount count within 50 km of the Project site.

10.68 The SMRU seal haul out count surveys have produced 437 harbour seal count records (between 1997 and 2013) that are located within a 50 km range of the Project site, which is at the upper end of normal harbour seal foraging ranges from haul out sites (SCOS, 2015). The most recent count data for the North Coast and Orkney Seal Management Units were in 2013 which recorded 64 haut outs within a 50 km range of the Project site (Figure 10-14). Most of these haul out sites were located in the Orkney Islands, which are between 40 and 50 km from the Project site. These haul out sites represent the edge of the typical foraging distances that harbour seals make and it is unlikely that seals from these Orkney haul out sites would spend any significant time at the Project site. There were only two haul out sites in 2013 that were within 20 km of the Project site: Port of Brims and Crosskirk (each n=1) and a further three that were located within 30 km, one at Dunnet and two at Ham, with counts of 8, 2 and 6 respectively.

10.69 Based on the counts obtained from the APEM aerial surveys, the sightings rate of harbour seals across the whole of the Pentland Firth and Orkney Waters survey area ranged from 0.0 to 0.2 harbour seals/km^2 in August 2012 (APEM, 2013). The average sightings rate of harbour seal across the entire Pentland Firth and Orkney Waters survey area, obtained from averaging the rates across all surveys, was 0.02 harbour seals/km^2.

10.70 The above information has established that harbour seals are present in the Project area, though there is evidence that the area does not represent important habitat for the species.

10.71 As harbour seals are listed as Annex II species and are listed as primary features at selected SACs, connectivity with the SAC population requires assessment. There is a harbour seal SAC at Sanday in Orkney which is approximately 100 km from the Dounreay Trì Project site. This distance far exceeds the typical foraging range of UK harbour seals, which is in the region of 25-50 km (Sharples *et al*., 2012). Therefore it is unlikely that there is any connectivity between any harbour seals present in the Project area and the Sanday SAC.

Harbour Porpoise

10.72 Harbour porpoise (*Phocoena phocoena*) are the smallest and most abundant cetacean species in UK waters (Reid *et al.,* 2003). They are typically sighted in small groups between one and three individuals. The North Sea harbour seal Management Unit population is currently estimated to be 227,298 animals (95% CI 176,360-292,948), of which, approximately 110,433 (95% CI 80,866-150,811) are within the UK portion of the Management Unit (IAMMWG, 2015). Animals are frequently sighted throughout coastal habitats with studies suggesting they are highly mobile and cover large distances (Nabe-Nielsen *et al.,* 2011). In the UK, harbour porpoise are considered to have a conservation status of Favourable[15].

10.73 Of the three cetacean species sighted and identified during the Dounreay aerial surveys, harbour porpoise were the least common. They were observed on three separate surveys: May, June and November 2015 where one individual was seen in each case (Irwin, 2015). One harbour porpoise sighting was located within the Dounreay Trì project site, while the other two were both located within the 2 km buffer surveyed around the site (Figure 10-5).

10.74 The marine mammal count data obtained from the APEM aerial surveys were divided into different categories depending on whether the images were sufficient to ID to group or species level. For those animals identified as cetaceans, data were provided at three levels: unknown cetacean, dolphin/porpoise and specific species. The sightings rate of animals using the dolphin/porpoise group across the whole of the Pentland Firth and Orkney Waters survey area ranged between 0 to 0.086 dolphins/porpoise/km^2 with an average rate of 0.03 dolphins/porpoise/km^2. The dolphin/porpoise group was sighted in 11 of the 14 surveys, with a peak recorded in the February/March 2011 survey when 18 individuals were counted (Figure

10-16 top). This species group was observed in the Pentland Firth however, while none of the sightings overlapped with the Dounreay Trì Project Site, there were sightings in close proximity (Figure 10-15).

10.75 Using data from the APEM surveys, the sightings rates of those animals identified to harbour porpoise species level ranged between 0 and 0.017 porpoise/km^2, with an average of 0.002 porpoise/km^2. The peak in harbour porpoise observations was in July 2012 when 2 individuals were counted. Despite these surveys covering the entire Pentland Firth, none of the harbour porpoise recorded were present near the Dounreay Trì Project area, with all sightings being recorded further north and in Orkney waters (APEM, 2013).

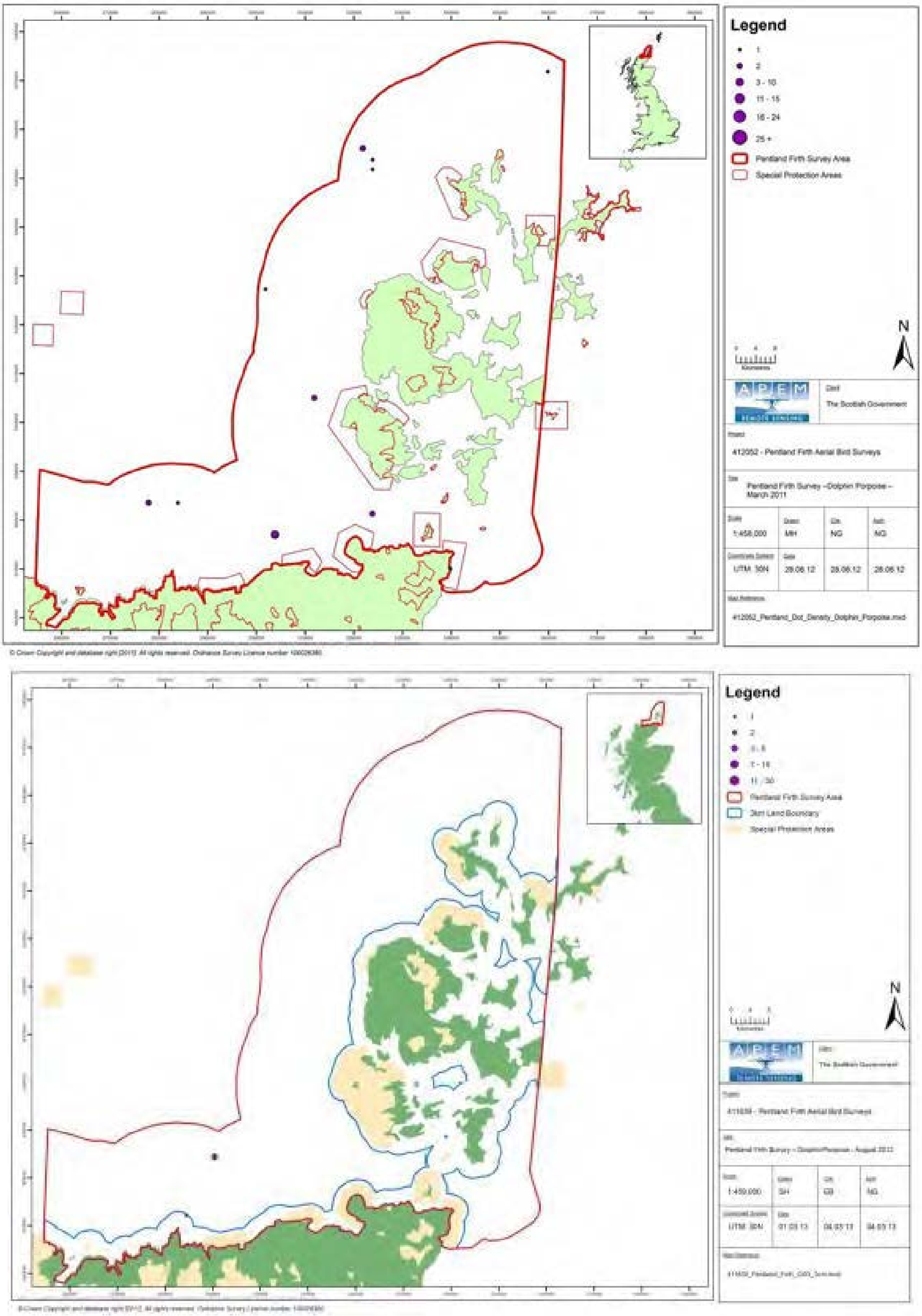

Figure 10-195 Distribution of dolphin/porpoise species recorded in the Pentland Firth during the APEM Pentland Firth and Orkney Waters survey area. February/March 2011 surveys (top) and August/September 2012 surveys (bottom) (APEM, 2013a, 2013b).

10.76 The Pentland Firth is located within SCANS II block J. The abundance of harbour porpoise in this entire block (covering the Pentland Firth, Orkney and Shetland) was estimated as 10,254 (95% CI 5,005-20,888) with a density of 0.27 porpoise/km^2 (95% CI 0.1335-0.5574) (Burt et al., 2006). From Figure 10-16 it is apparent that the Pentland Firth is not an important area for harbour porpoise in comparison to other areas such as the mid-southern North Sea. Within survey block J, the Pentland Firth itself has an estimated density of 0.2-0.3 porpoise/km^2 over most of the area, with smaller areas off Thurso and Dunnet Head having slightly higher densities of 0.3-0.4 porpoise/km^2 (Figure 10-16; Hammond et al., 2013). It should, however, be noted that the SCANS II survey data are based on a single snapshot of data obtained for a large survey block from one aerial survey in July 2005, which is now over ten years old and may not be representative of current harbour porpoise abundance and distribution in the Project area.

10.77 The Heinänen and Skov (2015) report presents predicted and observed densities of harbour porpoise around the UK, including the Pentland Firth. There were no sightings of harbour porpoise in the Pentland Firth in the JCP dataset analysed (Figure 10-17). The predicted density in the Pentland Firth is informed by the predictive models analysed with respect to topographic, hydrodynamic and anthropogenic covariates. The predicted density maps show very low densities of harbour porpoise in the Pentland Firth (up to 0.3-0.6 porpoise/km^2) in comparison to the Moray Firth (up to >3 porpoise/km^2 in the summer). This density estimate is comparable to the SCANS II density estimate of 0.2-0.4 porpoise/km^2, which strengthens the evidence base for low densities of harbour porpoise in the Pentland Firth in comparison to other areas in the UK such as the Moray Firth (Heinänen and Skov, 2015) and the mid-southern North Sea (Hammond et al., 2013).

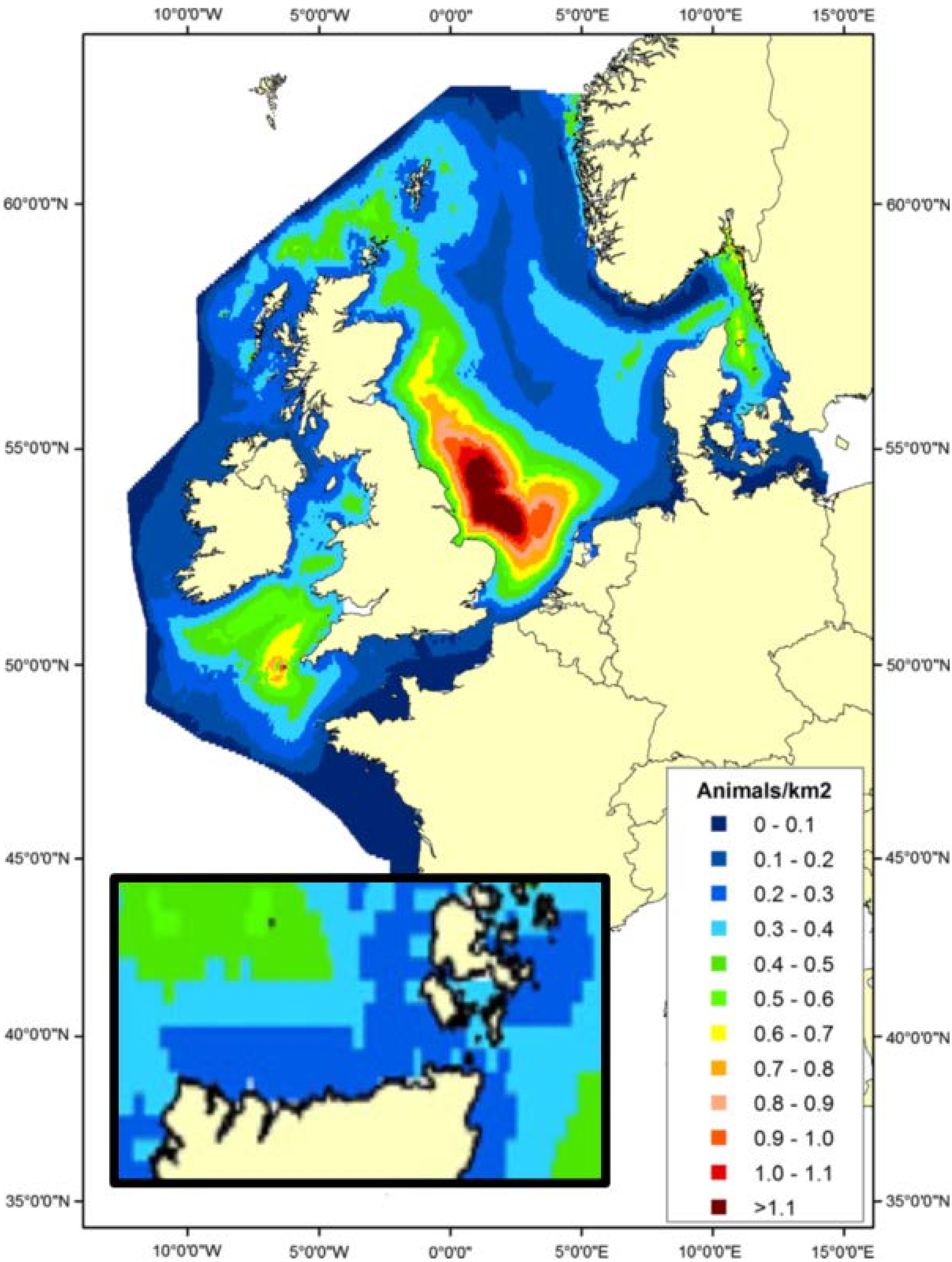

Figure 10-206 Predicted density surface for harbour porpoise in 2005 from SCANS II data (Hammond et al., 2013). Inset: zoomed in on the Pentland Firth and Orkney Waters.

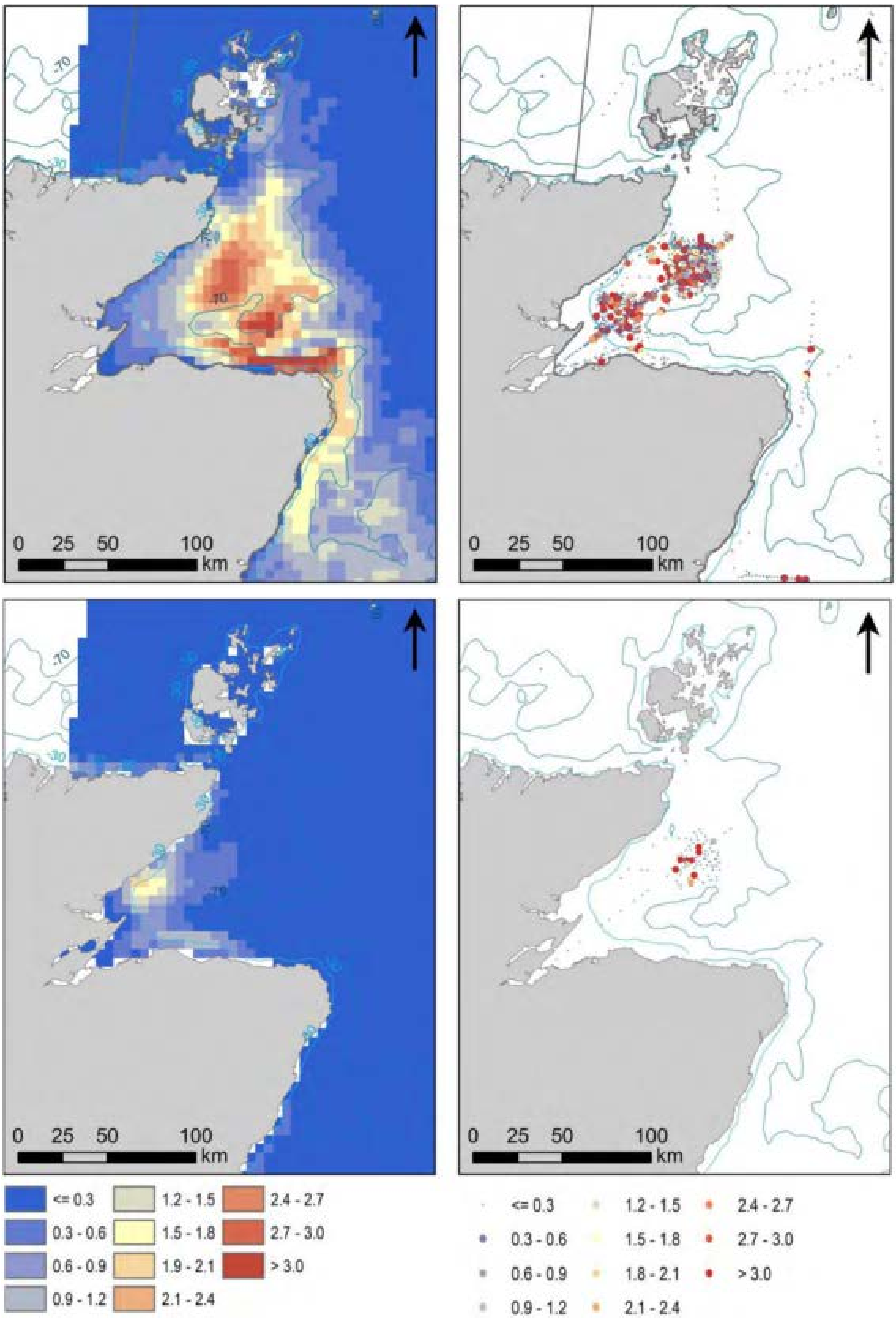

Figure 10-217 Predicted (left) and observed (right) densities (number/km^2) of harbour porpoise during the summer (top) and winter (bottom) of 2009 (Heinänen & Skov, 2015).

10.78 The sightings data assessed in Evans et al. (2011) do not suggest that the Project area is important for harbour porpoise. Most harbour porpoise sightings in the Pentland Firth and Orkney Waters were around the Orkney Islands and the eastern part of the Pentland Firth (Figure 10-18). Harbour porpoise sightings accounted for 50.4% of the cetacean records, which suggests that they are more common in the Pentland Firth and Orkney waters relative to other cetacean species.

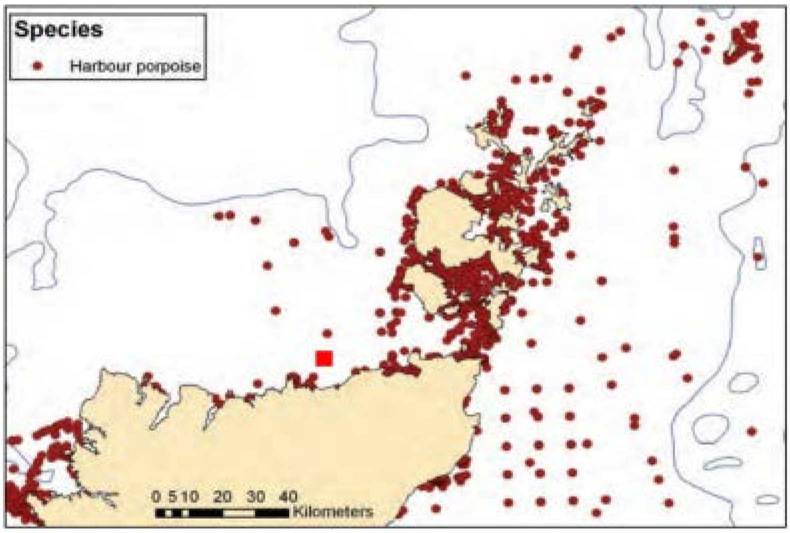

Figure 10-228 Distribution of sightings of harbour porpoise, 1980-2010 (Evans et al., 2011).

10.79 Evans et al. (2015) used shore based cetacean watch data with associated effort data to predict likelihood of harbour porpoise occurrence at watch sites around the UK. The analysis of this dataset resulted in a likelihood of porpoise occurrence of <0.25 for watch sites along the North coast of mainland Scotland near the Dounreay Trì Project area, at sites between Strathy, Dounreay, Thurso and Dunnet (Figure 10-19). These data show low likelihoods of porpoise occurrence along most of the East coast of Scotland, with highest likelihoods of occurrence in Shetland and around Aberdeen (Figure 10-19).

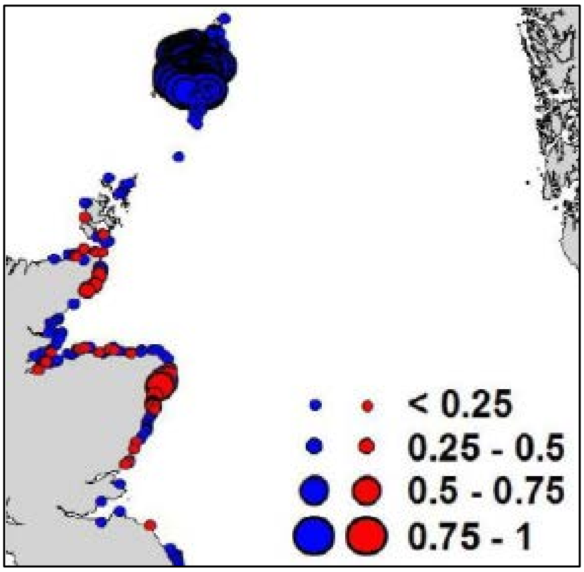

Figure 10-19 Map of GAM predicted likelihood of occurrence for harbour porpoise (red symbols = sites with >100mins effort for 3+ years) (Evans et al., 2015).

White-beaked Dolphin

10.80 White-beaked dolphins (*Lagenorhyncus albirostris*) are found in the temperate and sub-arctic waters of the North Atlantic and norther North Sea (Reid et al., 2003). The abundance of white-beaked dolphins in the Celtic and Greater North Sea management unit is estimated to be 15,895 animals, of which 11,694 (95% CI 6,578-20,790) are estimated to be within the UK EEZ (IAMMWG, 2015). In UK waters they are most commonly sighted in the central and Northern North Sea and western Scotland. White-beaked dolphins occur year round in near shore UK waters, primarily less than 100 m deep and in small groups (Reid et al., 2003). In the UK, white-beaked dolphins are considered to have a conservation status of Favourable[15].

10.81 White-beaked dolphins were the most commonly sighted and identified species during the Dounreay aerial surveys. White beaked dolphins were seen only in the winter months between December and March, and peaked at a density of 0.37 animals/km^2 in the project site in February, which equates to 9 animals within the project site (± 95% CI 0-24). The white beaked dolphins were sighted within the Dounreay Trì project site in February and December (Figure 10-6).

10.82 The marine mammal count data obtained from the APEM aerial surveys produced animals in some images that were identified as white-beaked dolphins. They were only identified in four of the 14 surveys between November 2010 and January 2013 (February/March, July and August 2011 and November 2012). The peak in white-beaked dolphin observations was in November 2012 when 5 individuals were counted. The sightings rate of white-beaked dolphins across the whole of the Pentland Firth and Orkney Waters survey area ranged between 0 to 0.038 white-beaked dolphins/km^2 with an average rate of 0.005 white-beaked dolphins/km^2. Despite these surveys covering the entire Pentland Firth, none of the white-beaked dolphins recorded were present anywhere near the Dounreay Trì Project area, with all sightings being recorded west to north-west of the Orkney archipelago (APEM, 2013).

10.83 The sightings data assessed in Evans et al. (2011) show a cluster of white-beaked dolphin sightings at the Strathy Point and Thurso Bay land-based watch sites, which are located approximately 8 and 15 km from the Project site respectively (Figure 10-20). Sightings of white-beaked dolphins accounted for 6.3% of the cetacean records for the Pentland Firth and Orkney Waters study site. They were sighted mainly between July and September with peak numbers between June and October. These data led to white-beaked dolphins being categorised as “regular” in the area.

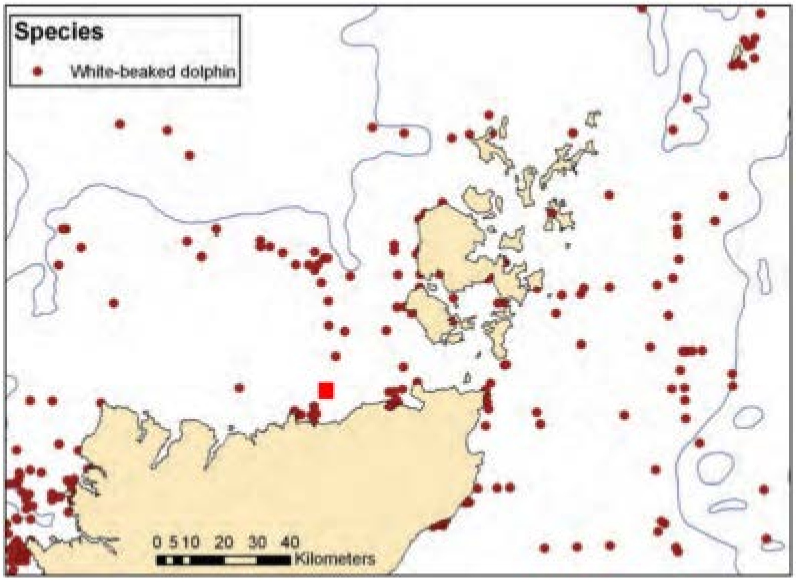

Figure 10-20 Distribution of sightings of white-beaked dolphin, 1980-2010

(Evans et al., 2011).

10.84 There were a total of 682 (95% CI 146-3,188) white-beaked dolphins estimated to be present in the SCANS II survey block J, giving a density of 0.0182 (95% CI 0.0039 - 0.0851) (Burt et al., 2006). This estimate of density is slightly lower that the peak density obtained from the APEM aerial surveys of the Pentland Firth and Orkney Waters (0.018 vs 0.038). This may be due to the timing of the survey as the SCANS II survey represents a single survey snapshot of the area from July 2005. In comparison, the APEM density estimates for July 2011 and 2012 was 0.022 and 0.0 white-beaked dolphins/km^2 respectively. As such, the July 2012 APEM density is comparable to that obtained from the SCANS II July 2005 survey.

Risso's Dolphin

10.85 In the UK, Risso's dolphins (*Grampus griseus*) are primarily observed around the West coast of Scotland, in the Hebrides. They form medium sized groups in UK waters, typically between 6 to 12 individuals and are often associated with other species including pilot whales, white-beaked, white-sided and bottlenose dolphins (Reid et al., 2003). They tend to be located in continental slope waters, mostly in depths of up to 100 m in the UK. There is no current abundance estimate for this species in UK waters (IAMMWG, 2015). In the UK, Risso's dolphins are considered to have an Unknown conservation status[15].

10.86 Risso's dolphins were the second most commonly sighted and identified species during the Dounreay aerial surveys. Risso's dolphins were only seen in the survey conducted in March 2015 where three probable sightings occurred. All Risso's dolphin sightings were located within the Dounreay Trì project site (Figure 10-6).

10.87 No Risso's dolphins were identified in any of the 14 APEM aerial surveys Pentland Firth and Orkney Waters (APEM 2013a; 2013b).

10.88 No Risso's dolphins were recorded in the SCANS II aerial surveys (Burt et al., 2006).

10.89 The sightings data assessed in Evans et al. (2011) show a cluster of Risso's dolphin sightings at the Strathy Point and Thurso land-based watch sites, which are located approximately 8 and 15 km from the Project site respectively (Figure 10-21). Sightings of Risso's dolphins account for 5.5% of the cetacean sightings records in the Pentland Firth and Orkney Waters study area, leading to them being categorised as “regular” in the area. Risso’s dolphins were sighted year round (except December) with peak numbers between June and August.

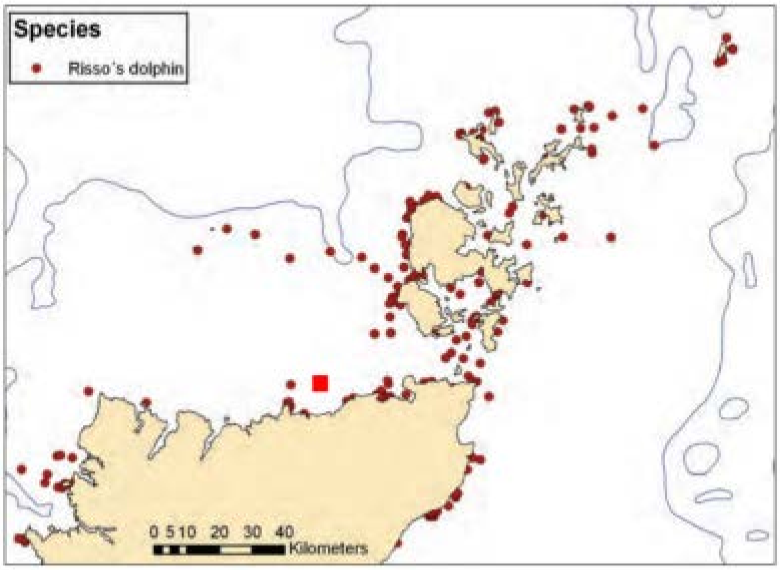

Figure 10-21 Distribution of sightings of Risso’s dolphins, 1980-2010

(Evans et al., 2011)

Bottlenose Dolphin

10.90 In Scottish waters bottlenose dolphins (*Tursiops truncatus*) are largely concentrated in two locations, the East Coast and the Hebrides where two separate resident populations occur (Cheney *et al.,* 2012). The East Coast population ranges between the Moray Firth and Fife consists of approximately 200 animals (Cheney et al., 2012; Quick et al., 2014). This population is protected by the Moray Firth SAC. The resident population in the Hebrides consists of approximately 45 individuals which form two discrete communities: one at the Sound of Barra and the other in the Inner Hebrides (Cheney et al., 2012). In the UK, bottlenose dolphins are considered to have a Favourable conservation status[15].

10.91 Intensive long term photo-ID studies on Scottish bottlenose dolphins have shown that some individual dolphins have made long-distance movements between the Hebrides and the East Coast (n=7) and there is confirmation that some individuals have made long-distance movements to Ireland (n=5) (Cheney et al., 2012). Therefore, while there is evidence of long-distance movements of dolphins between the East Coast, the Hebrides and Ireland, this is relatively rare. As such, it is not expected that bottlenose dolphins from the Moray Firth SAC are regularly present in the Pentland Firth and so are unlikely to be affected by the Dounreay Trì Project.

10.92 No bottlenose dolphins were sighted during the Dounreay aerial surveys.

10.93 No bottlenose dolphins were identified to species level during the APEM aerial surveys of the Pentland Firth and Orkney Waters (APEM 2013a, 2013b).

10.94 There were a total of 412 (95% CI 90-1,888) bottlenose dolphins estimated to be present in the SCANS II survey block J giving a density of 0.011 (95% CI 0.0024 - 0.0504) (Burt et al., 2006). However, none of the sightings during this survey were in the Pentland Firth, will all bottlenose dolphin sightings for block J being located in the Moray Firth within the Moray Firth SAC.

10.95 The sightings data assessed in Evans et al. (2011) show a cluster of bottlenose dolphin sightings at the Thurso Bay and-based watch site, approximately 15 km from the Project site, with some sightings near the Strathy Point site, approximately 8 km from the Project site (Figure 10-22). Sightings of bottlenose dolphins account for 2.2% of the cetacean sightings records in the Pentland Firth and Orkney Waters study area, with peak group sizes recorded between May and September. Photo-ID data show that at least some of the sighted animals in the Pentland Firth and Orkney Waters study area are part of the Moray Firth SAC population (Evans et al., 2011), but it is not stated which sightings these account for. For example, the Photo-ID matches could be those obtained from the Wick and Lybster shore-watch sites, which, being within the northern parts of the Moray Firth would be more likely.

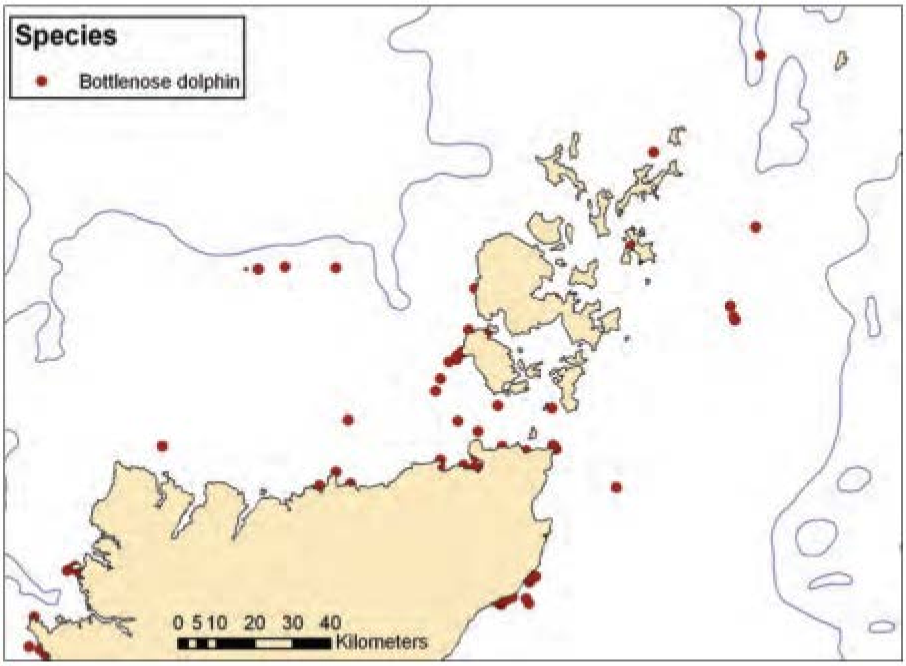

Figure 10-22 Distribution of sightings of bottlenose dolphin, 1980-2010

(Evans et al., 2011).

10.96 Evans et al. (2015) used shore based cetacean watch data with associated effort data to predict likelihood of bottlenose dolphin occurrence at watch sites around the UK. Little effort was available near the project site, with seven sites surveyed along the mainland north coast between Tongue and Dunnet Head, however, only two of these site has >100 minutes of effort for over three years. This analysis of this dataset resulted in a likelihood of bottlenose dolphin occurrence of 0 to 0.01 between Tongue and Dunnet Head (Figure 10-23). This area is clearly not important for bottlenose dolphins in comparison to the Moray Firth and along the east coast to Aberdeen where the likelihood of occurrence reaches 0.05 to 0.5 (Figure 10-23).

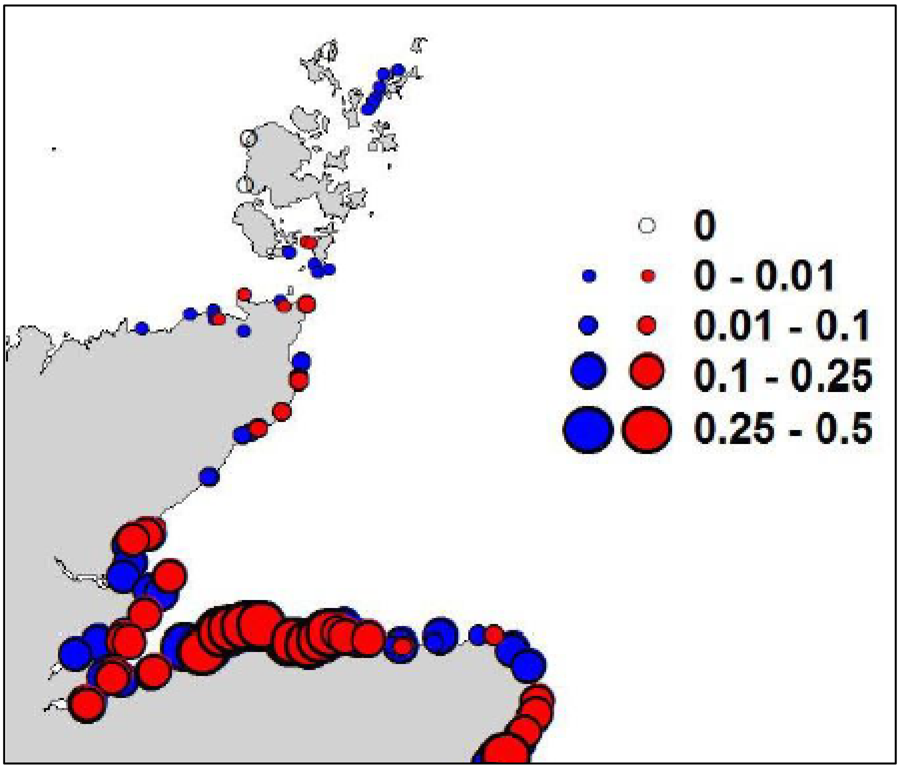

Figure 10-23 Map of GAM predicted likelihood of occurrence for bottlenose dolphins,1194-2014

(red symbols = sites with >100mins effort for 3+ years, blue symbols = remaining sites) (Evans et al., 2015).

Common Dolphin

10.97 Common dolphins (*Delphinus delphis*) are mainly found on the west coast of the UK, in the Celtic Sea and the western approaches to the Channel, with relatively few sightings recorded in the North Sea (Reid et al., 2003). They are a gregarious species and have been recorded in very large groups of hundreds of individuals. The Celtic and Greater North Sea management unit is estimated to consist of 56,556 animals, of which 13,607 (95% CI 8,720-21,234) occur in the UK EEZ (IAMMWG, 2015). In the UK, common dolphins are considered to have a Favourable conservation status[15].

10.98 No common dolphins were sighted during the Dounreay aerial surveys.

10.99 The marine mammal data obtained from the APEM aerial surveys produced images containing animals that were identified as common dolphins. They were only identified in two of the 14 surveys where one individual was counted in February/March 2012 and five individuals in December 2012/January 2013. The sightings rate of common dolphins across the whole of the Pentland Firth and Orkney Waters survey area ranged between 0 to 0.037 common dolphins/km^2 (APEM 2013b). These sightings were all located near Swona in the Pentland Firth, which is approximately 40 km from the Dounreay Trì Project area.

10.100 Common dolphins were included in the sightings data assessed in Evans et al. (2011), which shows common dolphin sightings between the Strathy Point and the Thurso land-based watch sites (Figure 10-24). The common dolphin sightings accounted for only 1.5% of the sightings records and 8.8% of the sighted individuals in the Pentland Firth and Orkney Waters study area. Sightings were recorded between May and November with largest groups recorded in

June and July. These data resulted in common dolphins being categorised as "casual visitors" to the area.

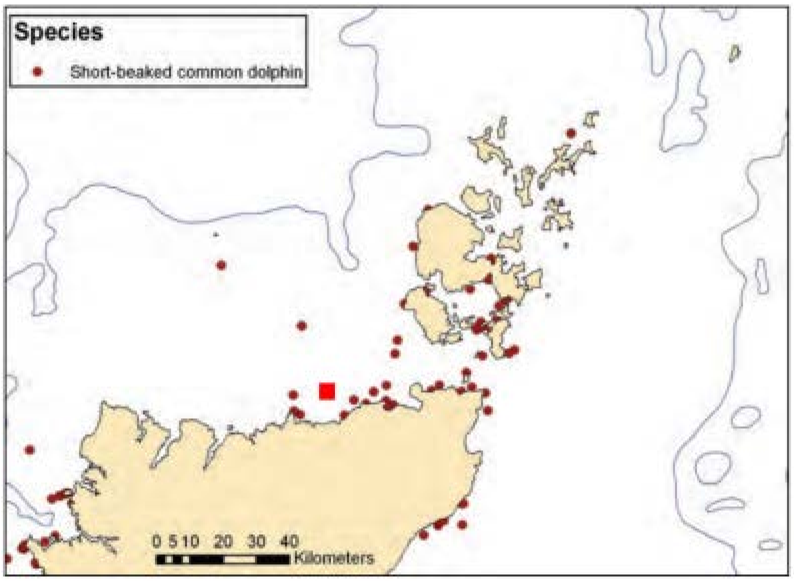

Figure 10-24 Distribution of sightings of common dolphins, 1980-2010

(Evans et al., 2011)

10.101 No common dolphins were recorded in block J during the SCANS II aerial surveys (Burt et al., 2006).

Minke Whale

10.102 Minke whales (*Balaenoptera acutorostrata*) are widely distributed around the UK, with higher densities recorded on the West coast of Scotland and the western North Sea (Reid et al., 2003). They occur mainly on the continental shelf in water depths less than 200 m and are sighted more frequently in the summer months between May and September. The abundance of minke whale sin the Celtic and Greater North Sea management unit is estimated to be 23,528 animals, of which 12,295 (95% CI 7,176-21,066) are located within the UK EEZ (IAMMWG, 2015). In the UK, minke whales are considered to have a Favourable conservation status[15].

10.103 No minke whales were sighted during the Dounreay aerial surveys.

10.104 The marine mammal count data obtained from the APEM aerial surveys produced images containing animals that were identified as minke whales. They were only identified in August 2012 when 1 individual was counted. The sightings rates of minke whales across the whole of the Pentland Firth and Orkney Waters survey area ranged between 0 to 0.011 minke whales/km^2 with an average sightings rate of 0.002 minke whales/km^2. Despite these surveys covering the entire Pentland Firth, minke whales were not recorded near the Dounreay Trì Project area, with the single sighting being located between South Ronaldsay and Muckle Skerry, approximately 50 km from the Project site (APEM, 2013).

10.105 The sightings data assessed in Evans et al. (2011) show minke whale sightings along the North Coast of mainland Scotland, with concentrations around the Strathy Point, Thurso, Stroma and Duncansby Head land-based watch sites, with a large concentration of sightings between Duncansby Head and Scapa Flow, which was covered by vessel surveys (Figure 10-25). Minke whales were the second most commonly recorded cetacean species after harbour porpoise, accounting for 12% of the records. This led to them being considered as "regular" in the

Pentland Firth and Orkney Waters study area. Sightings in the study area were only recorded between January and October with peak sightings numbers between June and August.

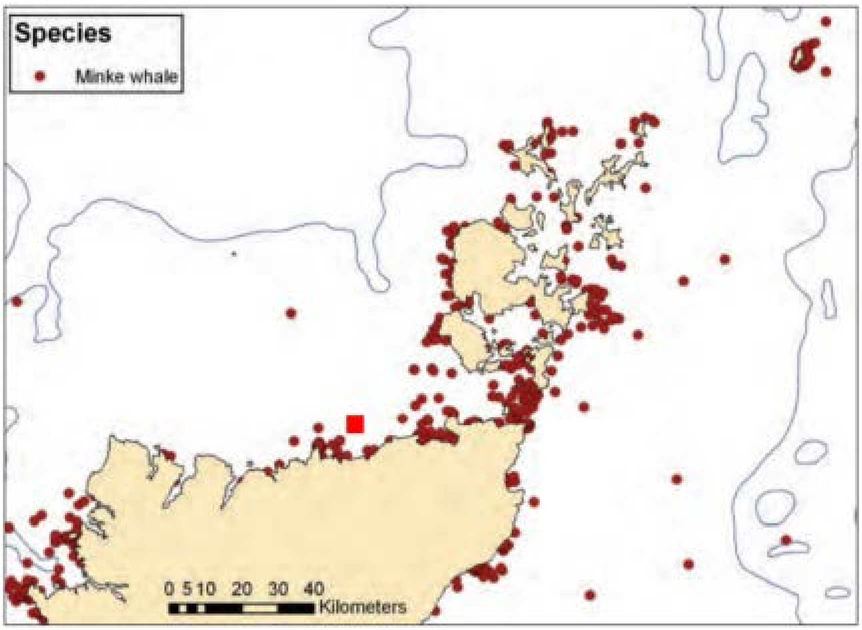

Figure 10-25 Distribution of sightings of minke whales, 1980-2010

(Evans et al., 2011)

10.106 There were a total of 835 (95% CI 155-4,498) minke whales estimated to be present in the SCANS II survey block J, giving a density of 0.0223 mike whales/km^2 (95% CI 0.0041 - 0.1200) (Burt et al., 2006). From Figure 10-26 it is apparent that the Pentland Firth does not represent an important area for minke whales in comparison to areas with considerably higher densities such as the North Sea where the density reaches up to 0.175 minke whales/km^2 (Figure 10-26).

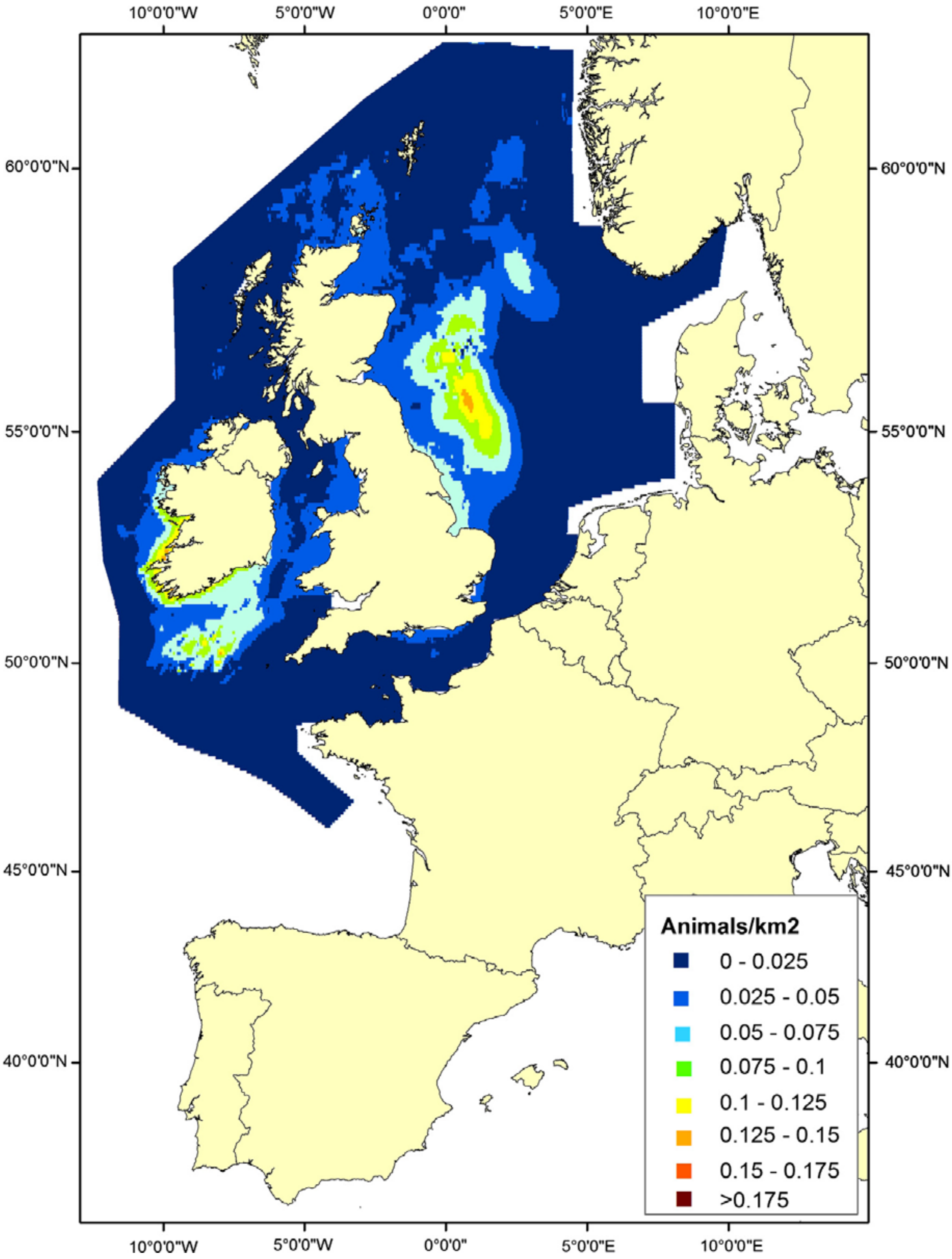

Figure 10-236 Predicted density surface for minke whales in 2005 from SCANS II data (Hammond et al., 2013).

Basking Shark

10.107 The basking shark (*Cetorhinus maximus*) is a widely distributed pelagic species found worldwide. It is the second largest fish species in the world and can grow up to ~10 m in length. In the UK they are mainly recorded off the south west coast of England and the west coast of Scotland where there are seasonal aggregations along the continental shelf area for feeding and reproduction (Witt et al., 2012; Figure 10-27). They are associated with tidal fronts on the continental shelf and shelf edge where they forage on plankton (Baxter et al., 2011). There is no current estimate for the size of the basking shark population in Scottish or UK waters.

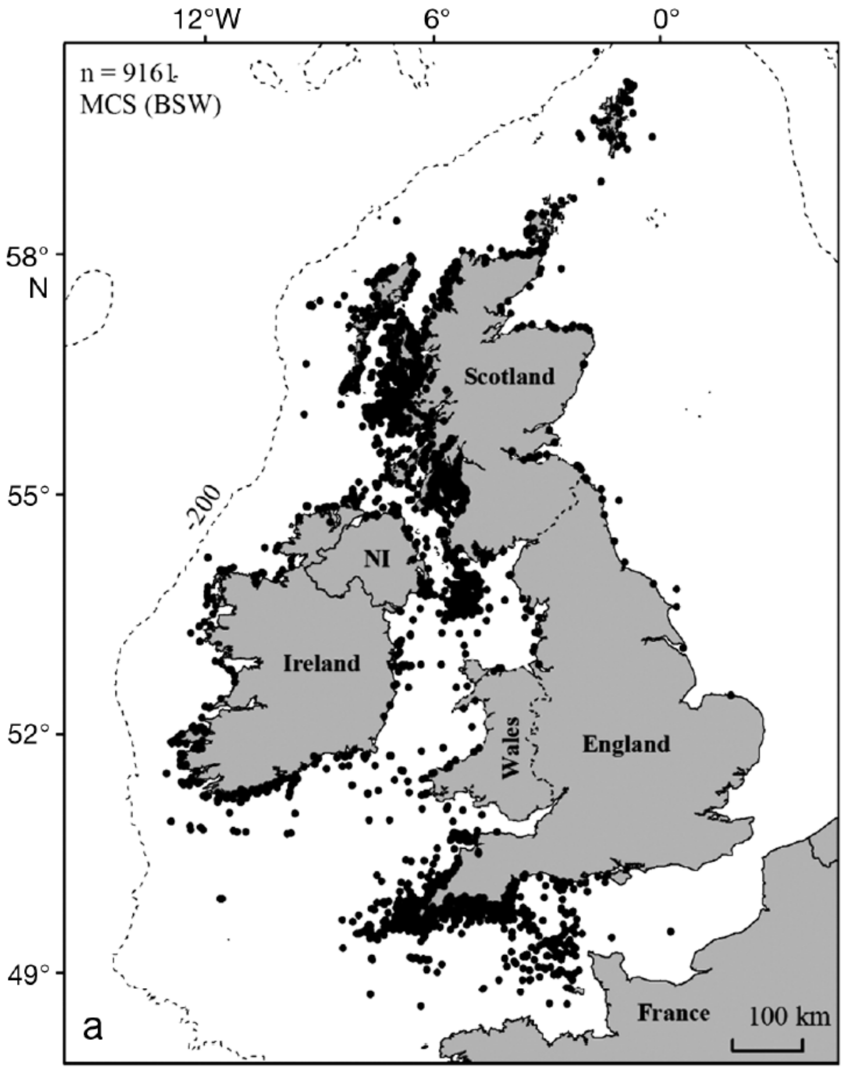

Figure 10-27 Spatial distribution of basking shark sighting records (1988 to 2008), showing the locations of all sightings records in the Basking Shark Watch database (Witt, et al., 2012).

10.108 Basking sharks are described in Evans et al. (2011) as being mainly located in British and Irish waters along the western seaboard where they make seasonal movements from the western English Channel in spring to the Hebrides and western Scottish waters where they are sighted mostly in the summer and early autumn. Basking shark sightings in North Scotland and Orkney are mostly between May and October with peak sightings records between July and September. There appears to be no particular concentration of basking sharks in the Pentland Firth area which suggests it is not a key habitat for this species (Figure 10-28).

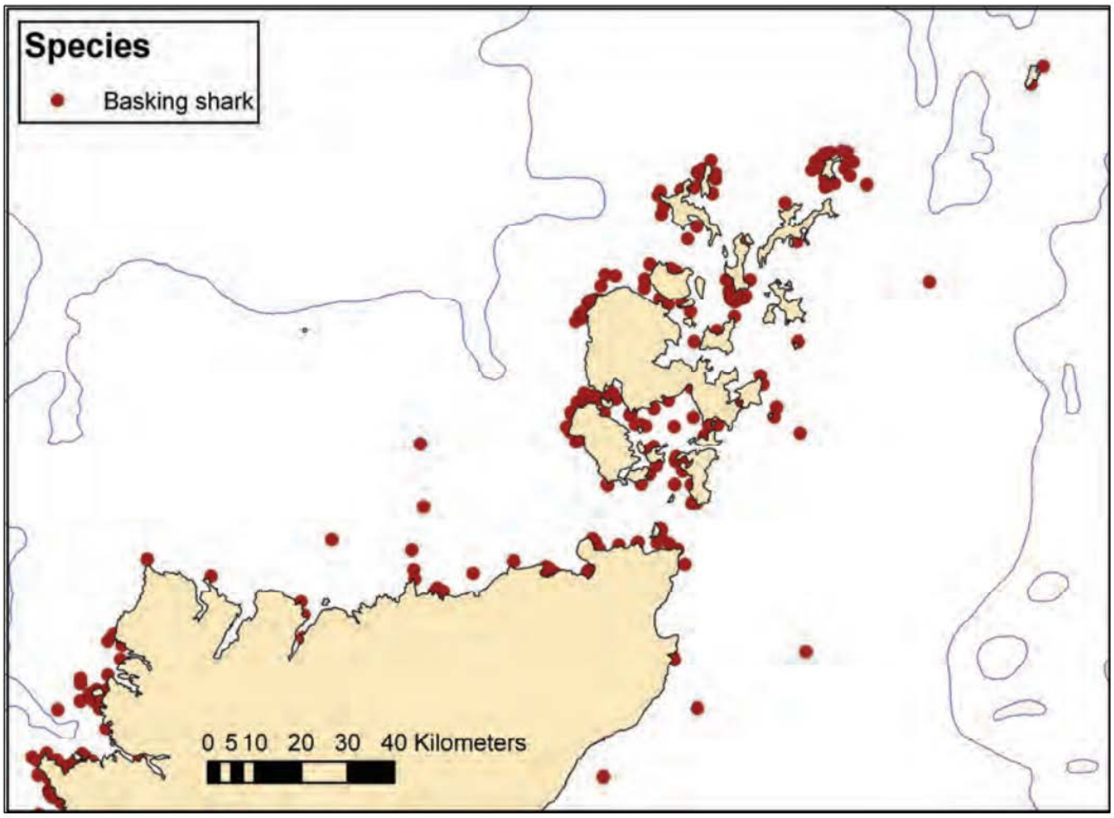

Figure 10-28 Distribution of sightings of basking shark, 1980-2010 (Evans et al., 2011).

10.109 The only shark species identified during the 14 APEM aerial surveys was a single porbeagle shark which was recorded in the near shore area between South Ronaldsay and Muckle Skerry during the October/November 2012 survey (APEM, 2013). No basking sharks were observed on any of the 14 surveys across the whole of the Pentland Firth and Orkney Waters survey area.

10.110 During marine mammal and bird surveys for the MeyGen project conducted between October 2009 and September 2011, only one basking shark was recorded in September 2010 (MeyGen Ltd., 2011).

10.111 During the site specific surveys conducted for the Brims Tidal Array, only one basking shark was recorded by the dedicated MMOs while off survey effort in August 2012 (RHDHV, 2014). The Brims Environmental Statement used basking shark density estimates from the EMEC Falls of Warness survey as a proxy for the Brims array site in the Pentland Firth. This gave a value of 0.001basking sharks/km^2 (EMEC, 2014).

10.112 The HiDef aerial surveys for marine megafauna recorded no basking shark sightings in any of the 12 surveys in 2015 across the Dounreay Project area and buffer.

Turtles

10.113 Five species of turtle have been recorded in UK waters; they are the leatherback (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), Kemp's ridley (*Lepidochelys kempii*) and green (*Chelonia mydas*) (Baxter et al., 2011). The leatherback turtle is the largest marine turtle and is the species most frequently recorded in UK waters. Leatherbacks migrate to UK waters in the summer to feed on jellyfish (Houghton et al., 2006). Most sightings and strandings of turtles occur between July and November with highest abundances in the summer which coincides with an increased jellyfish abundance (Baxter et al., 2011). There have been only three reported sightings of turtles in the Pentland Firth between 1989 and 2009 (Figure 10-28). Records state that the largest leatherback turtle recorded in Scottish waters was 8ft long and was observed inshore between Dunnet Head and Brough in 1992 (Baxter et al., 2011).

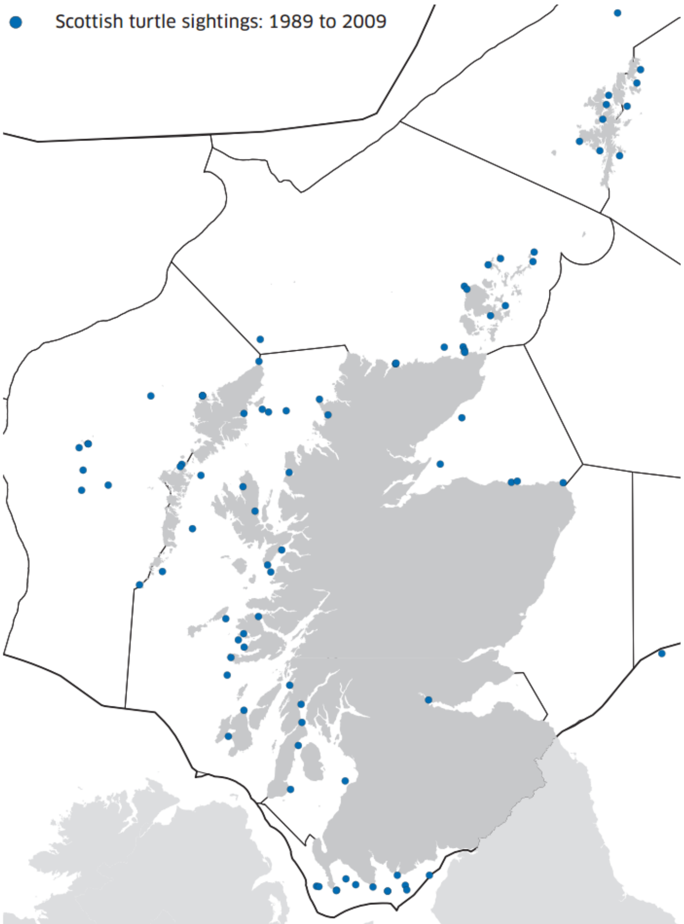

Figure 10-28 Sightings of turtles recorded in Scottish waters between 1989 and 2009 (Baxter et al., 2011 – data provided by the British Isles & Republic of Ireland 'TURTLE' database).

10.114 A report produced for the Crown Estate on the identification of cumulative and in combination effects associated with wave and tidal developments in the Pentland Firth and Orkney waters (Tarrant et al., 2011), reports records of sightings of turtles mostly to the north of Orkney during late summer and early autumn.

10.115 No turtle sightings were recorded during the 14 APEM aerial surveys across the whole of the Pentland Firth and Orkney Waters survey area.

10.116 The HiDef aerial surveys for marine megafauna recorded no turtle sightings in any of the 12 surveys in 2015 across the Dounreay Project area and buffer.

Summary of Species Not Taken Forward to the Assessment Phase

10.117 The literature review produced little evidence that common dolphins are present in the Project area in significant numbers. They were not sighted in either the Dounreay aerial surveys or the SCANS II survey and they are not considered to be regular inhabitants in the area. Therefore this species is not being taken forward for impact assessment.

10.118 The literature review produced little evidence that turtles are present in the Project area. The review found only three individual records of turtle sightings in the Pentland Firth between

1989 and 2009. None were sighted during either the Dounreay aerial surveys or the APEM aerial surveys. Therefore turtle species are not being taken forward for impact assessment for the Dounreay Trì development.

Summary of Species Taken Forward to the Assessment Phase

Grey Seal

10.119 Grey seals have been sighted in the Pentland Firth during both the Dounreay Trì and APEM aerial surveys. This, in combination with the fact that there are known grey seal haul outs along the north coast near the Project Site and that there is evidence from the telemetry data of small numbers of grey seals transiting through the Project area, grey seals were included in the following impact assessment. It should also be highlighted that there is some, albeit low, potential for connectivity between the Project site and the Faray and Holm of Faray SAC in Orkney for grey seals.

Harbour Seal

10.120 While it is highly unlikely that there is any connectivity between the harbour seal SAC at Sanday and the Project site, there is evidence that low numbers of harbour seals are present close to the Project area. There are known harbour seal haul out sites within transiting distance from the Project site and, while no telemetry tracks have crossed the Project Site, individual seals show transit to the nearby haul outs and potential foraging in the nearby area. However, based on low haul out counts, the lack of harbour seals sighted during the Dounreay aerial surveys and the low numbers sighted during the APEM aerial surveys, this is not considered to be a high density area for harbour seals. Given their presence in the area, their unfavourable conservation status and the declining population in the UK, harbour seals were included in the following impact assessment.

Harbour Porpoise

10.121 Based on shore based sightings records, harbour porpoise are the most commonly sighted cetacean species in the Pentland Firth and Orkney Waters (Evan et al., 2011), however there were relatively few sightings in the Project area during the Dounreay aerial surveys and none identified to species level in the area during the APEM aerial surveys. Given their inconspicuous surfacing behaviour, these data may reflect the difficulty of sighting harbour porpoise during aerial surveys rather than an actual absence in the area. Therefore, given that harbour porpoise were sighted in the Dounreay aerial surveys and their status as an EPS, they were included in the following impact assessment.

White-beaked Dolphin

10.122 White-beaked dolphins were the most commonly sighted species during the Dounreay aerial surveys and were present in the winter months. They have also been sighted near the Project area at shore based watch sites and during the SCANS II aerial survey during the summer which indicates they are present year round close to the Project area. This, combined with their status as an EPS, meant that white-beaked dolphins were included in the following impact assessment.

Risso's Dolphin

10.123 Risso's dolphins were the second most commonly sighted and identified species during the Dounreay aerial surveys. None were sighted in the Project area during the APEM or SCANS II aerial surveys however, shore based watch data show that they are present in the Project area year round and are considered to be a regular species in the area. This, combined with their status as an EPS, meant that white-beaked dolphins were included in the following impact assessment.

Bottlenose Dolphin

10.124 The literature review of available data on the abundance and distribution of bottlenose dolphins in the Pentland Firth and Orkney waters found that bottlenose dolphins are unlikely to be present in the Project area in high numbers. No bottlenose dolphins were sighted in either the Dounreay or APEM aerial surveys nor were they sighted in the Pentland Firth area during the SCANS II survey. However, since bottlenose dolphins have been sighted near the Strathy Point, and Thurso Bay shore based watch sites (Evans et al., 2011) and connectivity with the Moray Firth SAC population of bottlenose dolphins cannot be completely ruled out, this species was included in the following impact assessment.

Minke Whale

10.125 Minke whales were not sighted during the Dounreay aerial surveys, however they were sighted in the Pentland Firth during the APEM aerial surveys and shore watch records identify them as the second most commonly recorded cetacean species in the Pentland Firth and Orkney Waters after harbour porpoise. It has been identified in the literature that minke whales are susceptible to entanglement from renewable energy devices (Benjamins et al., 2014; see section 10.8.2.1 Collision or Entanglement with Mooring Lines for further information) and as such, they were included in this impact assessment.

Basking Shark

10.126 Basking sharks were not sighted during the Dounreay aerial surveys or during the APEM aerial surveys of the Pentland Firth. However there are a few records of basking shark sightings in the Pentland Firth and one was sighted during the MeyGen project specific surveys. It has been identified in the literature that basking sharks are susceptible to collisions with vessels and as such they are included in this impact assessment.

Identification of Potential Impacts

10.127 A number of potential impacts on marine mammals were identified in the Scoping Stage (Dounreay Trì Ltd., 2015). These were divided into those impacts which could occur during the construction, operational and decommissioning phases.

10.128 Potential impacts considered during construction:

- Impacts associated with construction noise including the risk of physiological impact, barrier effect and displacement.
- Impacts of construction noise on prey species.
- Risk of injury resulting from collision with installation vessels.
- Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity but also to any accidental release of pollutants.

10.129 Potential impacts considered during operation:

- Risk of injury resulting from collision or entanglement with mooring lines.
- Impacts of operational noise.
- Habitat exclusion resulting from the physical presence of devices occupying key foraging/breeding areas.

- Disturbance due to the physical presence of vessels and other human activity.
- Risk of injury resulting from collision with operational vessels.
- Risk associated with electromagnetic fields associated with subsea cabling.
- Long term habitat change, including the potential for change in foraging opportunities.
- Impacts associated with changes in fisheries practices.

10.130 Potential impacts considered during decommissioning phase are expected to be similar to those arising during the construction phase, and would be temporary and of short duration.

10.131 Additional to the impacts directly associated with this Project, the impact assessment will include potential cumulative impacts from the following developments: The Orkney-Caithness interconnector cable, HIE Dounreay Floating Wind Deployment Centre, Brims Tidal Array and Meygen. Potential cumulative impacts considered:

- Construction noise.
- Disturbance due to the physical presence of vessels and other human activity.
- Risk of injury resulting from collision with construction vessels.
- Impacts associated with effects upon marine water quality, particularly due to any disturbed sediments affecting turbidity but also to any accidental release of pollutants.
- Long term habitat change, including the potential for change in foraging opportunities.

10.5 Mitigation Measures

10.132 Given that piling is not being conducted as part of the construction, none of the construction activities are expected to produce significant underwater noise. The JNCC guidelines for minimising the risk of disturbance and injury to marine mammals only require implementation in the event of seismic surveys, pile driving or underwater explosives (JNCC, 2010a, 2010b, 2010c). As none of these activities will occur during the construction of this project, no marine mammal monitoring mitigation is required.

10.133 The construction, commissioning, operation and decommissioning of the Project will involve an increase in the number of vessels in the offshore Project area. It is recommended that a vessel management plan is put in place in order to minimise any potential impacts of vessels on marine mammals and basking sharks. These potential impacts include disturbance due to vessel noise and collisions with the vessels themselves. A vessel management plan should include the designation of a navigational route for vessel traffic to ensure that vessel movement is as predictable as possible. It is also recommended that vessel speeds are limited to less than 10 knots in order to reduce the risk of vessel collisions. This approach has been successful in reducing ship strike rates for larger whale species (e.g. Laist et al., 2014; Vanderlaan & Taggart, 2007; Conn & Silber, 2013). Protocols should also be put in place should marine mammals or basking sharks approach the vessels, which ensure that the direction and speed of the vessel is maintained as far as possible and any sudden changes in course or speed is avoided. These procedures will help to minimise disturbance and injury to marine mammals and basking sharks as a result of the increased vessel traffic in the Project area.

10.6 Impact Assessment - Construction Phase

Construction Noise

10.134 The main mechanism by which offshore wind farm construction activities impact marine mammals is through the noise created during impact piling. The potential risk of injury and/or disturbance to marine mammals during piling activities has been identified as a key risk, however, this impact pathway is not relevant to this Project. No piling is planned during the construction of this Project as drag anchors will be used to moor the structure.

10.135 The specific construction activities at the Project include: dragging of the anchors, dredging of the seabed to the bedrock in the area under the platform, ploughing to install the export cable (though jetting or vertical injection is under consideration) and burial of the export cable by flexible concrete mattresses or buried beneath stones. These activities are of very short duration. The laying of the export cable and the positioning of the mooring arrangement is expected to be conducted within 1 week each (Table 10-2). The installation and commissioning of the offshore platform, anchors and export cable is expected to be completed within two to three months.

10.136 The vessels that will be used for the construction and commissioning of the platform, mooring system and export cable are outlined in Table 10-3. Information on the sound produced by the specific vessels and construction activities for this Project are not available, however, parallels can be drawn from similar projects and vessels. Xodus (2014) conducted noise modelling for construction vessels at the Hywind Pilot Park development, and assessed the onset of injury from vessel types. This assessment included a cable laying vessel and an anchor handling vessel, both of which will be used for the construction of this Project.

Table 10-7 Calculated effects of continuous vessel/construction noise at the Hywind Pilot Park (Xodus, 2014).

Vessel	Radius of potential injury zone[a]				Radius of potential disturbance zone[b]
	Low Frequency	Mid Frequency	High Frequency	Pinnipeds	
Anchor handling tug[c]	< 5 m	< 5 m	< 5 m	15 m	750 m
Cable lay[d]	25 m	15 m	12 m	50 m	5 km

a) assuming continuous exposure within that radius over a 24 hour period
b) based on conservative 120 dB re 1 μPa (rms) criterion
c) Data source: tug used as proxy (Richardson, 1995)
d) Data source: 'Gerardus Mercator' trailer hopper suction dredger using DP as proxy (Wyatt, 2008)

10.137 The modelling for the Hywind Pilot Park vessel and construction noise concludes that the noise produced would not reach levels that would cause fatal injury to any marine mammal species. The noise modelling showed that cetaceans would have to remain within 5 m and pinnipeds within 15 m of the anchor handling vessel (and within 50 m of the cable lay vessel) for 24 hours in order to experience injury (Table 10-7). This scenario is extremely unlikely and it is far more likely that any marine mammal within the injury zone would move away from the vicinity of the vessel. This is supported by the fact that the offshore Project area is not considered to be an area of key importance for any marine mammal species and so there is no motivation for them to remain for any prolonged periods of time within a range that would result in injury.

10.138 Animals are predicted to be disturbed out to 750 m from the anchor handling vessels and up to 5 km from the cable lay vessel (Table 10-7). However, Xodus (2014) did note that the potential disturbance ranges were calculated using the 120 dB re 1 µPa (rms) criteria which was very precautionary and that ambient noise levels could exceed this value. Given that the desktop review found no evidence that the offshore Project site is important to marine mammals, any potential disturbance of animals that leads to changes in their behaviour by moving out of the disturbance zone is not expected to have any significant impact on foraging success or vital rates. In addition to this, the impact will be of very short duration and so unlikely to have any significant lasting impacts on the population.

10.139 Given the lack of piling activities, the spatial extent and severity of construction noise is likely negligible based on the data provided for similar vessels and construction activities from the Hywind Pilot Park development (Xodus, 2014) and the short duration of the export cable laying and anchor positioning activities. Therefore, construction noise is likely to have a **Negligible** magnitude of effect on any marine mammal species or basking sharks.

10.140 All cetacean species assessed have an assessed value of high due to their Favourable conservation status and stable or increasing population, and the lack of evidence of connectivity with an SAC population (where applicable). Given that the offshore construction area is not considered to be of key importance for any cetacean species there is no motivation for them to remain in the area of injury for any prolonged periods of time that would result in injury. Their mobility and lack of motivation to remain in the area means they are assessed as having high levels of adaptability to the impact. This results in an overall vulnerability score of **Low**. Therefore the assessed impact of construction noise on cetaceans is of **Negligible Significance**.

10.141 Grey seals are present in and near the offshore construction area, however, there is evidence from the available telemetry data that this area does not represent an import habitat for either foraging or haul out. It is likely that a small number of grey seals may transit through the construction area during the time of construction, but they are not expected to remain in the vicinity of the vessels and the construction noise sources for sufficient time to have any effect on them. Therefore, the vulnerability score for grey seals is assessed as **Low**, giving an assessed impact of construction noise on grey seal of **Negligible Significance**.

10.142 Harbour seals are present near the offshore construction area, with evidence from the available telemetry data and haul out counts that a very small number of harbour seals may be present near to the export cable area. Given that the most recent counts of harbour seals at the two haul out sites near the export cable were extremely low (1 seal counted at each site), combined with the lack of telemetry or usage data at or near the offshore project construction area, there are likely to be very few harbour seals exposed to the impact. However, given the declining population in the North Coast and Orkney areas, the species is highly vulnerable to any impacts that could affect behaviour and vital rates. This includes any potential behavioural disturbance that affects their haul out behaviour and so the vulnerability of harbour seals is assessed as **Medium**. The overall assessed impact of construction noise on harbour seals is of **Minor Significance**.

10.143 There is currently no literature concerning the sensitivity of basking sharks to underwater noise. It has been stated that basking sharks feeding at the water surface seem “immune” to the approach of vessels while younger sharks show more of a reaction (Speedie et al., 2009). A study on basking shark disturbance concluded that engine noise and angle of approach had little effect on basking shark behaviour (Wilson, 2000). Given the uncertainty on basking shark underwater hearing the vulnerability of basking sharks to disturbance from underwater noise is assessed as **Low**. The overall assessed impact of construction noise on basking sharks is of **Negligible Significance**.

Collision Injury

10.144 Increased vessel traffic in the Project area can result in an increase in the potential for physical trauma and death of marine mammals as a consequence of collisions with vessels. The offshore Project area (the offshore Site, the export cable corridor and the surrounding waters), will experience a marginal increase in vessel traffic (Dounreay Trì Ltd, 2015), with a maximum of up to 6 vessels expected to be in use at any one time (Table 10-3). The vessels that will be operated in the Project area for the purposes of construction and commissioning are outlined in Table 10-2 and will be present in the Project area for a maximum of 2-3 months in total, however the amount of time each vessel type will be in operation is very limited (3 days to up to 1 month).

10.145 There is limited evidence to suggest ship strike is a significant cause of mortality for any of the marine mammals species present in the Project area. None of the 60 post mortem examinations of stranded harbour porpoise UK wide in 2014 attributed ship strike as the cause of death (CSIP, 2015). Physical trauma by boat/ship strike was only attributed as the cause of death for 1 common dolphin (out of the 16 examined at post mortem) and 1 sperm whale (out of the 3 examined at post mortem) for stranded animals UK wide in 2014 (CSIP, 2015).

10.146 A study of shipping activity in the Pentland Firth and Orkney Waters (Anatec Ltd & Halcrow, 2012) found that there are large numbers of vessels that use Scrabster Harbour, with vessel numbers peaking in the summer. These vessels mainly consisted of merchant vessels including cargo, offshore and tanker vessels (80-85%). Based on data from AIS tracks in the summer of 2012, the Project area experiences a ship density of 3-6 ships per 1 nm^2 grid cell, and is located on the edge of the main Pentland Firth shipping channel which experiences >21 ships per 1 nm^2 grid cell (Figure 10-29). Therefore, it is not considered that the presence of the construction and commissioning vessels will present a significant additional risk to any marine mammal species above the normal vessel and shipping activities in the area.

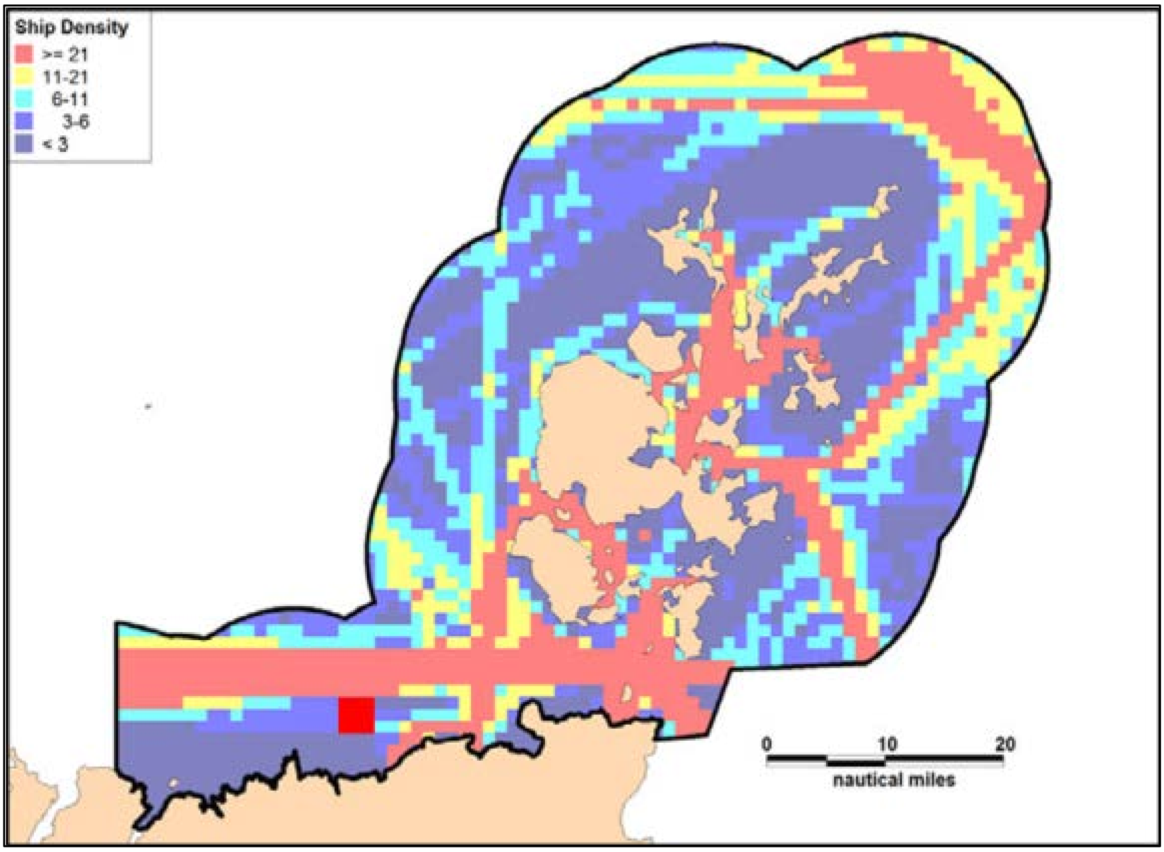

Figure 10-249 Summer 2012 AIS Track Analysis by Overall Ship Density

(Anatec Ltd & Halcrow, 2012).

10.147 With the implementation of a vessel management plan that limits the vessel speeds and designates a navigational route for vessel traffic, any potential for collisions should be minimised. Therefore, the negligible likelihood of a ship strike occurring gives the magnitude of the impact a score of **Negligible** for all assessed marine mammal species and basking sharks. Cetaceans and grey seals are assessed as having a **Low** vulnerability overall because of their favourable conservation status and population stability. Harbour seals are assessed as having a **Medium** vulnerability due to their due to their unfavourable conservation status and declining population. The vulnerability of basking sharks is assessed as **Medium** given that they are slow moving, swim close to the surface and show a lack of response to moving vessels during feeding and courtship-like behaviours (Speedie et al., 2009). This results in the impact having **Negligible Significance** on grey seals and all cetacean species and an overall impact assessment for harbour seals and basking sharks of **Minor Significance**.

10.148 There have been previous concerns that ducted propeller vessels were potentially causing fatal “corkscrew” injuries in both harbour and grey seals, characterised by a single smooth-edged, deep laceration starting at the head and spiralling around the body (Thompson et al., 2010; Bexton et al., 2012; Thompson et al., 2013). In 2015 a SMRU report was released detailing evidence of observed adult male grey seal cannibalism on grey seal pups causing wounds that “clearly resembled” corkscrew wounds (Thompson et al., 2015). As such, at least a proportion of the previous corkscrew seal cases are likely due to grey seal predation rather than as a result of interactions with vessel propellers; though it is premature to assume that propeller interactions were not responsible for any of the previous corkscrew injuries (Thompson et al., 2015).

10.149 Based on the latest information it is considered very likely that the use of vessels with ducted propellers may not pose any increased risk to seals over and above normal shipping activities and therefore mitigation measures and monitoring may not be necessary in this regard, although all possible care should be taken in the vicinity of major seal breeding and haul-out sites to avoid collisions. Given that corkscrew seal injuries as a result of vessel propeller interactions are unlikely to occur frequently and the data do not suggest that the Project area is an important area for grey seals the magnitude is assessed as **Negligible**. Grey seals are assessed as having a **Low** vulnerability as the UK population has a favourable population status. This combines to provide an overall assessment for corkscrew injury to grey seals as **Negligible Significance**.

10.150 For harbour seals, the magnitude is assessed as **Negligible** as the expected frequency of corkscrew injuries due to propeller interaction is negligible and the data suggest a low number of harbour seals hauled out along the North coast. Given that the UK harbour seal population is an EU protected species that is known to be in decline and is categorised as having an unfavourable conservation status, the vulnerability of harbour seals is assessed as **Medium**. This combines to provide an overall impact assessment for corkscrew injury to harbour seals as **Minor Significance**.

Water Quality

10.151 Disturbance to the water quality can have both direct and indirect impacts on marine mammals. Direct impacts include the impairment of visibility and therefore foraging ability, therefore reducing foraging success. Indirect impacts include a reduction in prey species and the potential introduction of contaminants into the environment as a result of disturbed sediment which could accumulate in marine mammals if they were to consume contaminated prey.

10.152 The water quality at the Project site may be impacted by the installation of the anchors and the export cable as well as during dredging activities as these activities could cause an increase in the suspended sediment. Chapter 8: Benthic and Shellfish Ecology assesses the impact of increased suspended sediment from the installation of the subsea infrastructure. This impact was assessed as Negligible as suspended sediment and turbidity is normal in this habitat.

10.153 Marine mammals are well known to forage in tidal areas where water conditions will be turbid and visibility conditions poor. Harbour porpoise and harbour seals in the UK have been documented foraging in areas with high tidal flows (e.g. Pierpoint, 2008; Marubini et al., 2009; Hastie et al., 2014), therefore low light levels, turbid waters and suspended sediments are unlikely to negatively impact marine mammal foraging success. When the visual sensory systems of marine mammals are comprised, they are able to sense the environment in other ways, for example, seals can detect water movements and hydrodynamic trails with their mystacial vibrissae (whiskers); while odontocetes (toothed cetaceans including dolphins and porpoise) can use echolocation (e.g. Hanke & Dehnhardt, 2013).

10.154 Given that the effect of increased suspended sediment was assessed as negligible, and the area is not known to be an important marine mammal or basking shark foraging area, the magnitude of impact on all assessed marine mammal species and basking sharks is considered to be **Negligible**. All assessed cetacean species, both grey and harbour seals and basking sharks are considered to be of **Low** vulnerability to this impact given that they are known to forage in areas of high tidal energy with poor visibility and so are likely to be able to adapt to and tolerate any temporary suspended sediment in the water column. Therefore, the impact of increased suspended sediment during construction is assessed as **Negligible Significance** for all assessed marine mammal species and basking sharks.

10.155 Water quality at the Project may also be impacted by the release of contaminants as a result of the construction and installation activities. Chapter 8: Benthic and Shellfish Ecology identifies a potential impact pathway as the result of the disturbance of radioactive particles that were discharged from the Dounreay Nuclear Facility in the 1960s and 70s. This was assessed as having a **Negligible** magnitude of impact as the particles are likely to be in extremely low numbers. However, given the fact that marine mammals, as top predators, can bioaccumulate contaminants, including radionuclides (e.g. Yoshitome, et al., 2003; Ciesielski et al., 2015), they have been assigned a vulnerability of **Low** rather than Negligible. Therefore, the impact of the release of contaminants is assessed as **Negligible Significance** for all assessed marine mammal species. As basking sharks are filter feeding planktivores, bioaccumulation of contaminants is less likely and so they are assessed as having **Negligible** vulnerability and a **Negligible Significance** of impact overall.

Indirect Impacts: Changes in Prey Availability

10.156 The benthic ecology impacts are expected to be localised around the infrastructure placed on the seabed within the Site and the export cable corridor, and no significant impacts on benthic and shellfish ecology are expected to occur during construction (Chapter 8: Benthic and Shellfish Ecology). Any impacts to the benthic ecology are likely to be small and localised; therefore it is anticipated that there will be no indirect impacts to marine mammals through changes in prey availability as a result of changes in the benthic habitat as a result of construction noise. This results in the Magnitude being categorised as **Negligible**.

10.157 Chapter 9: Fish Ecology assessed the overall significance of construction noise on fish species to be of Negligible Significance. There is no evidence to suggest that the Project area should be considered an important foraging area for marine mammals of any species. This, alongside the negligible impact on fish ecology means that the indirect impact to marine mammals is expected to be negligible. This results in the Magnitude being categorised as **Negligible.**

10.158 The vulnerability is categorised as **Negligible** for all species as, despite any differences in population size, conservation status or EPS classification, there is no evidence that the Project area is an important foraging area for any of the assessed marine mammal species or basking sharks, meaning they are likely to be able to adapt to, tolerate and recover from any change in prey availability. This results in an overall impact of **Negligible Significance** for all assessed marine mammal species and basking sharks as a result of changes in prey availability.

Summary of Impacts in the Construction Phase

10.159 The impact assessment has concluded that all construction phase impacts have a Negligible to Minor significance of impact on marine mammals and basking sharks, when a vessel management plan is implemented (Table 10-8). Therefore, the only mitigation measure required is a vessel management plan to minimise collision risk and disturbance to marine mammals and basking sharks.

Summary of Impacts in the Construction Phase

10.160 The impact assessment has concluded that all construction phase impacts have a Negligible to Minor significance of impact on marine mammals and basking sharks, when a vessel management plan is implemented (Table 10-8). Therefore, the only mitigation measure required is a vessel management plan to minimise collision risk and disturbance to marine mammals and basking sharks.

Table 10-8 Summary of the significance of construction phase impacts on marine mammal and basking shark receptors.

		Magnitude	Vulnerability	Impact Significance
Construction Noise	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Risso's dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
	Basking shark	Negligible	Low	Negligible
Collision Injury	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Risso's dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
	Basking shark	Negligible	Medium	Minor
Water Quality (sediment)	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Low	Negligible
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Risso's dolphin	Negligible	Low	Negligible

		Magnitude	Vulnerability	Impact Significance
	Minke whale	Negligible	Low	Negligible
	Basking shark	Negligible	Low	Negligible
Water Quality (contaminants)	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Low	Negligible
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Risso's dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
	Basking shark	Negligible	Negligible	Negligible
Indirect Impacts (prey species)	Grey seal	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Negligible	Negligible

10.7 Impact Assessment - Operational Phase

Collision or Entanglement with Mooring Lines

10.161 Entanglement is defined as the unintentional capture or restraint of marine animals by strong, flexible anthropogenic materials, specifically referring to stationary ropes, lines or cables (Benjamins, et al., 2014). Marine mammals and basking sharks may become entangled with stationary ropes, lines or cables (collectively referred to here as "ropes") because a) they are unable to detect the rope, b) they do not perceive the rope as a threat or c) they deliberately encounter the rope (Benjamins et al., 2014). The visual systems of marine mammals may be compromised due to environmental conditions such as low light levels, high turbidity or high levels of suspended sediment, which decreases the animals' ability to detect the ropes, thus increasing their entanglement risk. Entanglements can occur if an animal is attracted to the vicinity of the ropes due to the anthropogenic structures acting as artificial reef structures providing novel foraging opportunities.

10.162 Baleen whales, such as minke whales, are known to become entangled in various subsea structures, whereas smaller cetaceans, such as dolphins and porpoise, tend to be more vulnerable to bycatch in nets rather than entanglement due to their smaller size (Benjamins et al., 2014). Entanglement associated mortality accounts for approximately half of all reported baleen whale strandings in Scotland (Northridge *et al*., 2010), with creel fisheries identified as the cause in many of these cases. The inability of larger whales such as baleen whales to flex their body means they have limited manoeuvrability to enable them to escape entanglement situations.

10.163 Basking sharks have previously been recorded entangled in ropes associated with stationary gears and have stranded entangled in ropes. Benjamins et al. (2014) assessed basking sharks as being particularly vulnerable to entanglement because they forage by swimming with their mouths open, which means they are at risk of becoming entangled across the mouth. However, in comparison to large whales, basking sharks were considered to have better flexibility and manoeuvrability to avoid entanglements at close range (Benjamins et al., 2014).

10.164 The mooring lines associated with the Project structure consist of up to six vertical clump lines, and six catenary lines.

10.165 The vertical clump mooring lines are attached to the floating turbine structure and the clump weights. They will each be 48 m in length and present in the water column at depths between ~14 m and ~72 m. They will consist of stud-less steel chains, providing a diameter of ~120 mm each and an overall mooring line diameter of ~0.4 m. There is the option of the vertical clump mooring lines to consist of sheathed spiral strand wire made up of steel stranded ropes with a plastic sheathing. The diameter of these optional lines are expected to be ~92 mm. The vertical clump lines will be permanently taut (under tension) and so neither design type poses an entanglement risk for marine mammals or basking sharks.

10.166 The magnitude and vulnerability for all marine mammal species and basking sharks as a result of direct entanglement with the vertical clump mooring lines is assessed as **Negligible** due to the extremely unlikely probability of any marine mammal becoming entangled in a permanently taut line. This provides an overall impact of **Negligible Significance** for all assessed marine mammal species and basking sharks for direct entanglement with the vertical clump mooring lines.

10.167 The catenary mooring lines attach the clump weight to the seabed. They will be present in depths between ~72 m and the seabed at ~84 m and will be anchored to the seabed approximately 480 m from the centre of the structure. Each catenary mooring line will be 478.7 m in length, consisting of stud-less steel chains, with a diameter of ~120 mm. The catenary mooring lines will be taught to semi-taut and so have the potential to pose more of an entanglement risk for marine mammals and basking sharks.

10.168 Given the flexibility and manoeuvrability of seals, dolphins and porpoise, and the lack of any evidence that they are susceptible to direct entanglement with lines similar to the catenary lines used in this Project design, the magnitude and vulnerability for these species is assessed as **Negligible**. This provides an overall impact of **Negligible Significance** for dolphins, harbour porpoise and both seal species for direct entanglement with the catenary mooring lines.

10.169 The low numbers of minke whales in the Pentland Firth and at the Project site, combined with the extremely low probabilities of an entanglement event occurring (due to the catenary lines being taut-semi taut and extremely unlikely to produce loops which would entangle a minke whale) and the small spatial extent of the Project results in an overall magnitude score of **Negligible**. The consequence of entanglement with a static line can be fatal (as it can result in drowning, infection, tissue damage and emaciation), however, given low densities of minke whales present in the Project area and the fact that the population is stable and has a Favourable conservation status, they are assessed as having **Medium** vulnerability. This is in line with the assessment conducted by Benjamins et al. (2014) which found that smaller baleen whales had a moderate relative risk of entanglement with catenary and chain lines in comparison to other larger baleen whale species; concluding overall that baleen whales have the greatest relative risk compared with other marine mega fauna due to their size and foraging habitats. The overall impact assessment for entanglement with catenary mooring lines is of **Minor Significance** for minke whales.

10.170 The low numbers of basking sharks in the Pentland Firth and at the Project site, combined with the extremely low probabilities of an entanglement event occurring (due to the catenary lines being taut-semi taut and extremely unlikely to produce loops which would entangle a basking shark) and the small spatial extent of the Project results in an overall magnitude score of Negligible. Basking sharks were assessed by Benjamins et al. (2014) as having a moderate entanglement risk with catenary and chain lines compared to other marine megafauna species due to their large size, ability to detect objects underwater and foraging style. While basking shark entanglements could potentially be fatal, the low densities of basking sharks in the Project area in combination with a lack of evidence for it being a foraging area for this species means that they are assessed as having Medium vulnerability. The overall impact assessment for entanglement with catenary mooring lines is of **Minor Significance** for basking sharks.

10.171 There is also the possibility that indirect entanglement can occur. This could take place if other anthropogenic ropes or lines, such as lost/derelict fishing gear, were to become attached to the mooring lines. These smaller ropes and lines could present a higher entanglement risk than the mooring lines themselves. Therefore, secondary, or indirect entanglement could occur. The extent of this "ghost fishing" varies with fishery type, and it has been assessed that deep water gillnet fisheries cause the highest levels of ghost fishing in European waters (Brown et al., 2005). Given that the primary fishing type in the Pentland Firth and Orkney waters is creel fishing (>80%; Marine Scotland, 2012), it is highly unlikely that ghost fishing would be an issue in the Project area. Therefore, this will not change the magnitude or vulnerability of the entanglement assessments above.

10.172 There is no literature concerning the sensitivity of basking sharks to underwater noise. It has been stated that basking sharks feeding at the water surface seem "immune" to the approach of vessels while younger sharks show more of a reaction (Speedie et al., 2009). Given the uncertainty on basking shark underwater hearing sensitivity, the vulnerability of basking sharks to disturbance from underwater noise is assessed as **Low**. The overall assessed impact of operational noise on basking sharks is of **Negligible Significance**.

Operational Noise

10.173 Operational noise is likely to be associated with noise generated by the operating wind turbine units, movement of the mooring lines and the presence of vessels for maintenance activities. The level of underwater noise generated by the operating Hexicon Dounreay Trì device is unknown, however, parallels can be drawn from other floating wind devices. Underwater noise monitoring of the 2.3 MW Hywind I device by Fugro GEOS and JASCO (Xodus Group, 2013) showed that it produced tonal noise at a frequency of 25 Hz with harmonics, with an estimated source SPL and SEL of 162 dB re 1 µPa (rms) and 212 dB re 1 $\mu Pa^2 s$ at 1 m respectively. This provided a calculated potential zone of disturbance for marine mammals of approximately 10 – 15 m radius around each turbine.

10.174 Based on these data, the Hywind Environmental Statement (Statoil, 2015) assessed the number of marine mammals that could potentially experience behavioural disturbance as a result of the deployment of the Hywind Scotland Pilot Park. Using the density estimates and the size of the behavioural disturbance zone, it was predicted that less than one animal of each species would be in the behavioural disturbance zone at any one time. Given that the Hywind Scotland Pilot Park will consist of five turbines, compared to the two turbines at the Dounreay Trì Project, the effect magnitude of operational noise causing behavioural disturbance is **Negligible** due to the low densities of marine mammals in the Project area. Given that the Dounreay Trì Project site has not been identified as an important foraging area for any species of marine mammal, it is expected that behavioural disturbance at such a short range is highly unlikely to cause any change in behaviour other than potential movement out of the area. It is expected that animals would return to previous behavioural states/activities almost immediately, resulting in no changes in fitness, survival or reproductive rates. There is also evidence that both grey and harbour seals target offshore windfarm turbine structures for foraging (Russell et al., 2014), which suggests that the operational noise of the turbines is unlikely to disturb marine mammals. Therefore the vulnerability of all marine mammal species is assessed as **Negligible**. This results in an overall impact assessment of **Negligible Significance** for all assessed marine mammal species.

Disturbance from Vessels

10.175 Data presented in the Project Scoping Report (Dounreay Trì Ltd, 2015) and a shipping study report for the Pentland Firth and Orkney Waters (Anatec Limited & Halcrow, 2012) show fishing and shipping vessels are present in the Pentland Firth. Based on data from AIS tracks in the summer of 2012, the Project area experiences a ship density of 3-6 ships per 1 nm^2 grid cell, and is located on the edge of the main Pentland Firth shipping channel which experiences >21 ships per 1 nm^2 grid cell (Figure 10-29).

10.176 The Project will require ongoing inspections and maintenance throughout the Operational phase. Preventative maintenance will be conducted using crew vessels (unless specialised vessels are required for specific types of breakdowns). As stated in Chapter 4: Project Description, "it is expected that on average up to eight visits per turbine, per year will be required for fault rectification and up to three per turbine, per year for major component replacement (these figures may vary significantly from year to year)".

10.177 Information on the sound produced by the specific operation and maintenance crew vessels for this Project are not available, however, parallels can be drawn from similar projects and vessels. Xodus (2014) conducted noise modelling for small survey, inspection and crew vessels during the operation and maintenance phase of the Hywind Pilot Park development. These data showed that maintenance vessels are extremely unlikely to cause physical injury to marine mammals as cetaceans and seals would have to stay in the impact radius of 5 m and 15 m respectively for 24 hours before injury were to occur (Table 10-9).

10.178 Animals are predicted to be disturbed out to 750 m from the survey vessel (Table 10-9). Given that the desktop review found no evidence that the offshore Project site is important to marine mammals, any potential disturbance of animals that leads to them changing their behaviour by moving out of the disturbance radius is not expected to have any significant impact on foraging success or vital rates.

Table 10-9 Calculated effects of continuous operation/maintenance vessel noise at the Hywind Pilot Park (Xodus, 2014).

Vessel	Radius of potential injury zone[a]				Radius of potential disturbance zone[b]
	Low Frequency	Mid Frequency	High Frequency	Pinnipeds	
Survey Vessel[c]	< 5 m	< 5 m	< 5 m	15 m	750 m

a) assuming continuous exposure within that radius over a 24 hour period
b) based on conservative 120 dB re 1 µPa (rms) criterion
c) Data source: tug used as proxy (Richardson, 1995)

10.179 Due to the small number of expected maintenance trips (8 per year) and type of vessels associated with the operation and maintenance of the Project, it is not considered that they will present any additional risk of disturbance to any marine mammal species or basking sharks above the normal effects of vessel and shipping activities in the area. This results in both the Magnitude and the Vulnerability being categorised as **Negligible**, providing an overall impact of **Negligible Significance** for all assessed marine mammal species and basking sharks as a result of disturbance due to operational vessel traffic.

Vessel Collisions

10.180 The maintenance vessel traffic in the Project area will be infrequent (estimated 8 trips per year) and predictable in nature and will likely only involve the addition of vessels to the Project area (with the exception of major component replacements; see Chapter 4: Project Description). Therefore, the assessment of vessel collision impacts on marine mammals in the operational phase is expected to be similar to or less than the impact predicted during the construction phase. If a vessel management plan is implemented that limits the speed of vessels and designates a navigational route for vessel traffic, any potential for collisions should be minimised. Therefore, the negligible likelihood of a ship strike occurring results in **Negligible** magnitude for all assessed marine mammal species and basking sharks. Given their favourable conservation status, population stability and low densities in the area, all cetaceans and grey seals are assessed as having a **Low** vulnerability and an overall impact assessment of **Negligible Significance** if a vessel management plan is in place. Harbour seals are assessed as having a **Medium** vulnerability due to their due to their unfavourable conservation status and declining population. The vulnerability of basking sharks is assessed as **Medium** given that they are slow moving, swim close to the surface and show a lack of response to moving vessels during feeding and courtship-like behaviours (Speedie et al., 2009). If a vessel management plan is in place to minimise the risk of collisions then this impact is scored as having **Minor Significance** for harbour seals and basking sharks.

Electromagnetic Fields

10.181 Based on the data available to date, there is no evidence of electromagnetic fields (EMF) related to marine renewable devices having any impact (either positive or negative) on marine mammals (Gill, 2016). There have not been any studies to investigate the effects of EMF from marine renewable devices on these marine mammals, therefore the question remains open.

10.182 There is no evidence that seals can detect or respond to EMF, however, some of the literature does suggest that some species of cetaceans may be able to detect variations in magnetic fields (Normandeau et al., 2011; Gill, 2016). To date, the only marine mammal known to show any response to EMF is the Guiana dolphin (*Sotalia guianensis*) which has been shown to possess an electroreceptive system, which uses the vibrissal crypts on their rostrum to detect electrical stimuli similar to those generated by small to medium sized fish (Czech-Damal et al., 2012). However, this has not been shown in any other species of marine mammal.

10.183 There is no evidence that EMF produced at other offshore wind farms has had any negative impacts on marine mammals. For example, harbour porpoise detections actually increased during the operational phase of the Dutch offshore wind farm Egmond aan Zee in comparison to the baseline phase (Scheidat et al., 2011), which does not suggest negative impacts from EMF. Likewise, tagged harbour and grey seals have been shown to forage at offshore wind farm structures and subsea pipelines (Russell et al., 2014) which again, does not suggest any negative impacts from EMF.

10.184 Any effects of EMF on marine mammals would reduce with increasing distance from the seabed. This therefore minimises the impact on marine mammals in the water column and at the surface. Given that harbour porpoise and both species of seals are known to closely associate with offshore wind farm structures, it is predicted that the magnitude and vulnerability score for this impact is **Negligible**, giving an overall impact assessment of **Negligible Significance** for impacts of EMF on marine mammal species. Elasmobranchs (such as basking sharks) are the species group that is considered to be the most electro-sensitive as they are known to have electro-receptors to detect electrical fields. It has been suggested that elasmobranchs could be confused by anthropogenic EMF sources that are of similar ranges to natural bioelectric fields. However, based on the power rating of cables used in the renewables industry, EMFs are unlikely to reach levels where the animals are repelled and, given our current levels of knowledge, EMFs associated with renewables are not known to cause any negative effects on receptor species (Gill, 2016). Any EMF levels from cables associated with the Project are expected to be very small scale in nature given that the export cable between the Site and land will be buried in the seabed. Therefore, it is predicted that the magnitude score for this impact on basking sharks is **Negligible** with a conservative vulnerability of **Low** given that elasmobranchs are known to be electro-receptive and could, at most, potentially result in small scale behavioural responses. These combined scores give an overall impact assessment of **Negligible Significance**.

Long Term Habitat Change

10.185 There is no evidence to suggest that the Project area should be considered an important habitat for marine mammals of any species or basking sharks. It is known that the presence of anthropogenic structures in the marine environment can act as artificial reef systems. There is evidence that both grey and harbour seals can target anthropogenic structures such as subsea pipelines and offshore windfarm turbine structures (Russell et al., 2014). This telemetry data strongly suggests that the tagged seals were targeting these structures for foraging purposes. Therefore, it is possible that the underwater structures associated with the Project could provide an ecological benefit by providing new foraging opportunities to marine mammals in the area. Chapter 8: Benthic and Shellfish Ecology assessed the potential for creation of habitat for benthic fauna through colonisation of the subsea infrastructure and concluded that this would have a positive but Minor Significant impact on benthic and shellfish ecology. Chapter 9: Fish Ecology outlined that any potential artificial reef system or fish aggregation as a result of the Project is expected to be small given the small area of the Project footprint. It was therefore assessed that fish production in the area is unlikely to increase significantly. It is anticipated that there will be no significant indirect impacts to marine mammals or basking sharks through changes in prey abundance and distribution and any potential habitat change as a result of artificial reefs systems is expected to positively impact on marine mammals by providing novel foraging opportunities.

Habitat Exclusion

10.186 Exclusion from the habitat is likely to occur if there is a significant effect of increased vessel activity, underwater noise and changes to prey availability. Given the above assessments, neither vessel disturbance, underwater noise nor changes in prey species presence are assessed as having any significant impact on marine mammals or basking sharks. Therefore, the magnitude of habitat exclusion is assessed as **Negligible**. Even if marine mammals or basking sharks were to be excluded from the Project site and surrounding area this would have little consequence due to the fact that the available data do not indicate that this is an important habitat for any species of marine mammal or basking sharks. It is not expected that exclusion from the immediate habitat at the Project site would result in changes in fitness or survival or reproductive rates. Therefore the vulnerability of all marine mammal species and basking sharks is assessed as **Negligible**. This results in an overall impact assessment of **Negligible Significance** for all assessed marine mammal species and basking sharks.

Indirect Impacts: Change in Fisheries Practices

10.187 The Scoping report identified the main commercial fisheries as shellfish, followed by demersal and pelagic species, with main fishing methods including crab and lobster potting, scallop dredging, demersal trawling and herring fishing (Dounreay Trì Ltd., 2015). Very few of these commercial fishers operate at the Project site or along the export cable route, therefore, it is expected that there would be little change to the movement of fishing vessels in the area. As such, the magnitude of effect is likely to be **Negligible**. Any potential change in commercial fisheries vessel movement is unlikely to have an effect on marine mammal or basking shark foraging efficiency, especially considering that the area is not considered to be an important foraging location for either marine mammals or basking sharks. Therefore the vulnerability of marine mammals and basking sharks to changes in commercial fisheries practices is assessed as **Negligible**. This results in an overall impact assessment of **Negligible Significance** for all marine mammal species and for basking sharks.

Summary of Impacts in the Operational Phase

10.188 The impact assessment has concluded that all operational phase impacts have a Negligible to Minor significance of impact on marine mammals and basking sharks, when a vessel management plan is implemented (Table 10-10). Therefore, the only mitigation measure required is a vessel management plan to minimise collision risk and disturbance to marine mammals and basking sharks.

Table 10-10 Summary of the significance of operational phase impacts on marine mammal and basking shark receptors.

		Magnitude	Vulnerability	Impact Significance
Collision/ Entanglement	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Low	Negligible
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible

		Magnitude	Vulnerability	Impact Significance
	Risso's dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Medium	Minor
	Basking shark	Negligible	Medium	Minor
Operational Noise	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Low	Negligible
Vessel Disturbance	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Negligible	Negligible
Vessel Collisions	**Grey seal**	Negligible	Low	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Risso's dolphin	Negligible	Low	Negligible

		Magnitude	Vulnerability	Impact Significance
	Minke whale	Negligible	Low	Negligible
	Basking shark	Negligible	Medium	Minor
EMF	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's Dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Low	Negligible
Long Term Habitat Change	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's Dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Negligible	Negligible
Habitat Exclusion	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's Dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible

		Magnitude	Vulnerability	Impact Significance
	Basking shark	Negligible	Negligible	Negligible
Fisheries Practices	Grey seal	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's Dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Negligible	Negligible

10.8 Impact Assessment - Decommissioning Phase

10.189 Potential impacts considered during decommissioning phase are expected to be similar to those arising during the construction phase, and would be temporary and of short duration.

10.9 Cumulative Impacts

10.190 The following section describes the potential cumulative impacts as a result of the construction of the following developments: The Orkney-Caithness interconnector cable, HIE Dounreay Floating Wind Deployment Centre, Brims Tidal Array and MeyGen.

10.191 The Orkney-Caithness interconnector cable proposal involves a 70 km 220 kV subsea cable link between Orkney and Dounreay. It is anticipated that the cable will be installed in the summer of 2017 (SSE, 2013).

10.192 The Highlands and Islands Enterprise (HIE) Dounreay Floating Wind Deployment Centre (DFOWDC) is being developed to test prototype floating offshore wind technologies. It will consist of up to five turbines up to a total capacity of 30 MW, located approximately 3.7 km from shore, northwest of the Dounreay nuclear facility, on the northern coast of Caithness (Marine Scotland, 2015). Where possible, the subsea cable will be buried which will involve first laying the cable then burying it using water-jetting technology (Scottish Hydro Electric Transmission Ltd., 2011).

10.193 Brims Tidal Array Ltd (OpenHydro Site Development Ltd and SSE Renewables UK Ltd) are developing the 200 MW Brim Tidal Array site in the Pentland Firth, south of Hoy in Orkney. This project prefers to use the OpenHydro Open-Centre Turbine which is a shrouded horizontal axis turbine. Construction is planned to begin in 2019 with Phase I consisting of 60 MW, then commissioning of the full 200 MW array in 2023 (Brims Tidal Array Ltd, 2013). The devices will be attached to the seabed by an unpinned gravity base structure and so no piling or drilling will be required. Alternative technologies are also being considered which may require the use of monopole foundations.

10.194 The MeyGen project, developed by MeyGen Ltd, will be located in the inner sound of the Pentland Firth between mainland Scotland and Stroma Island. Phase 1 of the MeyGen project is for the installation of up to 86 one MW tidal turbines. Phase 2 will consist of a further 312 MW (MeyGen Ltd, ES). The export cable was installed in 2015 with installation of the turbine structures planned in the summer of 2016. The devices will be attached to the seabed by gravity foundation structures and so no piling or drilling will be required.

Table 10-11 Summary information on the developments considered in the cumulative impact assessment.

Project	Construction/ Installation Date	Approx. Distance to Dounreay Tri	Piling?	Current Status
MeyGen[16]	2016	38 km	No	ES complete. Project under construction.
Orkney-Caithness interconnector cable[17]	2017	5 km [18]	No	Consultant assigned to produce EIA.
Brims Tidal Array[19]	2019	31 km	No	Application submitted.
Dounreay Demonstration Centre[20]	unknown	1.3 km [21]	Optional	Screening complete.

Construction Noise

10.195 The source level for the drilling activities for the MeyGen development is below the level that would be lethal or cause hearing damage to marine mammals (Kongsberg, 2012). The noise assessment concluded that there is insufficient noise produced to cause TTS and so no animals are expected to leave the area during construction leading to the conclusion that no population level impacts are expected as a result of construction noise. Therefore the magnitude of disturbance from construction noise is considered to be **Negligible**. The Environmental Statement for the MeyGen development concluded that construction noise would not result in lethal or physical injury to fish species (including basking sharks) and that

[16] MeyGen Ltd, Environmental Statement

[17] SSE (2013)

[18] From the nearest point of the preferred cable route

[19] Brims Tidal Array Ltd (2013)

[20] Aquatera Ltd (2014)

[21] From the edge of the "offshore area of search" for the Dounreay Floating Wind Deployment Centre

behavioural disturbance from underwater noise would be limited and likely only observed in hearing specialist fish (MeyGen, 2011).

Table 10-12 Behavioural impact ranges for receptor groups during drilling and vessel operations (Kongsberg, 2012).

Species	Impact	Strong avoidance ($90dB_{ht}$)		Mild avoidance ($75dB_{ht}$)	
		Precautionary conditions	Typical conditions	Precautionary conditions	Typical conditions
Pinniped	Vessel	<1 m	<1 m	14 m	14 - 18 m
	Drilling	<1 m	<1 m	<1 m	<1 m
Odontocetes	Vessel	<1 m	<1 m	28 m	28 m
	Drilling	<1 m	<1 m	<1 m	<1 m
Mysticetes	Vessel	56 m	56 m	1.176 km	620 – 1,036 m
	Drilling	<1 m	<1m	<1 m	<1 m

10.196 The construction design of the DFOWDC has yet to be finalised. Various anchoring options are being considered which include: piling fixed points, drilling, gravity-base anchors and suction brackets (Aquatera Ltd, 2014). If the worst case scenario is considered then it is the potential impacts of underwater noise generated by piling activities that contributes to this cumulative impact assessment. Given standard mitigation measures associated with offshore piling (MMs and PAM) or ADD based mitigation, the risk of injury to marine mammals and basking sharks will be completely mitigated. Since this is a test centre, it is limited in size to only 5 turbines, therefore, the piling construction is very small in terms of size, duration and frequency, making the disturbance to marine mammals and basking sharks of **Low** magnitude.

10.197 The magnitude of the considered developments range from **Negligible** to **Low** for the effect of construction noise on marine mammals. The timing of the construction of these developments does not overlap and so there is no simultaneous cumulative impact expected. If JNCC guidelines are followed then injury to marine mammals will be mitigated. The remaining impact is therefore behavioural disturbance from construction noise. Since the Pentland Firth does not represent an important habitat for any species, any behavioural disturbance is unlikely to result in changes to foraging success, survival or reproductive rates. Therefore the vulnerability of all marine mammal species and basking sharks is assessed a **Low**, providing an overall cumulative impact from construction noise of **Minor Significance** for all species.

Disturbance from Vessels

10.198 There is a general lack of information in the vessel types, number of vessels and frequency of vessel transits that will be required for each of the developments. Therefore, only limited data can be assessed here to inform the cumulative impact significance of vessel disturbance on marine mammals.

10.199 The Brims Tidal array will require a specialist custom-design heavy lift barge to install the turbines alongside other vessel types such as tugs and support boats (Brims Tidal Array Ltd., 2013). The DFOWDC will require a jack-up barge, cable laying vessel and multi-cats for construction activities (Aquatera Ltd, 2014). The installation of the Orkney-Caithness interconnector cable will likely be completed by one cable laying vessel carrying the entire cable associated with one circuit in one mobilisation. This means that the entire cable is likely to be laid and buried in one summer period (Scottish Hydro Electric Transmission Ltd., 2011).

10.200 The main impact pathway for disturbance from vessels at the MeyGen development is vessel noise. However, this would be the same or lower than the construction vessel noise which was assessed as not significant due to the small localised effects in comparison to the species ranges (MeyGen, 2011).

10.201 Given the potentially low number of vessels required for each development and the baseline levels of vessel and shipping activities in the Pentland Firth, it is not considered that the presence of construction and maintenance vessels will present any additional disturbance risk to any marine mammal species or basking sharks above the normal vessel and shipping activities in the area. This cumulative impact is therefore considered to be of **Negligible Significance**.

Collision with Construction Vessels

10.202 The construction vessel traffic associated with each development would likely be predictable in nature and would likely not involve the addition of significant additional traffic into the Pentland Firth. Therefore, it is not considered that the presence of construction vessels will present any additional collision risk to any marine mammal species above the normal vessel and shipping activities in the area. This magnitude of this impact is therefore considered to be **Negligible**. Given their favourable conservation status, population stability and low densities in the area, all cetaceans are assessed as having a **Low** vulnerability, grey seals as **Negligible** and harbour seals as **Medium** due to their unfavourable conservation status and declining population. Basking sharks are assessed as having a **Medium** vulnerability due to them showing slow moving, unresponsive surface behaviours during feeding and courtship. This results in an overall impact assessment for construction vessel collisions of **Negligible** to **Minor Significance** for all marine mammal species and **Minor Significance** for basking sharks.

10.203 Given the new evidence available with regards to grey seal cannibalism causing corkscrew seal deaths (Thompson et al., 2015), corkscrew seal injuries as a result of vessel propeller interactions are unlikely to occur frequently therefore giving a magnitude of **Negligible** for both seal species. Grey seals have a **Low** vulnerability due to their favourable conservation status and stable population, while harbour seals have a **Medium** vulnerability due to their unfavourable conservation status and declining population. Therefore, the cumulative impact of corkscrew seal collisions is assessed as only **Minor Significance** for both seal species.

Water Quality

10.204 The impact of increased turbidity effecting water quality at MeyGen was assessed as negligible magnitude and not significant as the impact would be very short lived and highly localised (MeyGen, ES). No information on the predicted changes in water quality for any of the other developments was available for assessment.

10.205 Any changes in water quality are expected to be very localised and short term at each development site, therefore, the magnitude of impact on all assessed marine mammal species and basking sharks is considered to be **Negligible**. All assessed marine mammal species as well as basking sharks are considered to be of **Low** vulnerability to this impact given that they are known to forage in areas of high tidal energy with poor visibility and so are likely to be able to adapt to and tolerate any temporary suspended sediment in the water column. Therefore, the cumulative impact of changes in water quality during construction is assessed as **Minor Significance** for all assessed marine mammal species and basking sharks.

Long Term Habitat Change

10.206 There is no evidence to suggest that any of the developments are likely to cause long term habitat changes. There is the possibility that some or all of the developments may provide the infrastructure for the formation of artificial reef systems which could increase prey densities in the area and could increase marine mammal foraging opportunities. This does not represent a negative impact on marine mammals or basking sharks and as such, this is considered to be of **Negligible** magnitude. Given that the UK harbour seal population is an EU protected species that is known to be in decline and is categorised as having an unfavourable conservation status, the vulnerability of harbour seals is assessed as **Medium**. This combines to provide an overall impact assessment to harbour seals as **Minor Significance**. For all other marine mammal species, their vulnerability is assessed as **Low** given their Favourable conservation status and the fact that the area is not considered to be important habitat for any of these species it is likely that they would be able to adapt to and/or tolerate a small change in the habitat. Basking sharks are rarely sighted in the Pentland Firth and it does not represent an important habitat for this species; therefore it is expected that they would be able to adapt to and/or tolerate a small change in the habitat. This combines to provide an overall impact assessment to of **Negligible Significance** for all other marine mammal species and for basking sharks

Summary of Cumulative Impacts

10.207 There are a large number of uncertainties associated with this cumulative assessment. These are largely driven by the lack of available or finalised information for most of the developments under consideration. For example, of the five developments considered in this cumulative impact assessment, only one has a completed Environmental Statement. The ES/EIA is in progress or has been assigned to a consultant for three of the developments and only the screening has been completed for the final development (Table 10-13). Therefore, there is a lack of information available on the final project designs or timescales, the methods of construction or the impacts of the developments to be used in this cumulative impact assessment.

Table 10-13 Summary of the cumulative impact significance on marine mammal and basking shark receptors.

		Magnitude	Vulnerability	Impact Significance
Construction Noise Vessel Disturbance	Grey seal	Low	Low	Minor
	Harbour seal	Low	Low	Minor
	Harbour Porpoise	Low	Low	Minor
	White-beaked dolphin	Low	Low	Minor
	Bottlenose dolphin	Low	Low	Minor

		Magnitude	Vulnerability	Impact Significance
	Risso's dolphin	Low	Low	Minor
	Minke whale	Low	Low	Minor
	Basking shark	Low	Low	Minor
	Grey seal	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Negligible	Negligible
Vessel Collision	**Grey seal**	Negligible	Low	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Risso's dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
	Basking shark	Negligible	Medium	Minor
Water Quality	**Grey seal**	Negligible	Low	Negligible
	Harbour seal	Negligible	Low	Negligible
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible

		Magnitude	Vulnerability	Impact Significance
	Bottlenose dolphin	Negligible	Low	Negligible
	Risso's dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
	Basking shark	Negligible	Low	Negligible
Long Term Habitat	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Risso's dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
	Basking shark	Negligible	Negligible	Negligible

10.10 Summary

10.208 No significant impacts to marine mammals or basking sharks have been identified during the construction, operation and maintenance or decommissioning of this Project. Any impacts related to vessel collisions and disturbance will be mitigated through the implementation of a vessel management plan which limits vessel speeds and designates a navigational route for vessel traffic. This vessel management plan will minimise any potential for collisions and disturbance to marine mammals and basking sharks as a result of increased vessel traffic at the Project site. As a result of this mitigation, the impact significance was assessed as **Negligible** to **Minor**.

10.209 There are a large number of uncertainties associated with the cumulative assessment. These are largely driven by the lack of information available on the final project designs or timescales, the methods of construction or the impacts of the developments to be used in this cumulative impact assessment. Therefore, the impact assessment is limited in its quantitative detail. Despite this, none of the cumulative impacts were assessed as having a significant impact on marine mammals or basking sharks.

Table 10-14 Summary of impacts on marine mammals and basking sharks.

	Magnitude	Vulnerability	Impact Significance
Construction Phase			
Construction Noise	Negligible	Low to Medium	Negligible to Minor
Collision Injury	Negligible	Low to Medium	Negligible to Minor
Water Quality (sediment)	Negligible	Low	Negligible
Water Quality (contaminants)	Negligible	Low	Negligible
Indirect Impacts (prey species)	Negligible	Negligible	Negligible
Operational Phase			
Collision/ Entanglement	Negligible	Low to Medium	Negligible to Minor
Operational Noise	Negligible	Negligible	Negligible
Vessel Disturbance	Negligible	Negligible	Negligible
Vessel Collisions	Negligible	Low to Medium	Negligible to Minor
EMF	Negligible	Negligible	Negligible
Long Term Habitat Change	Negligible	Negligible	Negligible
Habitat Exclusion	Negligible	Negligible	Negligible
Indirect Impacts (Fisheries Practices)	Negligible	Negligible	Negligible
Decommissioning Phase			
Impacts expected to be similar to Construction Phase impacts.	Negligible	Negligible to Medium	Negligible to Minor
Cumulative Impacts			
Construction Noise	Low	Low	Minor
Vessel Disturbance	Negligible	Negligible	Negligible
Vessel Collisions	Negligible	Low to Medium	Negligible to Minor
Water Quality	Negligible	Low	Negligible

	Magnitude	Vulnerability	Impact Significance
Long Term Habitat Change	Negligible	Negligible to Medium	Negligible to Minor

11 Marine Ornithology

11.1 Introduction

11.1 This Chapter describes the marine ornithological interest within and around the offshore project area as defined in Chapter 4: Project Description and shown in Figure 1-1.

11.2 This Chapter concentrates on those species that are known to or are likely to occur within the offshore Site and off the North Coast of Scotland, with particular focus on those species recorded during the surveys undertaken to inform this assessment.

11.3 The chapter describes the baseline environment and the potential impacts on marine ornithology arising from the construction, operation and decommissioning of the Dounreay Trí Project.

11.4 Related issues including intertidal ecology, benthic and shellfish ecology and fish ecology are covered in Chapter 7: Intertidal Ecology, Chapter 8: Benthic and Shellfish Ecology and Chapter 9: Fish Ecology respectively.

11.2 Guidance and Legislation

11.5 A key aspect of the assessment of potential impacts on marine ornithology is the identification of species of conservation importance in the offshore Site and cable corridor and assessment of potential impacts on those species. The consideration of impacts is subject to, and guided by, relevant guidance and legislation. The following legislation has been considered in defining the scope of this assessment:

- Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000, as amended ("the EIA Regulations");
- Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland) and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (together "the Habitats Regulations") which implement species protection requirements of European Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora ("the Habitats Directive") and European Council Directive 2009/147/EC on the conservation of wild birds (the codified version of European Council Directive 79/409/EEC as amended) ("the Birds Directive");
- Wildlife and Countryside Act 1981 (as amended) ("WCA"); and
- Nature Conservations (Scotland) Act 2004 ("NCA").

11.6 The Habitats Regulations implement the requirements of the Habitats Directive in the UK and provide a comprehensive mechanism for the protection of all wild bird species naturally occurring in within the European Union. Site designated under the Habitats Directive are known as Special Areas of Conservation ("SAC"). Article III of the Habitats Directive requires the establishment of an European network of important high-quality conservation sites that will make a significant contribution to conserving the 189 habitat types and 788 species identified in Annexes I and II of the Directive (as amended). The listed habitat types and species are those considered to be most in need of conservation at a European level (excluding birds).

11.7 Article IV of the Birds Directive requires the protection of those habitats deemed important for rare and vulnerable birds (as listed on Annex I of the Directive) and for regularly occurring migratory species through the establishment and maintenance of a coherent network of Special Protection Areas ("SPA") comprising the most important territories for these species.

11.8 The Natura 2000 network are sites designated as either SAC or SPA. In addition, wetlands of international importance designated under the Ramsar Convention (“Ramsar sites”) are treated as if they were Natura 2000 sites, in accordance with Government policy.

11.9 Plans or projects which are likely to have a significant impact on Natura 2000 (and other European sites) either alone or in-combination with other plans or projects (and are not directly connected with the management of the site) are subject to a Habitats Regulations Assessment (“HRA”) under Article 6(3) of the Habitats Directive.

11.10 WCA protects wildlife within the terrestrial environment and inshore waters (between 0 to 12 nautical miles (“nm”)) within Great Britain. Amendments to the legislation, such as the Nature Conservation (Scotland) Act 2004 have altered the application of the WCA within Scotland. Part I of the WCA relates to the protection of wild birds, affording various levels of protection to different species.

11.11 Under the WCA, Scottish Natural Heritage (“SNH”) is able to designate Sites of Special Scientific Interest (“SSSI”) where land is considered to be of special interest by reason of any natural (biological or geological) features.

11.12 The NCA requires that SSSI in Scotland be subject to notifications regarding operations requiring consent and that management statements between SNH and the landowners or occupiers be agreed.

11.13 The UK Biodiversity Action Plan (“UKBAP”) was published in 1994 as a response to the 1992 Rio de Janeiro Convention on Biological Diversity. The UKBAP identifies biological resources in the UK and plans for their conservation. This was succeeded by the UK’s Post-2010 Biodiversity Framework in 2012 in response to the Convention on Biological Diversity’s Strategic Plan for Biodiversity 2011 – 2020 (published in 2010) and the European Union’s (“EU”) Biodiversity Strategy (published in 2011). The UK Post-2010 Biodiversity Framework describes how the UK can meet the Aichi Biodiversity Targets. The UK BAP identified priority species that are the most threatened and require conservation. These UK BAP priority species include some marine bird species present in UK waters. This list of priority species is still used to inform statutory lists of priority species in the UK, as required by Section 2(4) of the Nature Conservation (Scotland) Act 2004.

Other Sources of Information

11.14 A detailed review was undertaken of the existing literature and data relating to marine ornithology, in and around the Dounreay Trí site, which was used to give an overview of the existing environment.

11.15 Data sources used in the preparation of this chapter are listed in Table 11-1.

Table 11-43 Major data sources used in the preparation of the marine ornithology chapter

Source	Content
HiDef Aerial Surveying Limited	Monthly ultra-high resolution digital video ornithology and marine mega-fauna surveys.
Scottish Government	Digital stills data collected under contract to Marine Scotland between 2010 and 2012.
Joint Nature Conservation Committee (“JNCC”)	European Seabirds At Sea (“ESAS”) database.

Source	Content
Webb *et al.* (2015)	An analysis of historical boat-based and digital stills survey data from around the Dounreay Trí project.
Irwin *et al*. (2015a)	Digital video aerial surveys of seabirds and marine mammals at the Dounreay project: interim report of surveys between January and June 2015.
Irwin *et al*. (2015b)	Digital video aerial surveys of seabirds and marine mammals at the Hexicon Dounreay project: final report of surveys between January and December 2015
JNCC (2015)	Seabird Population Trends and Causes of Change: 1986-2014 Report (http://www.jncc.defra.gov.uk/page-3201). Joint Nature Conservation Committee. Updated October 2015.
Thaxter *et al.* (2012)	Seabird foraging ranges as a preliminary tool for identifying candidate Marine Protected Areas.
Mitchell *et al.* (2004)	Seabird Populations of Britain and Ireland: results of the Seabird 2000 census (1998 – 2002).
Kober *et al.* (2010)	An analysis of the numbers and distribution of seabirds within the British Fishery Limit aimed at identifying areas that qualify as possible marine SPAs. JNCC Report No. 431.

High-resolution digital video surveys

11.16 In January 2015, Hexicon commissioned HiDef Aerial Surveying Limited to undertake a programme of ultra-high resolution digital video aerial marine megafauna, ornithological and human activity surveys in support of the Dounreay Trí project.

11.17 Surveys were commissioned to run between January and December 2015, on a monthly basis, although two (2) surveys were successfully completed in June 2015.

11.18 The survey design consists of 1km spacing within the Dounreay Trí project area and at a 2km spacing within the 2km buffer, as shown in Figure 11-1.

11.19 A series of strip transects were flown following the protocol agreed with Marine Scotland in May 2015.

11.20 HiDef designed the survey methodology to provide information suitable to support an Environmental Impact Assessment ("EIA") of the potential effects of a floating wind demonstrator, for which an accurate assessment of abundance and distribution of seabirds and marine mammals is required.

11.21 A reasonable level of precision is required for abundance estimates in EIA studies; however, as any survey data collected is likely to be the only baseline data available under a regime of 'survey, deploy, monitor', then a higher degree of precision will be required than is typical for EIA. For this reason, HiDef therefore designed a survey that placed transects at 1km apart within the Dounreay Trí project Site and at 2km apart in a 2km buffer around the site.

11.22 HiDef proposed a transect-based survey design in which strip transects are placed approximately perpendicular to the depth contours along the coast. Such a design ensures that each transect samples a similar range of habitats (primarily relating to water depth) and will reduce the difference in bird and mammal abundance estimates for each transect.

11.23 Surveys were undertaken using an aircraft equipped with four (4) HiDef second generation ("GEN II") cameras with sensors set to a resolution of 2 centimetres ("cm") Ground Sample Distance ("GSD"). Each camera sampled a strip of 125m width, separated from the next camera by ~25m, thus providing a combined sampled width of 500m within a 575m overall strip.

11.24 Using HiDef's GEN II system offers many advantages over other, conventional, methods of ornithological surveys (such as boat-based or digital stills), including an average identification to species rate of approximately 95%.

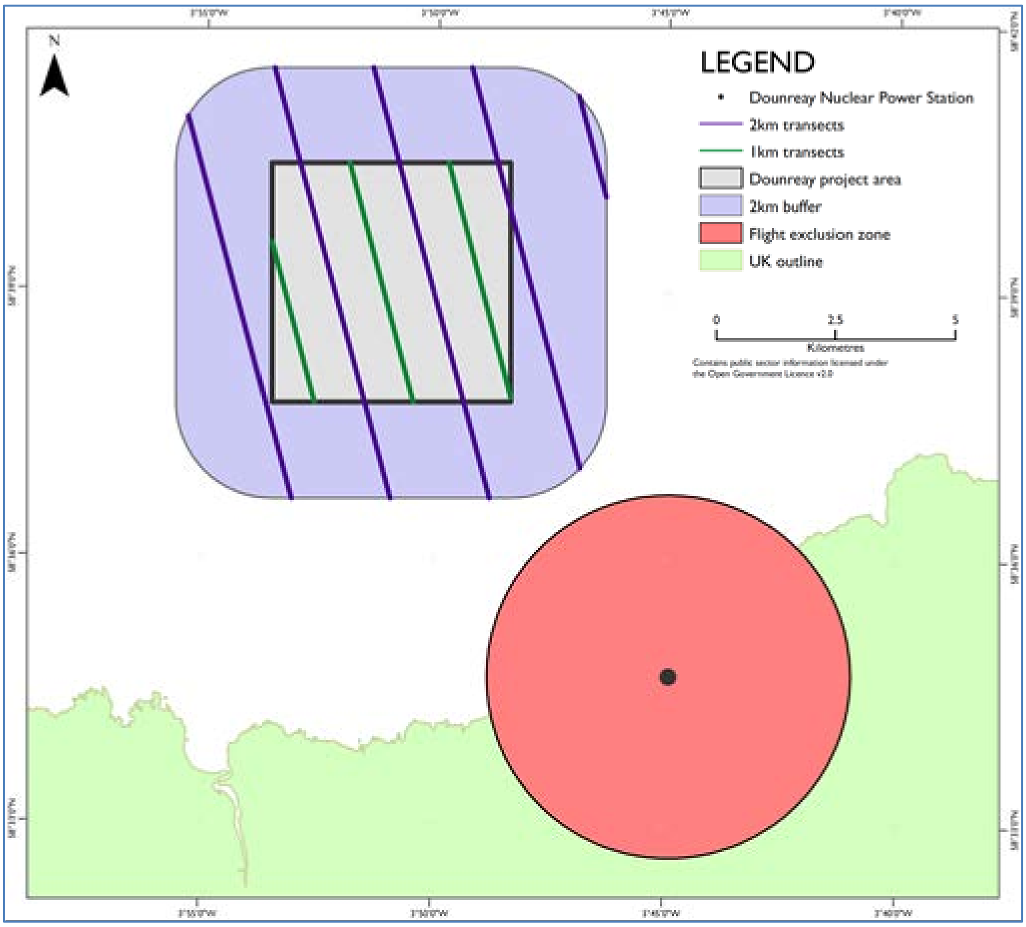

Figure 11-1 Survey design showing 2km and 1km spaced transects with 2km buffer around Dounreay Trí project area

11.25 The surveys were flown along the transect pattern shown in Figure 11-1 at a height of approximately 550m above sea level ("ASL"). Flying at this height ensures that there is no risk of flushing those species which have been proven to be easily disturbed by aircraft noise (Buckland *et al.*, 2012; Thaxter *et al.* 2015).

11.26 The data collected was viewed by trained reviewers who mark any objects in the footage as requiring further analysis, as well as determining which are birds, marine mammals or marine megafauna, and which are anthropogenic objects such as ships or buoys.

11.27 As part of HiDef's comprehensive quality assurance ("QA") process, an additional "blind" review is carried out and the results compared with those of the original review. This allows additional confidence in the results provided.

11.28 All objects are assigned to a species group and then further identified to species level. Surfacing behaviour was defined as any surfacing behaviour that occurred while a non-avian animal was visible.

11.29 After basic presentation, data were processed for estimating abundance and distribution of the key species and species groups. All confidence levels of species identifications were used in the analysis. In the analysis of species groups, rationalisation of the full list of species groups was carried out in order to simplify the interpretation.

11.30 For species groups which include different genus, species level identification was used to assign to species group. Where identification to species level isn't possible, a broader species group category is instead used for that record. For example, birds originally assigned to the category 'Shearwater / auk species' might be assigned to 'Shearwater species' if they were identified as a Manx shearwater *Puffinus puffinus*; and to 'Auk species' if identified as a guillemot, or remain as 'Shearwater / auk species' if no species level identification was recorded.

11.31 The abundance of each species observed was estimated separately using a design-based strip transect analysis with variance and confidence intervals ("CI") derived through 10,000 bootstraps. The bootstrapping technique uses total length of transect to limit selection rather than total number of transects. This method has a particular advantage when transects are of unequal length and provides better precision estimates.

11.32 In a strip transect analysis, each transect is treated as an independent analysis unit, and the assumption is made that transects can be treated as statistically independent random samples from the site. The length of each transect and its breadth (i.e. the width of the field of view of the camera) multiplied together give the transect area; dividing the number of observations on that transect by the transect area gives a point estimate of the density of that species for the site. The density of animals at the site (and hence the population size), the standard deviation, 95% CI and coefficient of variance ("CV") are then estimated using a non-parametric bootstrap method with replacement (Buckland *et al.*, 2001).

11.33 The density estimate is expressed as the average number of animals per square km surveyed over the whole site, and the population estimate is then calculated as the average density multiplied up to the area of the whole site. The standard deviation is a measure of the variance of the population estimate, standardised by the number of samples (transects). The upper and lower CI define the range that the population estimate falls within with 95% certainty. The CV, also referred to as the relative standard error, is a measure of the precision of the population and density estimates. A CV value of less than 16% allows a 50% decline or 100% increase in abundance between two samples to be detected with greater power than 0.8. This is usually regarded as the minimum precision required for monitoring effects of developments on key species.

11.34 In wildlife surveys, a proportion of seabirds or marine mammals that spend any time underwater, especially while feeding, will not be detectable at the surface. This may lead to an under-estimate of their abundance during surveys, which is known as availability bias. For species that make long dives underwater, this bias might be significant (for example, shag).

11.35 There are two main approaches to accounting for availability bias: by using double platform surveys (for example Borchers *et al.* 2002) which is logistically difficult to achieve and relatively expensive; and by using known data on time spent underwater to apply correction factors to abundance estimates (for example Barlow *et al.*, 1988).

11.36 Barlow used an equation to determine the proportion of time that an animal is not available in equation 1:

$$\Pr(being\ visible) = \frac{(s+t)}{(s+d)}$$

11.37 Where s is the average time spent below the surface, t is the window of time that the animal is within view and d is the average time spent at the surface. In the case of digital video surveys, the value of t is negligibly small and is treated as 0.

11.38 All available data for seabirds relate to diving behaviour obtained by direct observation, or in the case of guillemots and razorbills, to data obtained during the breeding season using data loggers. Thaxter *et al.* (2010) give average times for these species engaged in flying, feeding and spent underwater during the chick-rearing period. We have used the mean time spent underwater (1.9 and 0.8 hours for guillemots and razorbills respectively) as a percentage of the mean time spent at sea not flying (8.0 and 4.6 hours respectively). Thus the percentage time spent underwater for guillemots is 23.75% and for razorbills of 17.4%. For puffins, data from data loggers were used from Spencer (2012), which estimated that puffins spend 14.16% of daylight time underwater when not flying.

11.39 These figures can only be applied to estimates of relative abundance of birds sitting on the sea, and should be added to the true abundance of flying birds to give an estimate of true abundance for the species.

11.40 For this reason, it was necessary to calculate the percentage of birds as a total of all observations and applying these to the estimates of abundance for the two species. Because of low sample sizes of guillemots and razorbills in many months, the percentage of sitting birds was used to calculate the correction factors for abundance estimates within the proposed development area. For some species, too few observations were available to assess the ratio of sitting to flying birds with confidence and consequently, a ratio was used that pooled data for certain species. These percentage figures were used to scale up the relative abundance estimate of guillemots, razorbills and puffins sitting on the sea by factors of 1.2375, 1.174 and 1.1416 respectively, and then added these corrected abundance estimates for sitting birds to the abundance estimate of flying birds. A scaling factor was also applied for large auks and auk species in proportion to the ratio of the estimated abundance of sitting guillemots, razorbills and puffins to each other and to other species within each of the mapped grid cells.

11.41 The same transect lines were used for each survey, although effort differed slightly between surveys. This was caused by minor differences in start and stop times for transects and minor deviations of the aircraft from the transect line. Table 11-2 shows survey effort at the Dounreay Trí project between January and December 2015 inclusive.

Table 11-2 Survey effort at the Dounreay Trí project between January and December 2015 inclusive

Survey date	Number of transects analysed	Total length of transects analysed (km)	Area Covered (km^2)
19 January 2015	8	49.26	24.63
25 February 2015	8	48.51	24.26
13 March 2015	8	47.73	23.87
9 April 2015	8	49.18	24.59
9 May 2015	8	49.50	24.75
8 June 2015	8	47.40	23.70
30 June 2015	8	48.59	24.30
14 July 2015	8	48.02	24.01
5 August 2015	8	48.20	24.10
28 September 2015	8	49.04	24.52
13 October 2015	8	48.08	24.04
25 November 2015	8	48.58	24.29
3 December 2015	8	49.05	24.53

11.42 The surveys were highly successful in characterising the bird and mammal species present in the Dounreay Trí project area, recording a total of 4960 birds of 14 species and 24 marine mammals of four (4) species. A further 172 animals were recorded which were not assigned to a species.

11.43 Fulmar *Fulmarus glacialis* were recorded at low to moderate density in the study area, mostly less than 0.61 birds/km^2 but at densities up to 24.00 birds/km^2 in August 2015. This abundance was not typical for this species, with the next highest peak in April being 2.95 birds/km^2. Many young fulmars leave their nest sites in August, and it is likely that the high numbers recorded in August related to a departure event. ESAS data were found to be fairly sparse in the late winter months when the density was 0 birds/km^2, but increased to 8.26 birds/km^2 in May and 6.15 in July. Digital stills data found similar densities which ranged from 0.48 birds/km^2 in May to 2.64 in April. These suggest that the findings for fulmar in the current study are typical for what might be expected of this species.

11.44 Gannets *Morus bassanus* were recorded at very low density generally. A higher density of 1.88 birds/km^2 in the study area in the August survey was not matched within the project site, where the density was much lower. Densities of gannet in ESAS data were much lower at up to 0.37 birds/km^2 and also occurred throughout the winter period, unlike in the present study. This perhaps reflects the age of the ESAS data, in which there have been considerable increases in the breeding population of gannets (Mitchell *et al.* 2004) and evidence for fewer gannets spending the winter around the UK than previously (R. Furness pers. comm.). Digital stills surveys found densities of 0.78 and 1.15 birds/km^2 in April and May, with no surveys in June and no gannets recorded during the winter months. This suggests a high degree of similarity between these two contemporary digital data sets.

11.45 Very low numbers of great skuas *Catharacta skua* were found, with a peak abundance of 0.14 birds/km² recorded in the study area. No great skuas were recorded in the ESAS data for the same period and digital stills data found a density of 0.23 birds/km² which suggests a degree of similarity in the results for the current and historical digital survey data.

11.46 Kittiwakes *Rissa tridactyla* were present in the survey area in all months at low to moderate density but increased in the June surveys with a peak of 6.04 birds/km². The peak in the ESAS data occurred in July with a density of 17.95 birds/km² (although with very wide confidence limits). Relatively few kittiwakes were recorded in the digital stills data, with a peak in March of 0.54 birds/km², but a peak in the density of unidentified small gulls in April of 1.74 birds/km² (and 0 kittiwakes) may be attributable this species. There is reasonably good agreement with the densities found in the ESAS data which suggests that the abundance of this species found in the current surveys were typical of previous years.

11.47 Great black-backed gulls *Larus marinus* were present in the survey area at low density in the winter, but a peak occurred in March with a density of 0.60 birds/km² in the survey area, then again in August with 1.75 birds/km². This last concentration occurred mainly in a single group at the edge of the study area and probably equated to a flock scavenging at a fishing boat (although no such boat was recorded during the survey). ESAS data for this species found a density of 0.10 birds/km² in January, while digital stills data had densities that ranged from 0 to 0.22 birds/km² in May. The large flock in August aside, this suggests some degree of conformity between the different data sets.

11.48 The current survey found Arctic terns *Sterna paradisaea* to be at high density in the survey area in June at 1.77 birds/km². No terns were recorded in the ESAS surveys and only 0.22 birds/km² unidentified tern species in the digital stills data (although there were no surveys carried out in June for this data set). This suggests a higher than expected abundance of this species during the current surveys.

11.49 A high density of guillemots *Uria aalge* was present in many surveys, with a peak of 11.09 birds/km² in the survey area in one of the June surveys (13.70 birds/km² when corrected for availability bias). ESAS data found similar densities of guillemots with a peak in May of 9.14 birds/km². The HiDef surveys recorded an absence of guillemots in August, when the species is flightless and undergoing a full feather moult, followed by a winter peak in November and December. ESAS data also found that there were no concentrations of moulting guillemots in August, but density stayed low in those surveys for the remainder of the year. Digital stills surveys recorded no guillemots but a density of up to 5.79 birds/km² of unidentified large auks in May, which is lower than the digital video data set. Based upon the ESAS data, there appears to be a high degree of correspondence between the current surveys and historical data sets.

11.50 Generally, low density of razorbills *Alca torda* was recorded, but a peak of 1.17 birds/km² was found in one of the June surveys (1.37 birds/km² when corrected for availability bias). This compares with a peak density of 1.39 birds/km² in the ESAS database. No razorbills were recorded in the digital stills data, but a portion of the 5.79 birds/km² unidentified large auks may have been this species (see guillemot). Based upon comparison with the ESAS data, the results of the current study appear to be typical of what might be expected for this species.

11.51 A very high density of puffin *Fratercula arctica* was found in one of the June surveys but not in others, reaching a density of 52.22 birds/km² (59.28 birds/km² when corrected for availability bias). This compares with a peak density of 1.91 birds/km² in May and 0.51 birds/km² in a small sample of data in June in the ESAS data. No puffins were recorded in the digital stills data for this area and 0.46 birds/km² of unidentified auk species might have been this species (or one of the other auk species). Numbers decreased to typical low density after this peak in early June.

11.52 The high density of puffin encountered in early June in the current study was exceptional and not matched by historical surveys or by the repeated survey in the current study, and suggests an irregular phenomenon caused by temporary local feeding conditions.

11.53 Puffins are known to exploit temporary feeding opportunities, such as those provided at temporary oceanographic fronts (e.g. Harrison *et al.* 1994; Piatt 1990). The concentration of puffin could potentially have originated from one of several colonies with significant concentrations at Hoy SPA and Sule Skerry SPA, the North Caithness Cliffs SPA as well as the nearby colony at Strathy Point. The peak total number estimated to occur in the project site of 1321 birds (± 95% CI 935 – 1944), even when adjusted to take account of availability bias at 1505 birds (± 95% CI 1065 – 2142) is still relatively small given the size of the breeding populations of puffins at the above colony.

11.54 The ESAS database did not record any additional species to those encountered during the current study. However, herring gull *Larus argentatus* and unidentified divers (Gaviidae) were recorded at low densities during the same survey months of this study.

11.55 The distribution maps for all species show no regular patterns between surveys to give any suggestion that one part of the study area might be more important than any other. As such, with a small site such as this, it would be surprising if any such pattern were to emerge for what are highly mobile bird and mammal species.

11.56 The flight heights of several species were recorded during these surveys. The flight heights for the more abundant species (fulmar, kittiwake, guillemot and puffin) suggest that the flying heights recorded during these surveys were comparable with those reported by Johnson *et al.* (2014) and Furness and Wade (2013).

11.57 The flying directions of seabirds are difficult to interpret at a site such as this, and for many species there was no clear pattern. The majority of guillemots recorded flying were travelling either east or west, perhaps suggesting transit to or from the Pentland Firth. The flying direction for the few puffins recorded during the survey in early June, when density was very high, suggest that puffins were flying between inshore and offshore to the north-west and might indicate that birds were flying to and from the large colony at Sule Skerry. However the sample size is very small.

Consultation

11.58 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date.

Scoping Feedback

11.59 The following stakeholder responses have been received specifically relating to this chapter.

Table 11-3 Summary of scoping responses

Consultee	Comment	Relevance / Cross Reference
RSPB	We would welcome a second year of survey effort to strengthen the evidence base and better account for any inter-annual variability. However, should a second year survey not be undertaken we suggest consideration is made of the robustness of the baseline data in support of the assumptions taken in the environmental assessment. Particularly, we request that it is clearly demonstrated that parameters such as flight heights are sufficiently accurate to enable collision risk assessment.	See Sections 11.4, 11.5, 11.6.
RSPB	We recommend that potential impacts of displacement and changes in prey abundance or distribution of prey species offshore are also scoped in for consideration during the construction phases. We consider there could be significant risks of these impacts occurring during this phase, especially as a result of cumulative or in-combination impacts.	See Sections 11.4, 11.5, 11.6.
RSPB	The project hopes to progress through the Scottish Government's survey, deploy monitor approach. We acknowledge the benefits that such an approach provides to the delivery of offshore projects, nonetheless we emphasise the need for all monitoring measures to be effective. Any future proposals will rely on the robustness of the monitoring data and analysis, as such it must focus on providing specific and measurable outcomes. We offer our support and advice into preparing a monitoring programme.	Noted.
Scottish Government Planning	The potential for bird-strike with turbine blades, and the potential for diving bird collisions with support devices at or below the water level (i.e. surface structures, mooring cables, etc.) should be addressed.	See Sections 11.5 and 11.6.

Consultee	Comment	Relevance / Cross Reference
SNH	Mitigation and monitoring We advise that, within the ES, a schedule of commitments is provided with regard to proposed mitigation. Furthermore, we advise that the applicant provides a draft Environmental Mitigation and Monitoring Plan (EMMP) as part of the ES. The proposed EMMP should provide details on mitigation measures and monitoring studies to be undertaken.	See Chapter 4: Project Description, Project Commitments
SNH	In our response of the 11th February 2016 we provided advice in relation to the 12 month HiDef aerial surveys for seabirds and marine mammals. We advised that although further surveys in the May-July period would be useful to gain better understanding of the likelihood of such an influx of puffins occurring again, it is not essential that this information is submitted pre-application. This is due to the small scale of the project, and its 'demonstration' status. We advise that the impact assessment uses the 'worst case' of the maximum densities of birds recorded in the surveys (i.e. the maximum puffin density in June 2015). Furthermore, if consented, further survey work may be required for impact monitoring.	See Section 11.6.

11.3 Assessment Methodology

11.60 EIA is an iterative process, carried out in parallel with project design, where the emphasis is on identifying and preventing potential impacts where possible and suggesting adequate mitigate measures if not.

11.61 The overarching approach to assessment is described in Chapter 5: Environmental Impact Assessment Methodology. To support this, the following is a description of the specific criteria which are used to evaluate the impact on marine ornithology.

11.62 The project description is set out in Chapter 4: Project Description, with this chapter also containing the assumptions about the Dounreay Trí project's envelope (the Design Envelope). Specific assumptions relevant to the assessment in this chapter are described in the section below.

Design Envelope

11.63 The EIA process makes use of a design envelope, an approach to assessment applied where the final design has not been confirmed ahead of assessment. This approach is based in planning law and has been adopted in connection with other offshore and marine renewable consent applications where a level of flexibility is required in the Project Description.

11.64 The design envelope describes the limits of design proposed for the development, providing both minimum and maximum parameters within which the project worst case scenario will be assessed. A design envelop is used when the final design of a project has not been agreed but due to restrictions on timescale, the assessment and consenting processes must be progressed. So long as the final design of the project remains within those maximum parameters which were assessed any parameters within this envelope can be considered to have also been assessed.

11.65 The adoption of a design envelope approach allows meaningful EIA to take place by defining a realistic worst case scenario ("RWCS") that decision makers can consider in determining the acceptability, or otherwise, of the environmental impacts of a project. As long as a project's technical and engineering parameters fall within the limits of the envelope and the EIA process has considered the impacts of that envelope and provides robust and justifiable conclusions, then flexibility within those parameters is deemed to be permissible within the terms of any consent granted (i.e. if consent is granted on the assessed maximum parameters of a development, any parameters equal to or less than those assessed is permitted to be constructed).

11.66 For marine ornithology, collision risk and displacement are the two primary impacts likely to arise from the Dounreay Trí project. To ensure the assessment adequately covers all potential variations in the design, the RWCS has been assessed which ensures that all other variations within those maximum parameter are assessed by proxy.

11.67 Table 11-4 describes the RWCS for marine ornithology.

Table 11-4 RWCS for marine ornithological assessement

Potential Effect	Design Envelope Parameter	Value / description
During construction		
Potential impact of disturbance / displacement / exclusion due to construction noise or physical presence.	Maximum number of construction vessels.	**Construction:** Cable installation (1 week in Q2 2018) • 1 medium size cable laying vessel; and • 1 dive support vessel. Positioning of mooring (1 week in Q2 2018) • 1 Anchor Handling Tug Supply ("AHTS") vessel; and • 1 flat deck barge and tug. Platform tow (3 days in Q2 2018) • Up to 4 AHTS vessels. Platform connection (5 days in Q2 20182) • 4 AHTS vessels; • 1 dive support vessel; and • 1 workboat. Scour Protection (if necessary, Q3 2018) • 1 dynamically-positioned ("DP")

Potential Effect	Design Envelope Parameter	Value / description
		fall-pipe vessel; and • 1 crew boat. Commissioning (1 month – Q3 2018) • 1 crew boat. **Operation and Maintenance:** Turbine Maintenance • Crew vessels; • Possible side scan sonar for inspections; and • Pressure washers for cleaning.
	Maximum construction duration.	• Maximum construction window of 3 months, subject to weather.
Potential for a barrier effect due to physical presence.	Presence of vessels and turbine structures.	• Vessels – as above under Maximum number of construction vessels parameter; and • 2 turbines of maximum height 201m and rotor diameter 154m.
Potential change in habitat / prey availability.	Presence of vessels involved in installation and placement of mooring system on seabed.	• Vessels – as above under Maximum number of construction vessels parameter; and • 9m^2 30 ton Stevpris Mk 5 anchors; • Scour protection 20m out from the centre of the anchor and to a height of 2m above the seabed; and • 8 mooring lines each approximately 800m long, with up to 75% being in contact with the seabed.
Potential increase in suspended sediment affecting visibility.	Placement of mooring system on the seabed; and Installation of export cable.	• 9m^2 30 ton Stevpris Mk 5 anchors; • Scour protection 20m out from the centre of the anchor and to a height of 2m above the seabed; • 8 mooring lines each approximately 800m long, with up to 75% being in contact with the seabed; and • Export cable of between 6 and

Potential Effect	Design Envelope Parameter	Value / description
		13.8km length, to be installed by ploughing, jetting or vertical injection.
Operation		
Collision risk, in particular for migratory species / populations.	Largest rotor swept area.	• Rotor swept area of 18,626m^2.
Potential impact of disturbance / displacement / exclusion due to physical presence, marine noise and maintenance works.	Maximum foundation size and presence of maintenance vessels.	• Platform of 250m x 75m dimension; and • Up to 11 visits per annum for maintenance (8 visits per turbine for fault rectification and up to 3 for major component replacement).
Potential for a barrier effect due to physical presence.	Presence of vessels and turbine structures.	• 2 turbines of maximum height 201m and rotor diameter 154m; and • Up to 11 (8 visits per turbine for fault rectification and up to 3 for major component replacement).
Potential change in habitat/prey availability.	Presence of vessels, mooring system and turbine structures.	• 2 turbines of maximum height 201m and rotor diameter 154m; • Up to 11 visits per annum for maintenance; • Presence of 9m^2 30 ton Stevpris Mk 5 anchors; • Scour protection 20m out from the centre of the anchor and to a height of 2m above the seabed; and • 8 mooring lines each approximately 800m long, with up to 75% being in contact with the seabed.
Potential increase in suspended sediment affecting visibility.	Presence of mooring system on the seabed.	• 8 mooring lines each approximately 800m long, with up to 75% being in contact with the seabed.
Creation of a roosting habitat or foraging opportunities.	Presence of foundation structure.	• Platform of 250m x 75m dimension.

Potential Effect	Design Envelope Parameter	Value / description
Decommissioning		
Potential impacts arising from decommissioning phase are expected to be similar to but not exceeding those arising during the construction phase, and would be temporary and of short duration.		

Methods of Prediction

11.68 Potential ***effects*** have been identified and the significance of the ***impact*** arising has been assessed for each stage of the project lifecycle, with a significance being attributed relative to the background conditions.

11.69 Although *effects* and *impacts* are often used interchangeably in this ES, an ***effect*** is defined as a physical change in the environment as a result of an action or activity related to the development and an ***impact*** is defined as the consequence of that change.

11.70 The following impacts have been considered:

- Direct;
- Indirect; and
- Cumulative.

11.71 The overall methodology for impact assessment is as described in Chapter 5: EIA Methodology.

11.72 Significance is attributed using the following attributes:

Magnitude of Effect

11.73 Magnitude of Effect is based on the following four criteria:

- Spatial extent;
- Duration;
- Frequency;
- Severity.

11.74 For marine ornithology, the characteristics are defined as follows (see table 11-5 and table 11-6).

Table 11-5 Magnitude of effect categorisation

Characteristic	Categories	Description
Spatial extent	Negligible	• The effect occurs over a very small distance, only within the spatial extent of the source.
	Low	• The effect occurs beyond the source to 200m in all directions.
	Medium	• The effect occurs beyond the source to 1km in all directions.
	High	• The effect occurs beyond the source to 10km in

Characteristic	Categories	Description
		all directions.
Duration	Negligible	• Immediate or over a period of hours.
	Low	• Occurs over more than one day.
	Medium	• Occurs over several months
	High	• Sustained for the duration of the project.
Frequency	Negligible	• Occurs once.
	Low	• Occurs once per month.
	Medium	• Occurs once per day.
	High	• Occurs multiple times per day.
Severity	Negligible	• Very slight reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Reduction not detectable or barely discernible, approximating to the “no change” situation. Guide: <1% population affected, <1% change factor in mortality or productivity rate.
	Low	• Small but discernible reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 1 – 5% of population affected, 1 – 5% change factor in mortality or productivity rate.
	Medium	• Partial reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 6 – 20% of population affected, 6 – 20% change factor in mortality or productivity rate.
	High	• Major reduction in the status or productivity of a bird population due to mortality or displacement or disturbance. Guide: 21 – 50% of population affected, 21 – 50% change factor in mortality or productivity rate.

Sensitivity of the Receptor

11.75 The sensitivity of the receptor is also taken into account and is attributed according to the following characteristics:

- Adaptability;
- Tolerance;
- Recoverability; and

- Value.

Table 11-6 Sensitivity of receptor categorisation

Characteristic	Categories	Description
Adaptability	Negligible	Large foraging range and range of foraging habitats available
	Low	Restricted foraging range
	Medium	Restricted foraging habitat
	High	Restricted foraging range and foraging habitat available
Tolerance	Negligible	Receptor population generally tolerant of effect. e.g., likely to have moderate capacity to absorb additional mortality or reduced in productivity or habitat loss, so a population level effect very unlikely.
	Low	Receptor population has some tolerance of effect. e.g., likely to have minor capacity to absorb additional mortality or reduced in productivity or habitat loss, so a population level effect unlikely.
	Medium	Receptor population has limited tolerance of effect. e.g., very minor capacity to absorb change so a population level effect possible. Likely to include but not be limited to populations with poor existing conservation status
	High	Receptor population has very limited tolerance of effect. e.g., likely to have no capacity to absorb change, so a population level effect likely. Likely to be limited to populations with poor existing conservation status
Recoverability	Negligible	High annual reproductive output (multi-brooded and multiple chicks fledged per brood).
	Low	Single-brooded and more than two chicks raised to fledging.
	Medium	Single brooded and two chick raised to fledging.
	High	Low annual reproductive output. Single brooded and single chick fledged.
Value	Negligible	Species not listed in any of the categories below.
	Low	Species listed on Local Biodiversity Action Plan species not included in categories below. Other species making use of the area in locally

Characteristic	Categories	Description
		important numbers (in the absence of defined local populations, this is defined as 0.1% to 1% of regional population).
	Medium	Other species listed in Birds of Conservation Concern (BOCC) 'Red' list. Other species making use of the area in regionally important numbers (>1% regional population).
	High	Species listed in Annex 1 of the EU Birds Directive. Species listed on the IUCN threatened list. Breeding species listed on Schedule 1 of the Wildlife and Countryside Act (WCA). Species making use of the area in nationally important numbers (>1% national population).

11.76 In order to define the tolerance of species to key impacts for seabirds, the assessments provided by Furness *et al.* (2013) and Furness *et al.* (2012) were used and presented in Table 11-7.

Table 11-7 Species vulnerability to disturbance by vessels (Furness *et al.* 2012), displacement by structures (Furness *et al.* 2012) and collision risk with offshore wind turbines (Furness *et al.* 2013).

Species	Sensitivity to disturbance by vessels	Sensitivity to displacement by structures	Sensitivity to collision risk
	Score out of 5	Score out of 5	Risk score
Fulmar	1	1	48
Gannet	2	2	725
Great skua	1	1	320
Kittiwake	2	1	523
Herring gull	2	1	1306
Great black-backed gull	2	1	1225
Arctic tern	2	2	198
Common guillemot	3	1	37
Razorbill	3	2	32
Puffin	2	2	27

Significance of Impact

11.77 Following the identification of sources, effects, receptors and impacts, an assessment of the significance of the impact can be undertaken, relevant to the specific receptors.

11.78 Significance is determined through consideration of both the magnitude of effect and the vulnerability of the receptor. The assessed level of magnitude and vulnerability are put into a matrix to determine the overall level of significance of the impact on a given receptor.

11.79 All impacts have a level of significance but not necessarily a high significance. The classifications for magnitude and vulnerability will be defined on a topic by topic basis, i.e., the level or limit that is considered to be 'high', 'moderate', 'low' or 'negligible'. Through this, significance can be defined through expert judgement for specific topics.

11.80 For example, an effect of high magnitude acting on a highly vulnerable receptor will result in the impact being assessed as having a major significance (see Table 11-8 below).

11.81 Those impacts assessed as moderate or major significance are considered to require mitigation measures to be applied.

Table 11-8 Matrix for determining significance

		Magnitude			
		Negligible	**Low**	**Medium**	**High**
Vulnerability	**Negligible**	Negligible significance	Minor significance	Minor significance	Moderate significance
	Low	Minor significance	Minor significance	Moderate significance	Moderate significance
	Medium	Minor significance	Moderate significance	Moderate significance	Major significance
	High	Moderate significance	Moderate significance	Major significance	Major significance

11.82 Overall significance can be qualified by attributing uncertainty for example, the use of potentially unreliable or incomplete data sets could skew the assessment. Floating wind technology is new and there are no consented and operational sites, the lack of comparable real world developments may also add to the uncertainty.

11.83 The overall significance however, does not change, rather a note of caution is applied to the conclusions.

11.4 Description of the Current Environment

Study Area

11.84 The Dounreay Trí project is located near to a number of important bird sites which have been classified as SPA under the Birds Directive. The most significant of these are likely to be the North Caithness Cliffs SPA to the east, which holds internationally important concentrations of guillemot, and an internationally important breeding assemblage of seabirds including fulmar, kittiwake, razorbill and puffin. These seabird species are likely to use the waters in and around the Dounreay Trí project for feeding.

11.85 Further afield are SPAs classified for nesting seabirds (which are likely to be ecologically linked) are internationally important seabird colonies at Hoy SPA and Sule Skerry and Sule Stack SPA. The former holds nationally important concentrations of nesting red-throated divers *Gavia stellata* and internationally important concentrations of breeding great skuas, and an internationally important breeding assemblage of seabirds, including fulmar, kittiwake, great black-backed gull, Arctic skua *Stercorarius parasiticus*, guillemot and puffin.

11.86 The latter SPA comprises two offshore islands which hold nationally important concentrations of European storm-petrel *Hydrobates pelagicus* and Leach's storm-petrel *Oceanodroma leuchoroa*, and internationally important breeding numbers of gannet and puffin, and an internationally important breeding assemblage comprising also shag *Phalacrocorax aristotelis* and guillemot.

11.87 A total of 4960 birds of 14 species were recorded during thirteen surveys from January to December 2015 with two surveys undertaken in June. The identification rate to species was over 97%. The primary observations from the surveys to date are:

- Low to moderate density of fulmars were recorded, mainly during the winter months, but a peak in August was likely to have been of young birds leaving their nest sites;
- Low density of gannets were present, and these increased in numbers in late June and again in August, although most of these were in the buffer area around the project site;
- Kittiwakes were one of the commonest species recorded during these surveys and reached moderate density in June;
- A low density of great black-backed gulls was recorded with peak abundance in August. Few other large gulls present in these surveys. Only a very small sample size of flight heights was possible for this species;
- Arctic terns were found to be present at moderate density during the June and July surveys;
- Guillemots were the commonest species recorded and high density was found to occur in the two June surveys, then again at the end of the survey period in November and December;
- Razorbills were only present at low density in the study area and were also found to be most abundant in the summer months;
- The density of puffins was generally found to be low to moderate, but one of the June surveys found very high density of this species which was not present in a follow-up survey less than three weeks later, suggesting that this concentration was ephemeral and highly likely to be an exploitation of a temporary food source; and
- The total number of objects detected in each survey flight which were assigned to species level are presented in Table 11-9.

11.88 The behaviour of seabirds has been categorised as follows: flying and sitting. The number of each observed in presented in Table 11-10.

- Fulmar fluctuated in the number of individuals flying with an overall percentage of 38% flying between January and December. All fulmars in January, the first June survey, October and December were flying. The lowest percentage recorded flying was in August with 13% of observations;

- All gannets recorded between March and May were flying. When the abundance of the species peaked in the September survey, the percentage was 83%, revealing the variation in behaviour for this species. The lowest percentage recorded flying was in the second June survey of 8%;
- The overall percentage of great skua recorded flying in all months was 66.7%, although the sample size was low;
- The overall percentage of kittiwakes recorded flying was 73%. However, the percentage was greater than this in all surveys except in the April and the first June survey both with 67% of birds flying and second June survey when the percentage flying was 55%. No kittiwake were recorded flying in September;
- All apart from one Arctic tern was recorded flying or 98% of all observations between January and June 2015;
- Flying guillemot had a low percentage (9%) between January and December with the most of this species flying during March at 54% of observations. When abundance peaked in the first and second June surveys, the percentage flying was just 1% and 3% respectively;
- All razorbills recorded were sitting on the sea;
- Only one (1) individual puffin was observed flying in April and three (3) individuals were observed flying in the first June survey. Continuing through the year, only one (1) puffin was recorded flying in July and August. No puffins were observed flying in the remaining months; and
- Great black-backed gull had the highest percentage of flying birds in February with 75%, 67% in January and December and 31% in March.

Table 11-9 Number of observations detected during each survey assigned to species level

Species	Jan	Feb	Mar	Apr	May	Jun (i)	Jun (ii)	Jul	Aug	Sep	Oct	Nov	Dec	Total
Fulmar ***Fulmarus glacialis***	42	47	26	61	4	11	9	10	543	13	2	65	1	834
Gannet ***Morus bassanus***	0	0	4	2	1	5	36	0	45	36	7	3	0	139
Red-throated diver ***Gavia stellata***	0	0	0	0	0	0	1	0	0	1	0	0	0	2
Great northern diver ***Gavia immer***	0	0	0	0	0	0	1	0	0	0	0	0	0	1
Manx shearwater ***Puffinus puffinus***	0	0	0	0	0	0	0	5	0	0	0	0	0	5
Great skua ***Stercorarius skua***	0	0	0	0	2	1	3	0	2	0	0	0	0	8
Kittiwake ***Rissa tridactyla***	3	10	12	21	5	131	116	0	7	6	5	109	84	509
Common gull ***Larus canus***	1	1	0	0	0	0	0	0	0	0	1	0	0	3
Great black-backed gull ***Larus marinus***	6	4	13	0	0	0	0	0	39	0	10	4	6	82
Arctic tern ***Sterna paradisaea***	0	0	0	0	0	3	39	38	0	0	3	0	0	83
Guillemot	102	86	139	77	132	223	259	191	11	62	123	181	195	1781

Species	Jan	Feb	Mar	Apr	May	Jun (i)	Jun (ii)	Jul	Aug	Sep	Oct	Nov	Dec	Total
Uria aalge														
Razorbill ***Alca torda***	7	0	0	2	4	4	34	4	0	9	3	2	9	78
Puffin ***Fratercula arctica***	0	0	0	5	44	1174	130	12	43	4	2	0	0	1414
Total	**163**	**155**	**200**	**168**	**193**	**1552**	**630**	**261**	**690**	**131**	**156**	**365**	**299**	**4963**

Table 11-9 Summary of seabird behaviours between January and December 2015

Species	Number recorded flying	Number recorded sitting	% Flying	Total
Fulmar	318	516	38%	834
Manx shearwater	0	4	0%	5
Gannet	62	77	45%	139
Red-throated diver	1	1	50%	2
Great northern diver	0	1	0%	1
Great skua	5	3	63%	8
Kittiwake	436	161	73%	597
Common gull	3	0	100%	3
Herring gull	1	2	33%	3
Great black-backed gull	16	66	20%	82
Arctic tern	79	1	99%	80
Guillemot	165	1616	9%	1781
Razorbill	0	75	0%	75
Puffin	6	1408	0%	1414
No ID				
Fulmar / gull species	4	11	27%	15
Small gull species	0	1	0%	1
Large gull species	3	7	30%	10
Gull species	0	1	0%	1
Tern species	1	0	100%	1
Large auk	13	32	29%	45
Auk species	7	77	8%	84
Auk / small gull	1	1	50%	2
Large auk / diver species	0	2	0%	2
Total	**1121**	**4063**	**22%**	**5185**

Summary of Species/Specifics Not Taken Forward to the Assessment Phase

11.89 Species in which fewer than 10 individuals were recorded during the entire digital video aerial survey programme were not taken any further for assessment of impacts. These were:

- Red-throated diver;
- Great northern diver;
- Manx shearwater; and
- Common gull.

Summary of Species/Specifics Taken Forward to the Assessment Phase

11.90 Ten species were recorded more than ten times during the digital video aerial surveys and are considered for further assessment of impacts during the different phases of construction and operation of the Dounreay Trí project. These are:

- Fulmar;
- Gannet;
- Great skua;
- Kittiwake;
- Herring gull;
- Great black-backed gull;
- Arctic tern;
- Guillemot;
- Razorbill; and
- Puffin.

Regional receptor populations for seabird species

11.91 The impact assessment of seabirds for the Dounreay Trí Demonstration Project compares estimates of the number of seabirds that might potentially be impacted with the smallest biologically meaningful population for each of the ten seabird species. During the breeding season, this is defined as the population that might potentially be able to reach the project site from their known nest sites and is referred to as the regional breeding population. Outwith the breeding season, the potentially impacted seabirds are likely to originate from a much wider population base on account of the highly mobile nature of seabird species. In this case, the regional receptor populations are referred to as the biologically defined minimum population size ("BDMPS").

11.92 To calculate the regional breeding population for each species, maximum potential species-specific foraging range was used as defined by Thaxter *et al.* (2012) and are presented in Table 11-10.

Table 11-10 Maximum foraging ranges during the breeding season for key seabird species for the Dounreay Trí proposed site that occur during the breeding season (after Thaxter *et al.* 2012 unless stated).

Species	Maximum foraging range
Northern fulmar	580km
Northern gannet	590km
Great skua	219km
Black-legged kittiwake	231km[b]
Herring gull	61km
Great black-backed gull	60km[a]
Common guillemot	340km[b]
Razorbill	312km[b]
Atlantic puffin	200km

[a] Seys *et al.* (2001)

[b] FAME (2012).

11.93 The numbers of seabirds that breed within these ranges from the Dounreay Trí site were calculated by addition from the JNCC Seabird 2000 database (JNCC, 2010), which was plotted using ArcGIS v 10.3.1, and selected using buffers of the appropriate size from the development for each species. This was method was used for the initial selection, then where the buffer over-estimated the number of colonies within range, because the species would have to fly over land in order to reach the site, then some of the more distant nest sites were removed from the selection. This was carried out for fulmar, gannet, guillemot, razorbill and puffin for colonies in the North Sea and in south-west Scotland and north-west Ireland. This size of the buffers and the potential seabird colonies for all species within the buffers is presented in Table 11-10 and Figure 11-2. The number of breeding adults was calculated as the number of pairs multiplied by two, or for species in which census data are provided as individuals counted at each colony, then a multiplication of 1.34 was used as recommended by Mitchell *et al.* (2004). For kittiwake, there has been a significant decline in the number of nesting pairs in the North of Scotland since the Seabird 2000 census was carried out, and a multiplication factor of 0.55 was used to provide a more precautionary regional breeding population for this species based on data in JNCC (2015).

11.94 BDMPS populations for the periods of the year when seabirds are not breeding have recently been defined through a process of extensive literature review by Furness (2014). The BDMPS non-breeding population for a species that includes the waters off eastern Scotland (the North Sea area) is considered to be an appropriate for definition of non-breeding season seabird receptor populations. In cases where Furness (2014) splits the non-breeding season into more than one period, the smallest of the population sizes given is chosen as this provides the most cautious basis for assessments.

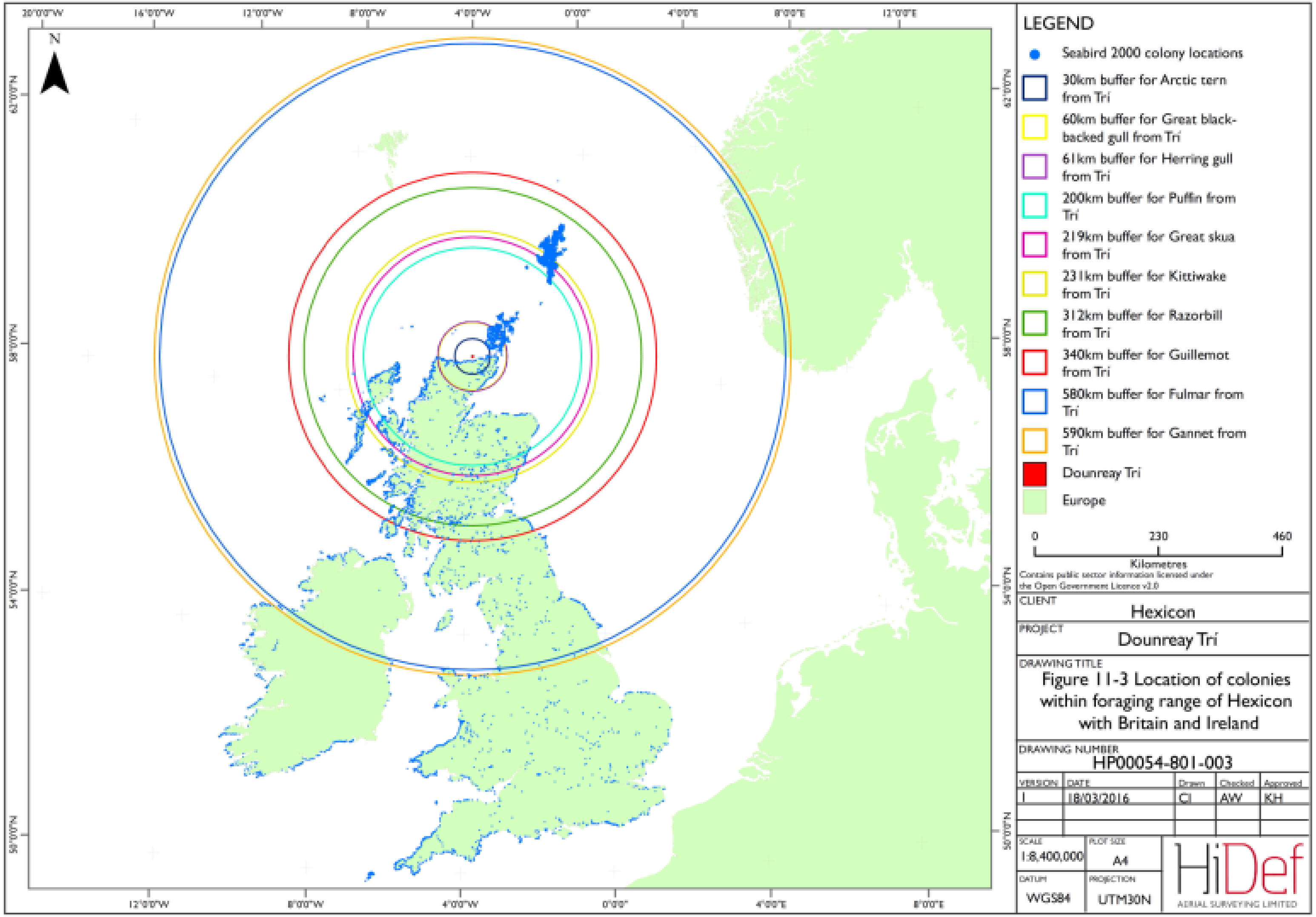

Figure 11-2 Extent of foraging range buffers for breeding seabirds and location of UK seabird colonies around the Dounreay Trí proposed site

11.95 To calculate the number of each species that might be impacted by the development, a buffer of 1km was created around the maximum dimensions of the single structure, thus a circle of 1.125km was used. This resulted in an impact area of 3.96 km^2 and this figure was multiplied by the density of each seabird species, and the upper confidence interval reported in Irwin *et al*. (2015) to give the impacted number and the upper confidence range for the impacted number. The density recorded at sea reported by Irwin *et al*. (2015) was of all ages of birds and all behaviours, so where comparison was required with the breeding population, this figure was multiplied by the proportion of adults in each survey in Irwin *et al*. (2015). For comparison of populations in the collision risk modelling, it was further necessary to calculate the number of birds that would be flying from the generic density estimates. In this case, the estimated impacted number was multiplied by the percentage of flying birds of the relevant species in each survey taken from Irwin *et al*. (2015).

11.96 In order to calculate the numbers of individuals impacted by displacement or disturbance, the numbers were calculated as the average for each month, and this impacted number was assumed to be sustained throughout the relevant season (i.e. breeding season or non-breeding season) that the average was calculated over.

Seabird species

Fulmar

11.97 Northern fulmar is a common seabird species nesting throughout the United Kingdom and present in northern Scottish waters throughout the year. Low to moderate density of this species was recorded during digital video aerial surveys of the study area around the proposed development site (Irwin *et al*. 2015). It has undergone a moderate decline in breeding numbers during the last 20 years (JNCC 2015).

11.98 On account of the large foraging range of this species during the breeding season (580km), a large number of breeding fulmars could potentially fly to the proposed development site from their nest site. Some of these colonies are SPAs. The reference population during the breeding season was 975,826 adults, and during the non-breeding period a BDMPS of 568,736 was used. It is not possible to distinguish adult from sub-adult fulmars in field surveys, consequently the density of all birds was always referenced to the breeding population. The estimated number of birds within 1km of the proposed development was low with 16 and 32 individuals in the breeding and non-breeding period, respectively. Consequently, the magnitude of any impact on the receptor populations of fulmar was always very small for this species at any time of the year.

11.99 Fulmar has low sensitivity to most human impacts, and was classified as being of low sensitivity to vessel disturbance, displacement by structures and to collision risk (Table 11-6). Because of the low sensitivity and the inevitably low magnitude of any impact, this species was a low priority in this impact assessment.

Gannet

11.100 Northern gannet is also a common seabird that breeds at a small number of very large colonies around the UK, but especially in the north of Scotland. Some of these colonies are SPAs. The species is present throughout the year in the UK, but in greatly reduced numbers during the winter. Gannets were recorded only during the spring, summer and early autumn during digital video aerial surveys in low to moderate density. The species has undergone historical increases in numbers as a breeding species, although these numbers have, in general, reached a plateau (JNCC 2015).

11.101 Gannets also have a large foraging range from their colonies and could potentially reach the proposed development site from as far as 570km away. Consequently, the reference breeding population for this species is large at 376,066 individuals, and during the non-breeding season a BDMPS of 248,385 individuals was used. It is possible to distinguish between adult and sub-adult gannets during digital video aerial surveys. Because of the usually low density of gannets detected during these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is also low at 8 and 1 birds in the breeding and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always very small for this species, even during the breeding season when this species' abundance is highest.

11.102 Gannets have low sensitivity to most human impacts and this species was classified as having low sensitivity to disturbance by vessels and displacement by structures, and as having medium sensitivity to collision with turbines (Table 11-6). Gannets were given low priority for the first two of these impacts and higher priority for collision risk modelling.

Great skua

11.103 Great skua, or bonxie to use its local name, breeds commonly in the Northern Isles and Western Isles and almost all of these spend the winter to the south of SW England. A high proportion of the global population of this species breeds in the UK, meaning that this species has a high conservation status. Great skuas were only recorded during the spring, summer and early autumn digital video aerial surveys and generally at very low density within the study site. This species has increased in number and range as a breeding bird in the UK, although it is likely that this increase has been followed by a decrease in parts of the species range in the Northern Isles.

11.104 Great skuas have a moderate foraging range from their colonies compared to other seabird species, and could potentially reach the proposed site from 219km away. Consequently, the reference breeding population for this species is large at 11,830 individuals, and during the non-breeding season a BDMPS of 19,556 individuals was used. It is possible to distinguish between adult and juvenile great skuas during digital video aerial surveys. Because of the usually low density of great skuas detected during these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is also low at 1 and 0 birds in the breeding and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always very small for this species, even during the breeding season when this species' abundance is highest.

11.105 Great skuas have low sensitivity to most human impacts and this species was classified as having very low sensitivity to disturbance by vessels and displacement by structures, and as having low sensitivity to collision with Turbine structures (Table 11-6). Great skuas were given low priority for the first two of these impacts and higher priority for collision risk modelling.

Kittiwake

11.106 Kittiwake breeds commonly in northern UK and although the species is present in UK waters throughout the year, birds of all ages disperse from their nesting area widely across the Atlantic Ocean. Kittiwakes were recorded throughout the year during digital video aerial surveys, mostly at low moderate density, but at high density in June. This species has undergone a rapid decline in its breeding population in the north of Scotland with declines of over 50% since the last census in 2000.

11.107 Kittiwakes have a moderate foraging range from their colonies compared to other seabird species, and could potentially reach the proposed site from 231km away. Consequently, the reference breeding population for this species is large at 211,465 individuals, and during the non-breeding season a BDMPS of 627,816 individuals was used. It is possible to distinguish between adult and immature kittiwakes during digital video aerial surveys. The numbers of birds estimated to be impacted within 1km of the proposed development is also low at 46 and 29 birds in the breeding and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always very small for this species, even during the breeding season when this species' abundance is highest.

11.108 Kittiwakes have low sensitivity to most human impacts and this species was classified as having low sensitivity to disturbance by vessels and low sensitivity to displacement by structures, and medium sensitivity to collision with Turbine structures (Table 11-6). Kittiwakes were given low priority for the first two of these impacts and higher priority for collision risk modelling.

Herring gull

11.109 Herring gull breeds commonly throughout the UK, including many that occur at inland sites and in urban environments. The species occurs widely throughout the UK at sea, generally close to the shore, with numbers augmented by visiting Scandinavian breeding birds during the non-breeding season. Herring gulls were only recorded in the study area in autumn during digital video aerial surveys at low density. This species has undergone a steady decline in its breeding population in the UK for a various reasons since the mid-1970s.

11.110 Herring gulls have a small foraging range from their colonies compared to other seabird species, and could potentially reach the proposed site from 61km away. In spite of this, the reference breeding population for this species is still large at 11,830 individuals, and during the non-breeding season a BDMPS of 466,511 individuals was used. It is possible to distinguish between adult and immature herring gulls during digital video aerial surveys. Because of the usually low density of Herring gulls detected during these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is also low at 0 and 1 bird in the breeding and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always very small for this species, even during the breeding season when this species' abundance is highest.

11.111 Herring gulls have low sensitivity to most human impacts and this species was classified as having low sensitivity to disturbance by vessels and very low sensitivity to displacement by structures, and as having medium sensitivity to collision with Turbine structures (Table 11-6). Herring gulls were given low priority for the first two of these impacts and higher priority for collision risk modelling.

Great black-backed gull

11.112 Great black-backed gull breeds commonly throughout the UK but in lower numbers than the previous species and has a more northerly distribution. Some also breed inland. The species occurs widely throughout the UK at sea, generally close to the shore, with numbers also augmented by visiting birds from Scandinavia during the non-breeding season. Great black-backed gulls were only recorded in the study area in autumn and winter during digital video aerial surveys at low density. This species has also undergone a steady but slight decline in its breeding population in the UK for a various reasons since the mid-1970s.

11.113 Great black-backed gulls have a small foraging range from their colonies compared to other seabird species, and could potentially reach the proposed site from 60km away. In spite of this, the reference breeding population for this species is still large at 4118 individuals, and during the non-breeding season a BDMPS of 91,399 individuals was used. It is possible to distinguish between adult and immature great black-backed gulls during digital video aerial surveys. Because of the usually low density of this species detected during these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is also low at 0 and 7 birds in the breeding and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always very small for this species, even during the breeding season when this species' abundance is highest.

11.114 Great black-backed gulls have low sensitivity to most human impacts and this species was classified as having low sensitivity to disturbance by vessels and very low sensitivity to displacement by structures, and as having medium sensitivity to collision with turbine structures (Table 11-6). Great black-backed gulls were given low priority for the first two of these impacts and higher priority for collision risk modelling.

Arctic tern

11.115 Arctic terns breed commonly throughout northern UK either in small, scattered colonies or sometimes in large numbers. The species occurs widely at sea around the northern UK and has the most offshore distribution of all of the common tern species but only during the summer and autumn. Arctic terns were only recorded in the study area in some of the summer months and early autumn during digital video aerial surveys at moderate density. This species has also undergone a steady decline in its breeding population in the UK since a peak in the early 1980s.

11.116 Arctic terns have a small foraging range from their colonies compared to other seabird species, and could potentially reach the proposed site from 30km away. Consequently, the reference breeding population for this species is very small at just 62 individuals, and during the non-breeding season a BDMPS of 163,930 individuals was used. It is possible to distinguish between adult and immature Arctic terns during digital video aerial surveys. Because of the usually moderate density of this species detected during these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is moderately high at 20 and 0 birds in the breeding period. Consequently the magnitude of any impact on the receptor populations was moderate for this species. This would appear to be an anomaly as there is no reason to believe that there is anything special about the proposed location of the wind turbines that would attract such a high proportion of the regional breeding population and surveys undertaken at projects in close proximity have shown similar moderate densities.

11.117 The most plausible explanation for why such relatively high density of Arctic terns were present during the surveys could be because there was low regional density of the species during the Seabird 2000 census, and that there has been a substantial influx since those surveys. This is a frequent phenomenon for Arctic terns in which colonies may be deserted and new colonies established nearby (Mitchell *et al.* 2004). The waters around the proposed wind farm site may have been used by non-breeding birds. The Arctic terns were travelling from much further away than 30km from their nest sites. The ephemeral and brief nature of the presence of these feeding concentrations also suggests that the proposed site of the Dounreay Trí project, the magnitude of any potential impacts should be scaled downwards.

11.118 Arctic terns have low sensitivity to most human impacts and this species was classified as having low sensitivity to disturbance by vessels and low sensitivity to displacement by structures, and as having low sensitivity to collision with turbine structures (Table 11-6). Arctic terns were given low priority for the first and last of these impacts and higher priority for assessment for displacement by structures.

Guillemot

11.119 Guillemot breeds abundantly around the UK but is most abundant in the north. The species occurs widely throughout the UK at sea where it is often the most abundant species recorded in any offshore survey at all times of the year. Guillemots were the most abundant species recorded throughout the year in all but one month during digital video aerial surveys at moderate to high density. This species becomes flightless for an extended period during July and August when the male parent accompanies its chick out to sea. This species has also undergone a slight decline in its breeding population in the UK for since the late 1990s.

11.120 Guillemots have a large foraging range from their colonies compared to other seabird species, and could potentially reach the proposed site from 340km away. Because of this, the reference breeding population for this species is very large at 1,380,255 individuals, and during the non-breeding season a BDMPS of 1,617,306 individuals was used. It is possible to distinguish between adult and juvenile guillemots during digital video aerial surveys for only a short period during late June to early August. Because of the usually high density of guillemots detected during these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is also relatively high compared with other species, but still low at 189, 14 and 140 birds in the breeding and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always very small for this species, even during the breeding season when this species' abundance is highest.

11.121 Guillemots have low sensitivity to most human impacts and this species was classified as having medium sensitivity to disturbance by vessels and very low sensitivity to displacement by structures, and as having very low sensitivity to collision with turbine structures (Table 11-6). Guillemots were given low priority for collision risk modelling and higher priority for the first two of these impacts.

Razorbill

11.122 The razorbill breeds commonly around the UK but is most common in the north and west. The species occurs widely throughout the UK at sea where it can sometimes occur in dense concentrations with guillemots. The species is most abundant during the summer and autumn months, and disperses mainly southwards during the winter. Razorbills were recorded intermittently at low density in the study area throughout the year, but were most abundant at the height of the breeding season during digital video aerial surveys. This species becomes flightless for an extended period during July and August when the male parent accompanies its chick out to sea. This species has also undergone a slight decline in its breeding population in the UK for since the late 1990s.

11.123 Razorbills have a large foraging range from their colonies compared to other seabird species, and could potentially reach the proposed site from 312km away. Because of this, the reference breeding population for this species is large at 129,907 individuals, and during the non-breeding season a BDMPS of 218,622 individuals was used. It is possible to distinguish between adult and juvenile razorbills during digital video aerial surveys for only a short period during late June to early August. Because of the usually low density of razorbills detected during these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is also low at 7, 0 and 4 birds in the breeding, autumn moult and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always very small for this species, even during the breeding season when this species' abundance is highest.

11.124 Razorbills have low sensitivity to most human impacts and this species was classified as having medium sensitivity to disturbance by vessels and low sensitivity to displacement by structures, and as having very low sensitivity to collision with Turbine structures (Table 11-6). Razorbills were given low priority for collision risk modelling and higher priority for the first two of these impacts.

Puffin

11.125 Puffins are cheeky looking chappies that breed commonly around the north and west of the UK, most abundantly on remote offshore islands. The species occurs at sea widely throughout the UK where it can sometimes occur in dense concentrations with other seabird species. Puffins are most abundant during the spring, summer and autumn, and disperse mainly westwards during the winter. Puffins were recorded mostly at low density in the study area between April and October, but were most abundant in June at the height of the breeding season during digital video aerial surveys. One particular survey is of special note during June when very high density of puffins was recorded, but an additional survey carried out two weeks later recorded much lower density, illustrating the ephemeral nature of this particular feeding concentration. This species has also undergone a slight decline in its breeding population in the UK for since the late 1990s.

11.126 Puffins have a large foraging range from their colonies compared to many other seabird species, and could potentially reach the proposed site from 200km away. Because of this, the reference breeding population for this species is large at 89,906 individuals, and during the non-breeding season a BDMPS of 231,957 individuals was used. It is not possible to distinguish between adult and immature puffins during digital video aerial surveys. Because of the usually low density of puffins detected during most of these surveys, the numbers of birds estimated to be impacted within 1km of the proposed development is low at 187 and 2 birds in the breeding and the non-breeding periods, respectively. Consequently the magnitude of any impact on the receptor populations was always low for this species, even during the breeding season when this species' abundance is highest.

11.127 Puffins have low sensitivity to most human impacts and this species was classified as having low sensitivity to disturbance by vessels and displacement by structures, and as having very low sensitivity to collision with Turbine structures (Table 11-6). Puffins were given low priority for disturbance by vessels and collision risk modelling and higher priority for displacement by structures.

11.5 Impact Assessment - Construction Phase

Potential impact of disturbance / displacement / exclusion due to construction noise or physical presence

11.128 Construction and installation activities have the potential to disturb seabirds foraging in the marine environment.

11.129 The construction phase will take place over approximately 2 – 3 month in 2017, subject to weather, although construction vessels are likely to be on site for only about half this period. Disturbance during the construction phase will therefore likely involve a series of temporary events, over a short duration.

11.130 The effect of disturbance during the construction phase would be to temporarily displace birds from the vicinity of the Dounreay Trí site and can therefore be considered as temporary habitat loss.

11.131 Although disturbance would be likely to occur across the Dounreay Trí site and export cable corridor, at any one time it would be spatially limited to where the vessels are operating. Vessels moving between the construction port and the Dounreay Trí area would also have the potential to disturb seabirds; however, given the limited vessel movements and the infrequency of those movements, it would be likely to only result in very short term and spatially limited disturbance, as each individual vessel transited an area.

11.132 This assessment has considered the worst case to be that vessel disturbance results in all seabirds leaving the “area of influence” (quantified as an area of 3.98 km^2 based on the Dounreay Trí project (250m radius) and a 1km buffer) throughout the full 3 months of construction. This worst case can be considered highly unlikely and therefore overly conservative. In reality, no species would be expected to respond in such an extreme manner and any disturbance arising would be spatially limited to a small part of the Dounreay Trí project area.

11.133 Disturbance is likely to have two primary effects:

- Removal of foraging habitat; and
- Increasing the energy burden required for feeding.

11.134 All of the species taken forward for this assessment have large potential foraging areas available and therefore the removal of foraging habitat can be considered negligible in the context of the potential habitat available.

11.135 The required increase in energy required for feeding is unlikely to result in adult mortality, although the potential exists for a reduction in provisioning rates, with a concomitant reduction in population productivity.

11.136 The installation of the export cable also has the potential to disturb seabirds, although this can be considered highly localised and short-term in nature. The total installation window for the export cable is projected to last no more than one week (subject to weather), with the footprint being limited to the export cable corridor and the immediate vicinity of any installation vessels.

11.137 During installation, the vessels used will be moving very slowly and therefore seabirds will be likely to only exhibit a mild response when compared to more rapidly moving vessels (Ronconi & Cassady St. Clair, 2002).

11.138 Individuals more than a few hundred metres from installation vessels are unlikely to exhibit any disturbance behaviour and therefore the area affected will be spatially highly limited. As such, disturbance effects arising from the installation of the export cables can be considered negligible and is therefore not considered further.

11.139 None of the species recorded in the Dounreay Trí project area is considered to have a high vulnerability to vessel disturbance, when using the sensitivity analysis derived by Furness *et al.* (2012).

11.140 However, of those species recorded in the Dounreay Trí project area, only guillemot and razorbill are considered by Furness *et al.* (2012) as having a moderate vulnerability to disturbance and as such may be likely to exhibit disturbance behaviour at distances of up to a few hundred metres from vessels.

11.141 As such, the effects of disturbance and displacement during construction on all species bar guillemot and razorbill can be considered negligible.

11.142 Furness *et al.* (2012) considered that Guillemot and razorbill have a low sensitivity to disturbance during the colony attendance part of the breeding season, as well as during the autumn and winter.

11.143 As a worst case assessment, if vessel disturbance during construction and installation displaced all guillemot and razorbill during April to July (colony attendance) and August to

March (non-breeding period) from the area of influence and 1km buffer, this would result in a short-term displacement of fewer than 0.01% of the population (the estimated 95% UCL of the mean) and has therefore been considered negligible.

11.144 However, Furness *et al.* (2012) considered that when adults take their chicks to sea in August and when adults become flightless during their moult, both guillemots and razorbills have less tolerance to the effects of disturbance and are therefore considered as being of medium sensitivity.

11.145 However, despite this, the effect of indirect and temporary habitat and foraging time loss is considered negligible for both guillemot and razorbill (Table 11-11).

Table 11-11 Summary of disturbance impact characterisation for seabird receptor populations during the construction and installation stage

Species	Season-specific regional receptor population	Sensitivity	Magnitude	Significance
Guillemot and razorbill	Breeding (colony attendance)	Low	Negligible	Negligible
	Breeding (chicks at sea)	Medium	Negligible	Negligible
	Autumn & winter	Negligible	Negligible	Negligible
All other species	All periods	Negligible	Negligible	Negligible

Potential for a barrier effect due to physical presence

11.146 The presence of two offshore wind turbines mounted on a floating foundation has the potential to act as a barrier to the free movement of flying or swimming birds that would normally pass through the site as part of their daily or seasonal movements. This effect is closely related in its nature to displacement, but here we are concerned with consideration of the impact to a receptor population of individuals being potentially prevented from taking their preferred travel route, be this the potential additional time and energy requirements imposed by taking a detoured route or the reduced access to an area.

11.147 Post-construction monitoring studies at much larger offshore wind farms have provided evidence of birds altering course around wind farms. These studies are reviewed Furness *et al.* (2013), though barrier effects are not considered separately from displacement effects. All seabird species that use the Project area are considered by Furness *et al.* (2013) to have low or very low sensitivity (a score of 1 or 2 in Table 11-5) to displacement by structures.

11.148 All the seabirds that were recorded in the Dounreay Trí proposed turbine deployment area are highly mobile species, flying tens or even hundreds of km on a daily basis to move between feeding areas, or between a colony location and their feeding area. These species are also migratory when they may cover distances of hundreds to thousands of km.

11.149 Given that the proposed horizontal dimension for the Dounreay Trí project is 250m, the relatively small size represents a trivial detour for any seabird forced to fly around the turbines in comparison to the daily flights that they might make. For example, an Arctic tern which has a relatively small foraging range from its colony, if making a foraging journey of 10km would, at most, have 2.5% added to each journey as a worst-case scenario. This is certainly a worst case scenario, as it is unlikely that a foraging area during the breeding season would be fixed in its location relative to the location of the breeding site, nor would the angle of the widest point always be oriented perpendicular to the flight line, and nor would all individuals breeding birds use the same feeding area. For this reason, the scenario of a 2.5% increase in the time and energy budget for flying would be irregular and highly likely well below 1% for all seabird species.

11.150 For the regional breeding populations of all seabird species, any barrier effect during the operation and maintenance stage are likely to be small and impact on a few individuals on a few occasions. The impact is judged to be negligible for these receptor populations and therefore not significant

Potential change in habitat/ prey availability

11.151 The presence of the Dounreay Trí project and mooring system are not predicted to cause any adverse effects on seabird prey species (principally small fish such as sand eels, gadoids, clupeids and mackerel); see fish ecology Chapter 9. Therefore no indirect effects on bird species are predicted.

11.6 Impact Assessment - Operational Phase

Potential impact of disturbance / displacement / exclusion due to operations and maintenance activities

11.152 Operation and maintenance (O&M) activities have the potential to disturb seabirds, with the nature of this disturbance being likely to occur over the same spatial area as described for the construction phase.

11.153 Both planned and unplanned maintenance activities are unlikely to cumulatively exceed 3 weeks per year. It must also be expected that the frequency and intensity of vessel activity during O&M activities will be much reduced when comparted to construction, with the concomitant disturbance also being much reduced.

11.154 Based on this, this assessment concludes that the conclusions reached on the impact significance during construction activities also holds true for O&M and therefore the level of impact is negligible.

Potential impact of disturbance / displacement / exclusion due to physical presence

11.155 Structures in the marine environment have the potential to disturb and displace seabirds from foraging habitat. However, this displacement effect also has the benefit of reducing collision risk as individuals change their course as they transit through an area.

11.156 However, given the fact that the Dounreay Trí project will only comprise two wind turbines and that there are significantly larger foraging areas available, it is reasonable to suggest that the extremely small reduction in foraging area arising from the Dounreay Trí project will not result in adult mortality. Any impacts arising would be likely to be limited to a reduction in population productivity.

11.157 All seabird species taken forward for this assessment were considered by Furness *et al.* (2012) as having either a low or very low sensitivity to displacement.

11.158 Results from analogous operational projects also provide some context:

- Studies at the Robin Rigg Offshore Wind Farm (Robin Rigg) project concluded that both guillemot and razorbill exhibited only a small displacement effect (approximately 30%)

with large numbers being present inside the Robin Rigg project during the operational phase; and

- Webb *et al.* (2015b) found a large displacement effect for gannets around the Lincs Offshore Wind farm (Lincs) project (a much larger wind farm) during the migration season (i.e. not likely to be feeding).

11.159 However, no studies have been undertaken which quantify the effects of offshore wind structures on the foraging distribution of Arctic terns.

11.160 Table 11-12 demonstrates that for all species except Arctic tern outside of the breeding season, the Dounreay Trí area and 1km buffer can be considered of negligible importance, with all of these species having been assessed as having a low sensitivity to displacement effects.

11.161 It can be concluded that most of the species taken forward for this assessment are unlikely to show more than a minor response to the presence of an array comprising only two turbines.

Species	Season	Receptor population (RP)		Source	Mean in demonstrator site		95% UCL in demonstrator site		Importance of demonstrator site to RP
		Number	Units [1]		Number (all ages)	% of RP	Number (all ages)	% of RP	
Fulmar	Breeding season (May – Sep)	975,826	Adults	Seabird 2000	3	<0.01%	5	<0.01%	Negligible
	Autumn & winter (Oct – Apr)	568,736	Birds	Furness 2014	5	<0.01%	8	<0.01%	Negligible
Gannet	Breeding season (Apr – Sep) [1]	376,066	Adults	Seabird 2000	1	<0.01%	2	<0.01%	Negligible
	Autumn & winter (Oct – Mar)	248,385	Birds	Furness 2014	0	<0.01%	0	<0.01%	Negligible
Great skua	Breeding season (Apr – Sep) [1]	11,830	Adults	Seabird 2000	0	<0.01%	0	<0.01%	Negligible
	Autumn migration (Jul – Nov)	19,556	Birds	Furness 2014	0	<0.01%	0	<0.01%	Negligible
Kittiwake	Breeding season (Apr – Aug)	211,465	Adults [2]	Seabird 2000	7	<0.01%	12	<0.01%	Negligible
	Autumn & winter (Sep – Mar)	627,816	Birds	Furness 2014	5	<0.01%	8	<0.01%	Negligible
Herring gull	Breeding season (Apr – Aug)	11,830	Adults	Seabird 2000	0	<0.01%	0	<0.01%	Negligible
	Autumn & winter (Sep – Mar)	466,511	Birds	Furness 2014	0	<0.01%	0	<0.01%	Negligible

Great black-backed gull	Breeding season (Apr – Aug)	4118	Adults	Seabird 2000	0	<0.01%	0	<0.01%	Negligible
	Autumn & winter (Sep – Mar)	91,399	Birds	Furness 2014	1	<0.01%	2	<0.01%	Negligible

Table 11-12 Importance of the Dounreay Trí project and 1km buffer when considered alongside the regional receptor population

Species	Season	Receptor population (RP)		Source	Mean in demonstrator site		95% UCL in demonstrator site		Importance of demonstrator site to RP
		Number	Units [1]		Number (all ages)	% of RP	Number (all ages)	% of RP	
Arctic tern	Breeding season (May – July)	62	Adults	Seabird 2000	3	5.02%	6	9.58%	Medium
	Migration seasons (Aug – Oct)	163,930	Birds	Furness 2014	0	<0.01%	0	<0.01%	Negligible
Common guillemot	Colony attendance (Apr – July)	1,380,255	Adults	Seabird 2000	30	<0.01%	49	<0.01%	Negligible
	Autumn & winter (Aug – Mar)	1,617,306	Birds	Furness 2014	20	<0.01%	30	<0.01%	Negligible
Razorbill	Colony attendance (April – July)	129,076	Adults	Seabird 2000	1	<0.01%	2	<0.01%	Negligible
	Autumn & winter (Aug – Mar)	218,622	Birds	Furness 2014	1	<0.01%	1	<0.01%	Negligible
Puffin	Colony attendance (Apr – Aug)	89,906	Adults	Seabird 2000	30	<0.01%	44	<0.01%	Negligible
	Autumn & winter (Sep – Mar)	231,957	Birds	Furness 2014	0	<0.01%	1	<0.01%	Negligible

[1] Numbers of breeding adults are derived from sum of colony counts in Mitchell *et al.* (2004) for regional breeding populations For most species the number of breeding adults is the number of apparently occupied nests/burrows multiplied by two, for common guillemot and razorbill the number of breeding adults is the number adults counted at the colony multiplied by 1.34, the conversion factor given in Mitchell *et al.* (2004).

[2] Number of breeding kittiwake is adjusted for recent declines by multiplying Seabird 2000 derived number of pairs by 0.55, (decline rate derived from JNCC 2015).

Table 11-13 Maximum potential magnitude of impact of displacement on seabirds from Dounreay Trí demonstrator project

Species	Receptor popn.	Breeding season abundance (95% UCL)	Displacement (no. birds)				Baseline adult mortality rate	Change factor to mortality rate at 50% displ.	Change factor to breeding success at 50% displ.	Magnitude
			30%	40%	50%	60%				
Arctic tern	62	30 (44)	9	12	15	18	ca 12%	202%	- 48.4%	High

11.162 The Dounreay Trí area and 1km buffer is only considered to be of 'medium' importance for the regional breeding population of Arctic tern and an overview of potential displacement impacts is provided in Table 11-12 (Arctic tern during the breeding season). A range of 30 – 60% displacement is provided, to allow for comparison with other projects, and the expected impact on regional breeding success is presented.

11.163 For the purposes of this assessment, a conservative assumption has been made that the scenario resulting in the greatest impact would be for 50% of individuals to be displaced from the Dounreay Trí project and 1km buffer throughout the duration of the operational phase. In making this assumption, it is also assumed that all displaced birds are breeding adults and that each bird impacted also represents a pair failing to breed.

11.164 Under this scenario, there would be a 102% increase in annual mortality for Arctic terns and a reduction of 48.4% in the breeding success for the regional breeding population assuming a 50% mortality rate as a result of displacement. This assessment would result in a high magnitude impact on the regional breeding receptors for this species. However, this assessment is highly precautionary, as the abundance of Arctic terns recorded in the study area is disproportionate to the breeding numbers recorded during the Seabird 2000 census for this species. Webb *et al.* (2015a) found that during historical boat-based and digital stills surveys, no terns were recorded in and around the proposed development site.

11.165 The presence in 2015 could be for a variety of reasons but mainly: the area is used by large numbers of non-breeding adults during the nesting season; because there has been a significant increase in the breeding numbers within range of the project area for this species; and because the foraging range for this species has been underestimated. The last of these scenarios is the least likely. There is much evidence for this species shifting breeding locations between years on a small scale, especially in and around the Pentland Firth (Mitchell *et al*. 2004). Regardless, the likelihood that nearly all of the Arctic terns nesting in the region should need to feed in a small patch of sea of less than $4km^2$, and that displacing these would result in significant mortality and reduced breeding season seems highly improbable and highly over-precautionary. For this reason, we have re-assessed the magnitude of the impact to be low and the significance to be minor.

11.166 Because of the minor significance of the project on Arctic terns, no mitigation measures are required.

Table 11-14 Summary of displacement impact characterisation for seabird species during the operational phase

Species	Season-specific regional receptor population	Sensitivity	Magnitude	Significance
Arctic tern	Breeding, colony attendance	Negligible	Low	Minor
All other species	All populations	Negligible	Negligible	Negligible

Collision risk, in particular for migratory species/populations

11.167 Offshore wind turbines have the potential to impact flying birds through collision.

11.168 Collision risk modelling was undertaken to assess the likely number of individuals that might be impacted by the Dounreay Trí project using the methods recommended by Band (2012) and based on data collected by during the digital video aerial survey programme.

11.169 The species taken forward for assessment were those regularly recorded species that are considered to have either a high, or a moderate vulnerability to collision risk based on Furness *et al.* 2013. These species are

- Gannet;
- great skua;
- herring gull;
- great black-backed gull;
- kittiwake; and
- Arctic tern.

11.170 In all cases, the collision risk modelling was undertaken based on the RWCS defined in Table 11-4.

11.171 There is significant uncertainty over the true avoidance rates shown by seabirds. For the purposes of assessment, avoidance rates are those presented in Cook *et al.* (2012) for all species. The actual avoidance rates are likely to be much higher (indeed, substantially so for some species) which will further reduce the projected number of collisions.

11.172 The impact of collision mortality has been assessed in term of the effect on the baseline annual adult mortality rate, taken from published studies.

11.173 For all species, one collision rate model option was used, this being the basic Band model (Option 1), using generic flight height data derived from Johnston *et al.* (2014). In order to present the most precautionary assessment of potential collision, an upper confidence level of 95% of the species density estimates from Irwin *et al*. (2015b) was used alongside the upper confidence interval of the flight height for each species provided in Johnston *et al.* (2014).

11.174 The density of flying birds used in the model was calculated from the density estimates provided by Irwin *et al*. (2015) multiplied by the proportion of flying birds outlined in the same publication.

11.175 Inputs for species biometrics were all taken from Birds of the Western Palaearctic (Vols 1, III and IV), flight speed from Alerstam *et al.* 2007 and Pennicuick (1997) for gannet and great skua.

11.176 Nocturnal foraging activity scores of (1 to 5) were taken from Garthe and Hüppop (2004).

11.177 The sensitivity of a species to collision mortality depends on its capacity to absorb that additional mortality. Species that have a declining population status will have greater sensitivity than those that are stable or increasing. All seabird species that are known to currently have a poor conservation status are considered to have medium sensitivity to this effect, namely: kittiwake, herring gull, great black-backed gull, great skua and Arctic tern.

11.178 All the other seabird species that were taken forward for assessment have either broadly stable or increasing populations and are therefore considered to have to a low sensitivity to this effect.

11.179 The results of the collision risk modelling are summarised in Table 11-15. Additional information on the proportions of adults are taken from survey results presented in Irwin *et al*. (2015). This shows that the numbers of adult seabirds that might be impacted are exceptionally small in the context of the receptor population and that the additional mortality would cause only an extremely small increase to baseline annual adult mortality rates.

11.180 For the regional populations of gannet, gull species, great skua and Arctic tern, the potential impact of collision during the operational phase is predicted to cause a long-term increase in adult mortality rate by a factor of zero or substantially less than 1% and are therefore considered negligible.

Table 11-15 Collision risk modelling for key species recorded in the Dounreay Trí project

Species	Season	Receptor population size (ad = adults only)	Avoidance Rate	Predicted mortality [1] (+95% CI)	Proportion adult birds	Predicted adult deaths [1]	Baseline adult mortality rate (AMR) [2]	Change factor to mortality rate [2] (+95% CI)	Magnitude
Gannet	Breeding	376,066 (ad)	0.991	0 (1)	N/A	0 (1)	8.1%	0.00% (0.003%)	Negligible
	Non-breeding	248,385		1 (2)	N/A	1 (2)	8.1%	0.004% (0.01%)	Negligible
Great skua	Breeding	11,830 (ad)	0.983	0 (0)	N/A	N/A	N/A	0.00%	Negligible
	Non-breeding	19,556		0 (0)	N/A	N/A	N/A	0.00%	Negligible
Kittiwake	Breeding	211,465 (ad)	0.980	6 (8)	92.0%	5 (7)	12%	0.02% (0.03%)	Negligible
	Non-breeding	627,816		3 (5)	95.3%	3 (5)	12%	0.003% (0.007%)	Negligible
Herring gull	Breeding	11,830 (ad)	0.980	0 (0)	N/A	0 (0)	N/A	0.00%	Negligible
	Non-breeding	466,511		0 (1)	N/A	0 (1)	N/A	0.00% (0.002%)	Negligible
Great black-backed gull	Breeding	4118 (ad)	0.980	0 (0)	69.0%	0 (0)	*ca.* 12% [3]	0.00%	Negligible
	Non-breeding	91,399		3 (7)	59.4%	2 (4	*ca.* 12% [3]	0.02% (0.04%)	Negligible
Arctic tern	Breeding	62 (ad)	0.983	0 (0)	N/A	N/A	N/A	0.00%	Negligible
	Non-breeding	163,930		0 (0)	N/A	N/A	N/A	0.00%	Negligible

[1] For breeding populations, the predicted number of adult deaths was derived by multiplying the prediction for all ages by the mean proportion of the birds seen during breeding season baseline surveys that were in adult plumage. [2] Percentage change in AMR. [3] No published rate, value used is rate for herring gull.

Table 11-16 Summary of collision risk impact characterisation for seabird populations during the operational phase

Species	Season-specific regional receptor population	Sensitivity	Magnitude	Significance
Gannet	Breeding	Low	Negligible	Negligible
	Non-breeding	Low	Negligible	Negligible
Great skua	Breeding	Low	Negligible	Negligible
	Non-breeding	Low	Negligible	Negligible
Kittiwake	Breeding	Medium	Negligible	Negligible
	Non-breeding	Medium	Negligible	Negligible
Herring gull	Breeding	Medium	Negligible	Negligible
	Non-breeding	Medium	Negligible	Negligible
Great black-backed gull	Breeding	Medium	Negligible	Negligible
	Non-breeding	Medium	Negligible	Negligible
Arctic tern	Breeding	Low	Negligible	Negligible
	Non-breeding	Low	Negligible	Negligible
All other species	-	Negligible	Negligible	Negligible

Potential for a barrier effect due to physical presence

11.181 The presence of two offshore wind turbines mounted on a floating foundation has the potential to act as a barrier to the free movement of flying or swimming birds that would normally pass through the site as part of their daily or seasonal movements. As discussed under the construction impacts, this effect is closely related in its nature to displacement, but instead is related to the impact on a receptor population of individuals being prevented from taking their preferred travel route, be this the potential additional time and energy requirements imposed by taking a detoured route or the reduced access to an area.

11.182 Post-construction monitoring studies at much larger offshore wind farms have provided evidence of birds altering course around wind farms. These studies are reviewed Furness *et al.* (2013), though barrier effects are not considered separately from displacement effects. All seabird species that use the Project area are considered by Furness *et al.* (2013) to have low or very low sensitivity (a score of 1 or 2 in Table 11-5) to displacement by structures.

11.183 All the seabirds that were recorded in the Dounreay Trí proposed turbine deployment area are highly mobile species, flying tens or even hundreds of km on a daily basis to move between feeding areas, or between a colony location and their feeding area. These species are also migratory when they may cover distances of hundreds to thousands of km.

11.184 Given that the proposed horizontal dimension for the Dounreay Trí project is 250m, the relatively small size represents a trivial detour for any seabird forced to fly around the turbines in comparison to the daily flights that they might make. For example, an Arctic tern which has a relatively small foraging range from its colony, if making a foraging journey of 10km would, at most, have 2.5% added to each journey as a worst-case scenario. This is certainly a worst case scenario, as it is unlikely that a foraging area during the breeding season would be fixed in its location relative to the location of the breeding site, nor would the angle of the widest point always be oriented perpendicular to the flight line, and nor would all individuals breeding birds use the same feeding area. For this reason, the scenario of a 2.5% increase in the time and energy budget for flying would be irregular and highly likely well below 1% for all seabird species.

11.185 For the regional breeding populations of all seabird species, any barrier effect during the operation and maintenance stage are likely to be small and impact on a few individuals on a few occasions. The impact is judged to be negligible for these receptor populations and therefore not significant

Potential change in habitat/prey

11.186 The presence of the Dounreay Trí project and mooring systems are not predicted to cause any adverse effects on seabird prey species (principally small fish such as sand eels, gadoids, clupeids and mackerel); see fish ecology Chapter 9. Therefore no concomitant effects on bird species are predicted.

Potential increase in suspended sediment affecting visibility

11.187 The presence of the Dounreay Trí project and mooring systems are not predicted to cause any significant increase in the amount of sediment suspended in the water column during the operational phase of the project. Therefore no concomitant effects on bird species are predicted.

Creation of a roosting habitat or foraging opportunities

11.188 The siting of a relatively low floating structure offshore from the coast is likely to be attractive for some seabird species as a roosting site. Most notably, these will be cormorants *Phalacrocorax carbo* and shags *Ph. aristotelis*, which are known to use the transition platform of wind turbines at Egremond an Zee (Lindeboom *et al.* 2011). There is no evidence for other species associating with wind turbines, but the nature of the structure might prove attractive to gulls (Laridae) and terns (Sternidae), as has been found to be the case at offshore oil platforms (Tasker *et al.* 1986).

11.189 Some seabird species might habituate further to the structure and use the structures as a safe nest site. In particular, black guillemot *Cepphus grylle* often make use of man-made structures for nesting (Mitchell *et al.* 2004). There is a chance that this species, which nests on the adjacent coastline, would be able to find suitable ledges within the structure on which they could nest.

11.190 The effect of an additional safe roost site is the provision of a safe resting place for those seabirds which choose to use such structures, potentially increasing the survivorship of those individuals, although no empirical evidence currently exists to support such a statement.

11.191 For species such as cormorants and shags, which have a limited foraging range from shore-based roost sites (on account of their need to dry their plumage between feeding bouts), would be able to exploit feeding sites further offshore than normal, thus providing additional feeding habitat. Black guillemots would also benefit by being able to forage further offshore than normal from any nests they might build on the floating structure.

11.192 If these predicted changes to roosting and nesting behaviour were to occur, they would provide a low to medium benefit to the local conservations status of the relevant seabird species. No cormorants, shags or black guillemots were recorded at all during the digital video aerial surveys around the proposed site, their feeding distribution normally being much closer to land. If these changes in behaviour were to take place, then it would be reasonable to expect these species to appear in the study area over a period of 5 – 10 years post-construction.

11.7 Impact Assessment - Decommissioning Phase

11.193 Impacts arising through the decommissioning phase of the Dounreay Trí project are considered to be similar to those considered under the construction phase and are not therefore considered in further detail here.

11.8 Mitigation Measures

11.194 No mitigation is required over and above the project-specific mitigation outlined in Chapters 4 and 22.

Residual Effects

11.195 No residual effects exist and therefore no receptor-specific mitigation is required.

11.9 Summary

11.196 This Chapter has described the marine ornithological interest within and around Dounreay Trí project, concentrates on those species that are known to or are likely to occur within the Dounreay Trí site and off the North Coast of Scotland, with particular focus on those species recorded during the surveys undertaken to inform this assessment.

11.197 Those site specific surveys ultra-high resolution digital video aerial marine megafauna, ornithological and human activity surveys were undertaken by HiDef Aerial Surveying Limited between January and December 2015, on a monthly basis, although two (2) surveys were successfully completed in June 2015.

11.198 The survey methodology was designed to provide information suitable to support an EIA of the potential effects of a floating wind demonstrator, for which an accurate assessment of abundance and distribution of seabirds and marine mammals is required.

11.199 The Dounreay Trí project is located near to a number of important bird sites which have been classified as SPA under the Birds Directive. The most significant of these are likely to be the North Caithness Cliffs SPA to the east, which holds internationally important concentrations of guillemot and an internationally important breeding assemblage of seabirds including fulmar, kittiwake, razorbill and puffin. These seabird species are likely to use the waters in and around the Dounreay Trí project for feeding.

11.200 A total of 4960 birds of 14 species were recorded during thirteen surveys from January to December 2015. The identification rate to species level was in excess of 97%.

11.201 The impact assessment was able to conclude that the effects of disturbance and displacement during construction on all species can be considered negligible.

11.202 The impact assessment also concluded that this held true for the operation phase.

11.203 Collision risk modelling demonstrated that the effects of the project on all species was negligible.

11.204 As a result of the impact assessment, no receptor specific mitigation measures were required.

11.205 Impacts arising through the decommissioning phase of the Dounreay Trí project have been considered similar to assessed under the construction phase.

12 Commercial Fisheries

12.1 Introduction

12.1 This chapter presents the assessment of the impacts of the Project on commercial finfish and shellfish fisheries within the vicinity of the Project boundaries.

12.2 There are no active finfish or shellfish marine aquaculture sites within the vicinity of the proposed development. The nearest marine aquaculture site is located 30 km west of the Project area in the Kyle of Tongue and at least 50 km north in Orkney waters. Impacts on marine aquaculture sites have therefore been scoped out of this assessment.

12.3 There is a low intensity fixed engine fishery located in Melvich Bay where the River Halladale enters the Pentland Firth, at least 8 km south west of the offshore Project boundaries. Due to the distance from the proposed Project, this fishery has also been scoped out of this assessment.

12.4 Impacts relating to the distribution and abundance of target species, including habitat impacts, are addressed in: Chapter 8: Benthic and Shellfish Ecology and Chapter 9: Fish Ecology. Other impacts associated with Commercial Fisheries including those relating to navigation and socioeconomics are discussed in Chapter 13: Shipping and Navigation, Appendix 13.1: Navigational Risk Assessment and Chapter 18: Socio-economics, Recreation and Tourism.

12.2 Study Area

12.5 The Offshore Site (area of search) is situated within the south west corner of ICES sub-area rectangle 46E6[22] which includes the north-east coast of Scotland from Strathy Point to Duncansby Head and the south west region of the Orkney Islands, including Scapa Flow and Hoy. The Study Area is identified as this ICES rectangle boundary which extends over 30' latitude by 1° longitude (approximately 30 x 30 nm or 56 x 56 km); which at the project latitude, is an area of approximately 900 nautical miles sq. (nm^2) or 3,136 km^2 (see Figure 12-1). Fisheries data are reported to Marine Scotland and the Marine Management Organisation (MMO) at this scale.

12.6 This area is deemed sufficient to provide an overview and context of fisheries within and around the development area likely to be affected by the proposals (including potential displacement of commercial fishing activity). National, district and ICES fisheries data for the wider area provide further context to the importance of the local area for Scottish commercial fisheries and the local community.

12.7 Due to the scale of the proposed Project footprint compared to the ICES rectangle area, available spatial data and consultation is used to refine understanding about the use of the Project area, including the Offshore Site and export cable corridor, and the surrounding vicinity as shown in Figure 12-1.

[22] The International Council for Exploration of the Sea (ICES) is a global organisation which coordinates oceanic and coastal monitoring and research, and advises international commissions and governments on marine policy and management issues. Fisheries effort and landings data (volume and value) are reported by defined statistical rectangles (geographical areas) to ICES and Marine Scotland for Scottish waters.

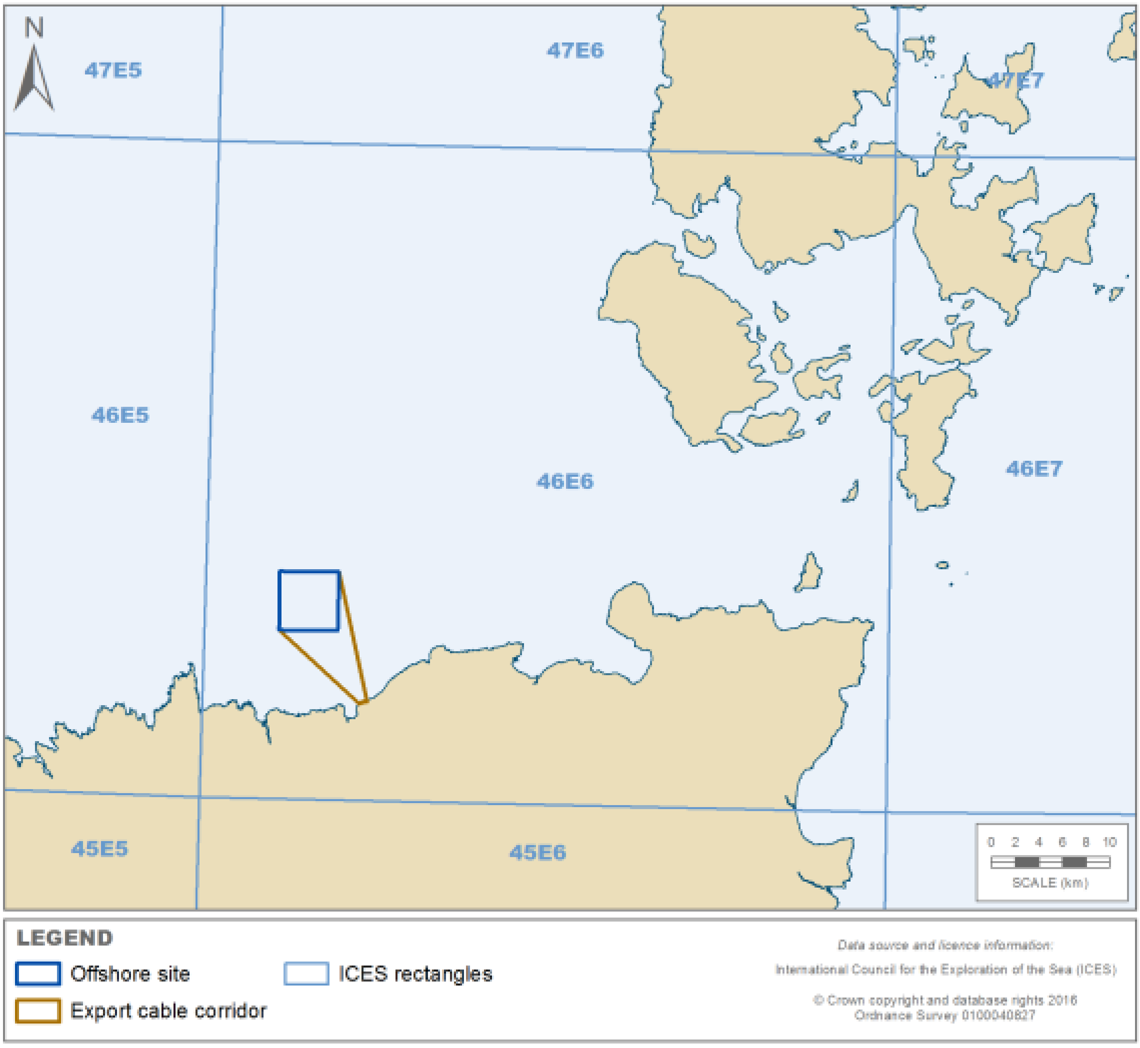

Figure 12-25 Commercial fisheries study area (ICES rectangle 46E6)

12.3 Legislation and Guidance

12.8 There is no specific legislation or EIA guidance relating to the assessment of commercial fisheries, however the following relevant guidance was referred to in preparation of this chapter:

- *Scotland's National Marine Plan, A Single Framework for Managing Our Seas* (Marine Scotland, 2015a), sets out a policy (*6. Sea Fisheries*) requiring marine planners and decision makers to consider the potential impacts of development on fisheries interests and is useful to identify some of the key concerns and issues that should be addressed in any impact assessment;
- Seafish Best Practice Guidance for Fishing Industry Financial and Economic Impact Assessments (Seafish and Poseidon, 2012); and
- Guidance on Commercial Fisheries Mitigation and Opportunities from Offshore Wind commissioned by Collaborative Offshore Wind Research into the Environment (COWRIE), (Blyth-Skyrme, 2010), which provides useful measures to reduce the impacts for offshore floating wind and included fisheries representatives in the process.

12.4 Sources of Information

12.9 A review was undertaken of the existing literature and data relevant to this assessment and was used to provide an overview of the existing environment. Key data sources used in the preparation of this chapter are described below in Table 12-1.

Table 12-44 Key data sources

Source	Content
Scottish Sea Fisheries Statistics, Marine Scotland	Fisheries statistics include an annual overview of the fishing fleet, landings data and employment in the sector by port districts (Marine Scotland, 2015b).
ICES reported landings data, Marine Scotland	International Council for Exploration of the Sea (ICES) landings data (quantity and value) by statistical rectangles. The area of each ICES rectangle is approximately 3,136 km^2 (Marine Scotland, 2015c).
UK Sea Fisheries Annual Statistics, Marine Management Organisation	MMO statistics provide information on structure and activity of fishing industry, landings and gears used by ports and ICES statistical rectangles for over and under 10 m vessels in the UK, including Scotland (MMO, 2015).
Marine Scotland Compliance VMS data	Vessel Monitoring System (VMS) data for spatial distribution of fishing vessels, amalgamated with species/gear type data from reported landings (vessels >15 m) to provide estimated distribution of fishing intensity from 2009-2013 for vessels over 15 m (Marine Scotland, 2015d).
Marine Scotland ScotMap data	Marine Scotland inshore fisheries mapping study of fishing activity of commercial vessels under 15 m overall length, including vessel numbers by gear type and monetary value by gear type. Fishing areas are delineated as 'polygons' and data are aggregated by cells of approximately 4.2 km^2 (Marine Scotland, 2014).
Project Vessel Traffic Analysis (VTA)	A VTA was undertaken as part of the Project Navigational Risk Assessment (NRA). Automatic Identification System (AIS) data, was analysed to identify fishing vessel activity in the study area for vessels 15 m and over. This data identifies individual vessels and vessel tracks.

12.5 Surveys and studies carried out

12.10 No site specific surveys have been undertaken to inform the assessment of commercial fisheries. The information available, including that in Table 12-1 and that obtained through consultation with SFF has helped provide the baseline description of commercial fisheries activity in the Study Area and to inform this EIA.

12.6 Consultation

12.11 Initial consultation with Scottish Fishermen's Federation (SFF) during the site selection process indicates that the site is not intensively fished and that the southern extent avoids known fishing grounds (SFF, pers comm., 2014). The harbour master at Scrabster opined that fishing effort within the offshore site and cable corridor is unlikely to be intensive because there is a "no-take zone" which extends ~2km from the old Dounreay cooling water outflow and the day boats tend to stay closer to the coast (pers comm., 2015). SFF (2016) opined that the site is not intensively fished and the platform is small so fishermen may avoid the platform and anchors, once installed. Nevertheless, SFF (2016) sought to ensure that conditions relating to navigational safety and cable burial are included with the Marine Licence.

Dounreay Trì drop-in session

12.12 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date.

12.13 Fisheries consultees invited or asked to communicate the event to fishermen included:

- Marine Scotland Compliance, local fisheries office (Scrabster);
- Local Harbour Authorities and Trusts (Scrabster, Wick, Gill's Bay and Kinlochbervie);
- Scottish Fishermen's Federation (SFF);
- Scottish Pelagic Fishermen's Association (SPFA);
- Scottish Creel Fishermen's Federation (SCFF);
- Moray Firth and North Coast Inshore Fisheries Group (IFG);
- Scrabster Harbour Trust;
- Orkney Fishermen's Society (OFS); and
- Orkney Fisheries Association (OFA).

12.14 No fisheries representatives or individuals with fisheries interests attended the drop-in session or responded to the invitation to provide feedback on the Project proposals.

12.15 A representative from Dounreay Site Restoration Limited (DSRL) confirmed that creel fishing occurs up to the boundary of the fishing exclusion zone (2 km buffer from Dounreay Nuclear Site's effluent pipe). DSRL, through local knowledge of the area, suggest that the exclusion zone may act as a 'nursery site' for target species and provide a good fishing resource up to the boundary of the exclusion zone.

Scoping feedback

12.16 The following stakeholder responses in Table 12-2 have been received specifically relating to this chapter.

Table 12-45 Summary of Scoping feedback

Consultee	Comment	Relevance/Cross Reference
Orkney Fisheries Association (OFA)	OFA would like to ensure that all spatial and biological implications including cumulative impacts are captured on the physical prosecution of fishing vessels and the biological impacts on all developmental stages of commercial stocks. Risk to navigation, transiting and fishing vessels navigation to, from and among gear should be considered.	Cumulative impacts have been addressed in Section 12.14. Biological impacts are addressed in Chapter 8: Benthic Ecology and Shellfish and Chapter 9: Fish Ecology. Navigational risks are addressed in the NRA.
Scottish Fishermen's Federation	Expect that EIA would consider whether there were any impacts whatsoever on fishing activity in the area, both in the development area and on the export cable, and mitigation should be considered. The possible interference with navigation routes E-W and vice versa, should be fully assessed along with wave and tidal developments in the inner firth.	Cumulative impacts have been addressed in Section 12.14. Navigational risks are addressed in the NRA.

12.7 Assessment Methodology

12.17 The overarching approach to the Environmental Impact Assessment (EIA) is described in Chapter 5: Environmental Impact Assessment Methodology. This section sets out the specific criteria which have been used to evaluate the impact of the proposals on Commercial Fisheries (as defined in Section 12.1).

Design envelope considerations

12.18 The Project Description is set out in Chapter 4. Specific assumptions relevant to this chapter are identified in Table 12-3 below.

12.19 In order that the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are considered by proxy.

Table 12-46 Design envelope parameters

Design Envelope Parameter	Value/description
Maximum Offshore construction Site footprint	Platform (0.09 km^2 including rotation and lateral movement), moorings, anchors (800 m radius) and construction safety zone (500 m) - 5 km^2 (20 % of

	Offshore Site and 0.16 % of Study Area)
Maximum Offshore Site operational footprint	Platform (0.09 km^2), moorings, anchors (800 m radius) and operational advisory zone (50 m) – 2.3 km^2 (9 % of Offshore Site and 0.07 % of Study Area). Up to 8 mooring lines and 16 anchors will be deployed to secure the device.
Export cable footprint	13.8 km max length and 8 m max width (inc. cable plough footprint): 0.1 km^2. Burial depth 1-2 m. Up to 20 % may require cable protection with rock placement - 2.8 km length or 0.02 km^2
Cable landfall installation method and location	Horizontal Direction Drilling (HDD) at the east of Sandside Bay or pinned to existing water cooler channel at the Dounreay Nuclear Site.
Timing and duration of cable landfall installation activities (below MLWS)	Installed at the beginning of the construction phase, between Q4 of 2017 and Q2 of 2018 lasting 1-2 months (includes onshore activity, allowing for downtime/weather restrictions).
Timing and duration of platform and associated infrastructure installation activities	2-3 months within Q2 and Q3 of 2018 (including commissioning). Vessels required include: up to 4 anchor handling tug supply vessels, up to 5 support vessels (crew transfer, dive support, guard vessels).
Timing and duration of export cable installation activities	1 week within Q2 of 2018. Vessels required include: 1 cable laying vessel, 1 dive support.
Frequency and duration of maintenance activities	Planned maintenance 19 visits per year for fault rectification and component replacement, 1 vessel required.

12.20 It is considered that impacts in the decommissioning phase will be comparable to those impacts assessed in the construction and operational phases. If the export cable is left *in situ* the potential impacts may be reduced further.

Methods of prediction

12.21 For commercial fisheries potential ***effects*** are identified and the significance of each ***impact*** is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions.

12.22 A matrix approach has been used as a tool to inform the impact assessment, while professional judgement has also been used following best practice, best available understanding and relevant EIA guidance (SNH, 2013).

12.23 Significance is attributed using the following key attributes:

Magnitude of effect

12.24 Magnitude of effect is based on the consideration of the following four criteria to inform the determination of an overall impact magnitude as summarised in Table 12-4:

- Spatial extent;
- Duration;
- Frequency; and
- Severity.

Table 12-47 Assessment of magnitude of effect

Category	Description
High	Excludes or prevents fishing activity, resulting in a major or widespread alteration or disruption for the duration of the project lifetime.
Medium	Barrier to or restricts fishing activity, partial alteration beyond that normally experienced in the area for an extended period or the duration of the project lifetime.
Low	Low limitation, consideration or nuisance to fishing activity/presents a navigable obstacle, minor alteration typical to those normally experienced in the area, or causing a short term, temporary alteration or disruption.
Negligible	Very limited alteration or undetectable change to activity for a temporary period.

Vulnerability of receptor

12.25 The vulnerability of the receptor to effects of the Project is also taken into account and is attributed according to the following characteristics to provide an overall impact vulnerability as summarised in Table 12-5:

- Adaptability;
- Tolerance;
- Recoverability; and
- Value

Table 12-48 Assessment of vulnerability of receptor

Category	Description
High	Intensively used, high commercial value fishing ground within project area. No capacity or opportunity to adapt to or tolerate change in baseline conditions.
Medium	Extensively used, moderate commercial value fishing ground lies within or partially overlaps with the project area. Very little capacity or opportunity to adapt to or tolerate change.
Low	Limited use, low commercial value fishing ground within or partially overlaps with the project area. Has capacity to adapt to or tolerate change.

Category	Description
Negligible	Very little or no fishing activity occurs within the project area. Has ample capacity to adapt to or tolerate change or will not be affected.

Significance of impact

12.26 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact (Table 12-6).). The significance of impact is assessed based on best practice and professional judgement. While there is no specific guidance for Commercial Fisheries, any impacts of 'moderate' or above are considered significant, in accordance with SNH's EIA guidance (SNH, 2013). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor. The evaluation of impact significance is informed by the matrix and by the professional judgement of the assessment team.

Table 12-49 Impact significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

12.8 Data Gaps and Uncertainties

12.27 It is difficult to determine or accurately predict where fisheries occur due to their dynamic and mobile nature. There are numerous data sources available to help define the spatial and temporal distribution of fishing activity, however these sources have certain caveats and some spatial data are considered sensitive and generally not disclosed.

12.28 A range of data sources have been utilised which endeavour to capture vessel activity and landings distributions. Ideally these would be supplemented with consultation to validate the data and refine understanding of fishing activity at a localised level. The suitability of the data sources is considered in the following sections.

ICES data

12.29 Statistics on commercial fisheries in Scotland are collated and analysed by the Scottish Government Marine Directorate. All port landings are recorded and species tonnage related to fishing location based on the ICES system of statistical rectangles. The area of each rectangle is approximately 3,136 km^2. The offshore Project boundaries are approximately 25 km^2, accounting for just 0.8 % of the ICES rectangle area, while the operational Project footprint will account for up to 2.3 km^2, just 0.07 % of the ICES rectangle (Study Area).

12.30 It is therefore difficult to determine the distribution of landings within the rectangle area and extrapolate the proportion relevant to the Project boundaries and potential area of effect. ICES 46E6 includes the north coast and the Orkney Islands which support a well-established shellfish fishery. Fish landings are subsequently extrapolated in proportion to the size, locality and nature of the Project area. Vessel tracking data, discussed in the following section, are also used to help focus understanding of the importance of the Project area.

12.31 Landings can be misreported, particularly where there is overlap of fishing grounds between ICES rectangles (see Figure 12-3 and Figure 12-4) which may skew reported landings for the area. However this should have little effect on identifying important fisheries relevant to the Project area given the relatively small area of the boundaries concerned (0.8 %).

VMS/AIS data

12.32 Scottish fisheries are regulated by the Scottish Government which uses the satellite based Vessel Monitoring System (VMS) to gather automatic data on vessel movements for vessels greater than 12 m from 2013. Data are available for vessel location and speed; however individual vessels, vessel type or gears used cannot be identified. The speed of the vessels at the time of data capture is recorded and can be used to make inferences about whether a vessel is fishing or steaming. The standard assumption is that vessels travelling at 0-3 knots are fishing (removing those recorded around ports) and those travelling at 3-6 knots may be fishing, depending on the gear type but most likely to be steaming. Speeds > 6 knots indicate vessels in transit.

12.33 Density maps using these data have been produced by Marine Scotland Compliance (Marine Scotland, 2015d) and combine landings data to provide more detail on the spatial distribution of fishing effort and target species for the years 2009-2013. This amalgamated data improves understanding of fishing distribution and intensity, however is restricted to vessels over 15 m.

12.34 Fishing vessels exceeding a certain size (over 15 m from May 2014) are also required to carry AIS (Automatic Identification System) equipment. For the Navigation Risk Assessment (see Appendix 13.1), twelve months of AIS data for the north of Scotland were gathered between October 2014 and September 2015. These data provide a representative 'snapshot' of activity in the area for one year, identify individual vessels and their tracks and are useful for identifying the frequency of activity by larger fishing vessels within the vicinity of the Project boundaries but do not capture the under 15 m vessels.

ScotMap data

12.35 There is a spatial data gap in the reporting of spatial vessel activity for those under 12-15 m overall length, as AIS and VMS are currently not a legal requirement for this fleet size.

12.36 The ScotMap source provides an insight into the likely distribution and intensity of fishing activity by smaller fishing vessels under 15 m overall length, which make up a significant proportion of the Scottish and Scrabster district fleet (see Section 12.8.2 and 12.8.3). However, data are collated using an interview-based methodology and for the period 2007-2011, which the dataset is now becoming dated. The Scrabster district interviewed 67% of target list vessel owners/operators (50/75 vessels). Approximately 77% of landings were accounted for from vessels under 15 m overall length in the district (Marine Scotland, 2014).

12.37 The ScotMap data does not provide an exhaustive list of gear types utilising a particular area, only those which are prevalent. Furthermore, where a particular gear type is represented across a very small area, this is not disclosed to protect vessel anonymity. Individual vessel operators using unique gear types may therefore be omitted from the spatial maps publicised.

12.38 ScotMap provides the best available data source on the likely use of the Project area by smaller vessels. As a precaution, it is assumed that these vessels will make use of the majority of inshore waters.

Data confidence

12.39 The combination of datasets used complements each other to address any shortfalls in each source and provide a reasonable baseline characterisation of fishing activity in the Study Area that is proportionate to the size of the Project. Where there is uncertainty, a precautionary approach is taken in the assessment of vessels using the Study Area and its importance for fisheries interests to ensure potential impacts are not underestimated.

12.9 Description of the Current Environment

12.40 The key commercial fisheries are identified from landings and gear type data within the Study Area. Vessel tracking data and other spatial data have been combined to identify the types and numbers of vessels within and around the offshore Project boundaries. These data are reviewed below and information gaps filled through consultation with local fishermen and fisheries representatives to refine understanding and relative importance of the Project area for each fishery operating here.

Scottish fishery

12.41 There were 2,030 active Scottish based fishing vessels registered in 2014. The Scottish fishing industry is dominated by vessels of 10 m overall length or less, accounting for approximately 70% of the Scottish fleet. This smaller vessel fleet typically fishes the inshore coastal waters while a larger fleet fish further offshore. Approximately 87 % of the fleet of 10 m overall length or less is represented by vessels using pots or creels to target shellfish[23].

12.42 Pelagic species are the most important species landed into Scotland in tonnage, followed by demersal and shellfish[24] at an average of 126,500 tonnes, 88,900 tonnes and 57,800 respectively from 2010 to 2014. However, shellfish landings have a greater market value at an average of £140.2 million, followed by demersal at £138.6 million and pelagic at £94.6 million[23].

Scrabster district

12.43 The Scrabster district is located within the Study Area and includes ports from Skerray, to the west of the Project area and Helmsdale to the south east. Ninety active Scottish based vessels were registered in the Scrabster District in 2014 (Marine Scotland, 2015b). Of these vessels:

- 81 vessels under 10m in length (90% of all vessels);
- Vessels under 10 m consisted of 80 creel fishing and 1 *Nephrop* fishing; and
- Vessels over 10 m consisted of 1 trawler, 2 seine netting, 5 creel fishing and 1 other targeting shellfish.

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[23] Marine Scotland (2015b). Scottish Sea Fisheries Statistics 2014. The Scottish Government [online]. Available at: http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/PubFisheries (Accessed 09/10/2015)

[24] Pelagic – highly migratory species, found mainly in shoals occupying midwater or near surface; Demersal – found in deeper waters, generally on or near the seabed; Shellfish – includes crustaceans and molluscs, fished mostly inshore but some deeper waters (within 6 nm)

12.44 Landings to the port district from 2010-2014 averaged 16,700 tonnes at £30.5 million. Landings of demersal species were approximately 12,700 tonnes at £23.4 million; pelagic species were 16 tonnes at £7,000; and shellfish species were 4,000 tonnes at £7.0 Million.

12.45 The district had 132 full time and 8 part time fishermen employed on Scottish based vessels in 2014 (Marine Scotland, 2015b).

12.46 UK, Irish, Norwegian, Faroes, French and German based fishing vessels account for the majority of landings to the main port at Scrabster. These vessels predominantly target and land demersal species, while most of the shellfish is targeted and landed by UK vessels (MMO, 2015).

12.47 It should be noted that species caught in the Study Area may not necessarily be landed to the district port of Scrabster and conversely landings to the port may have been caught from other or several ICES rectangle areas.

Fisheries landings within the Study Area

Landings by species type

12.48 The Study Area lies within ICES rectangle 46E6 (see Figure 12-1 in Section 12.2). Landings data for this area from 2010-2014 indicate that the predominant target species are shellfish, followed by demersal and pelagic species, both by average quantity and value (Table 12-7)[25]. Average landings in the study area for 2010-2014 are approximately 2,300 tonnes at £3.7 million; representing 0.8 % of Scottish landings and 1 % of value.

12.49 Demersal landings average at 650 tonnes at £1.1 million (Table 12-7), comparable with landings in the adjacent ICES 46E5, but these are low in comparison with the north-east and north-west offshore areas which account for in excess of 2,000 tonnes per year (Marine Scotland, 2015c).

12.50 Pelagic landings from ICES 46E6 account for an average of 550 tonnes at £0.2 million (Table 12-7), which is low compared to landings in excess of 2,000 tonnes in the adjacent ICES area 46E5 and landings in excess of 15,000 tonnes around Shetland (Matine Scotland, 2015c).

12.51 Shellfish landings average at 1,100 tonnes at a value of £2.4 million (Table 12-7), comparable with other areas around Orkney waters, Skerry Bank (47E5) and Papa Bank (48E6), and twice as much as that of adjacent ICES 46E5 of the north coast (Marine Scotland, 2015c).

12.52 Marine Scotland ICES stats show that ICES 46E6 is not as important for pelagic species landings as offshore waters and locally, the northwest coast of Scotland; demersal landings are relatively low compared to further offshore, northeast and northwest; and shellfish landings are similar to landings throughout much of Scotland's inshore waters (Marine Scotland, 2015c).

12.53 While landings in ICES rectangle 46E6 represent a small proportion of Scottish landings, these landings, particularly shellfish, will likely be important to the local inshore fishery which will consist of smaller vessels (typically less than 15 m overall length) targeting crab, scallop and lobster.

12.54 Shellfish landings are the highest targeted species by quantity landed and value, however the reporting area includes a large area of fishing grounds within the Orkney Islands, which has a predominantly shellfish-based fishery supporting pot and creel vessels and hand dived

[25] Marine Scotland (2015c). Fishing effort and quantity and value of landings by ICES rectangle. Available [online]: http://www.gov.scot/Topics/Statistics/Browse/Agriculture-Fisheries/RectangleData (Accessed 08/10/2015)

scallop vessels, and may account for a substantial proportion of the reported landings to ICES 46E6.

12.55 All species caught within the Study Area were landed by UK based vessels (MMO, 2015)[27]. Landings from the Study Area may go to Scrabster port, another port in the Scrabster district or ports further afield. Reported landings in Table 12-7 show that very little pelagic landings go to Scrabster port and do not account for the Study Area landings, while significant proportions of demersal species and some shellfish go to the port although it is evident from the reported landings to the Study Area that much of these must be caught outwith the Study Area.

12.56 Major ports Peterhead, Lerwick and Fraserburgh receive the majority of landings into Scotland, particularly for pelagic species (Marine Scotland, 2015b), while some shellfish landings from the Study Area may also go to Orkney based ports or others.

Table 12-50 Landings and value by species type[26] from Study Area, 2010-2014 (Marine Scotland, 2015c)

Species type	Demersal		Pelagic		Shellfish	
Year	Live weight (tonnes)	Value (£'000)	Live weight (tonnes)	Value (£'000)	Live weight (tonnes)	Value (£'000)
2011	827	1,512	78	46	1,289	2,940
2012	527	876	1,090	597	1,045	2,410
2013	418	637	1,050	368	1,060	2,130
2014	1,032	1,656	391	109	971	1,954
Scrabster annual average	12,700	23,400	16	7	4,000	7,000
Scottish annual average	88,900	138,600	126,500	94,600	57,800	140,000
% Scottish total in Study Area	0.7	0.8	0.4	0.2	1.9	1.7

Landings by gear types

12.57 Predominant gear types used in the Study Area include demersal trawl/seine gears landing demersal and pelagic species; and pots and traps targeting shellfish (Table 12-8). Vessels 10m and under account for approximately 27 % of live weight landings from the Study Area and 36 % of value from 2010-2014. Vessels over 10 m account for approximately 73 % of live weight landings and 64 % of value.

[26] Landings (quantity and value) by UK vessels into the UK and abroad, and foreign vessels into the UK

Table 12-51 Average landings by gear type[27] in Study Area, 2010-2014 (MMO, 2015)

Length Group	Gear type	Live weight (tonnes)	Value (£'000)	Species group
Over 10 m	Demersal trawl / seine	1,200	1,366	Demersal, some mixed bycatch
	Pots and traps	363	725	Shellfish, some mixed bycatch
	Dredge	92	184	Shellfish
	Other gears	30	98	Shellfish, some demersal
	Total	1,685	2,373	
10m and under	Pots and traps	549	1,196	Shellfish, some mixed bycatch
	Other gears	64	141	Shellfish, some pelagic and demersal
	Total	613	1337	

Landings by species composition

12.58 Table 12-9 presents average landings and values by species from the Study Area for those which represent at least 5 % of the total value. Important species include: crab and lobster, targeted by pots and traps; scallops, targeted by dredges and passive gears; and mixed demersal species (haddock, monkfish, cod) and herring, targeted by demersal trawl/seine, other mobile and passive gears (Table 12-8 and MMO, 2015).

12.59 Crab and lobster are the most important shellfish species landed in the study area, with crab representing 29 % of landings and 22 % overall value, while lobster landings just 3 % but 20 % of value. Other important landings include velvet crab, often caught as part of a mixed creel fishery and scallops, either dive-caught or targeted with dredges (Table 12-9).

12.60 Herring are the most important pelagic species landed in the study area, representing approximately 23 % of landings but just 6 % of value (Table 12-9) and likely caught alongside demersal species. A number of demersal species are landed as part of a mixed demersal fishery. Haddock, monkfish and cod are the most important species landed, collectively accounting for approximately 25 % of landings and 23 % of value (Table 12-9).

Table 12-52 Average annual landings and value[28] by species composition from Study Area, 2010-2014 (Marine Scotland 2015c)

Species	Live weight (tonnes)	Value (£)	% total live weight	% total value
Crabs	657	830,366	29	22

[27] Landings by UK vessels and gear type. N.B. quantities correspond to total landings from the Study Area (ICES 46E6), therefore presumed no foreign vessels reported landings for this area.

[28] Landings by UK vessels into the UK and abroad, and foreign vessels into the UK.

Lobsters	70	754,991	3	20
Haddock	328	386,837	14	10
Monks or Anglers	119	377,199	5	10
Scallops (King or Great)	129	305,228	6	8
Crabs - Velvet (Swim)	111	274,859	5	7
Herring	523	219,020	23	6
Cod	86	177,409	4	5
The majority of other species landed in lesser quantities or value include those often caught as by-catch in the mixed demersal fisheries such as whiting, megrim, saithe, lemon sole, ling, John Dory, plaice and Pollack; other shellfish/mollusc species include periwinkles, squid, Nephrops, green crab, crayfish, whelks, razor clams and queen scallops; and a small proportion of pelagic species include mackerel and horse mackerel.				

Fishing activity in Project area

Fishing vessel activity (over 15 m vessels)

12.61 The Offshore Site (24.8 km^2) and export cable corridor (25 km^2) represent a small proportion of the available fishing grounds in the Study Area (0.8 %), while the Project operational footprint will be somewhat lower (2.3 km^2 and 0.07 % of the Study Area). Vessel monitoring and surveillance data collated by Marine Scotland Compliance is therefore useful to help identify the spatial distribution and intensity of fishing activity in relation to the Project boundaries.

12.62 Project AIS fishing vessel tracks (vessels of 15 m overall length or over) recorded during the study period October 2014 to September 2015 (see Chapter 13: Shipping and Navigation and the NRA) are widespread throughout the Offshore Site and occasional through the export cable corridor (see Figure 12-2). The fishing exclusion zone is clearly avoided, however larger vessels generally tend not to fish the shallower inshore waters (see following VMS figures Figure 12-3 and Figure 12-4). There are clear densities of traffic north of the project area in the Pentland Firth shipping channel (east to west) and transits to and from Scrabster port and to offshore fishing grounds further north and north-west.

12.63 A total of 91 individual fishing vessels were recorded during the AIS study period (see breakdown in Chapter 13: Shipping and Navigation and the NRA). The frequency of fishing vessels transiting the Project boundaries consisted of 60 vessels transiting on one day in the year (66 %); 21 vessels on two to three days in the year (23 %); and 10 vessels on four or more days (10 %).

12.64 AIS data provide an indication of the number of individual fishing vessels and frequency of transits in the project area for vessels of 15 m or greater overall length, however the data cannot determine whether these vessels are fishing in the area or navigating to and from fishing grounds or landing ports and only provides a ‘snapshot’ of fishing vessel activity in one year (see Section 12.7 on data gaps and uncertainties).

12.65 Landings of demersal and shellfish species to Scrabster port (see Table 12-7) support conclusions that many of the vessels transiting the Offshore Site, and to and from the port, may not be fishing in the Study Area since only a small proportion of landings to the port could be accounted to this particular ICES reported rectangle.

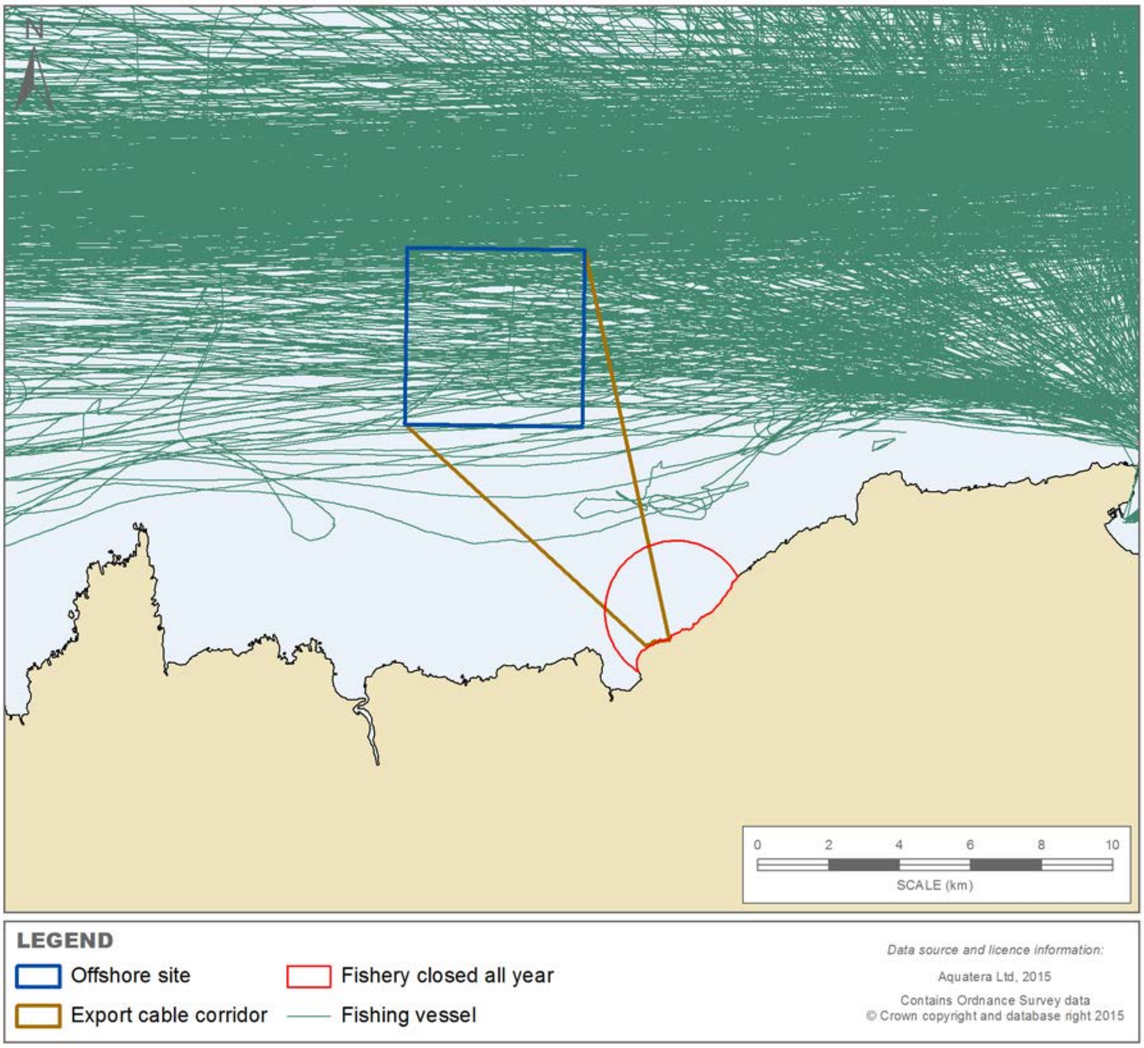


Figure 12-26 AIS fishing vessel data (October 2014 – September 2015)

12.66 Vessel Monitoring System (VMS) data collated by Marine Scotland Compliance provides an additional level of analysis whereby vessel speed can provide an indication as to whether a vessel is likely to be fishing or steaming.

12.67 All EU, Faroese and Norwegian commercial fishing vessels that exceed 15 m overall length must be fitted with VMS units. From 2012, this changed to an overall length of 12 m for EU vessels.

12.68 Marine Scotland Compliance provides VMS data amalgamated with landings by assigning reported landings to those particular vessels and reporting by gear type. Important shellfish (crustaceans and molluscs) are presented in Figure 12-3 and finfish species in Figure 12-4. The first 2 km of the export cable corridor is closed to all fisheries all year and activity presented here will likely be indicative of vessels transiting the area only (Figure 12-3 and Figure 12-4) or reflect the rendering process in presentation of the data.

12.69 Data for the period 2009 – 2013 show generally low intensity targeting of crab in the Offshore Site and some low to medium activity west, while the north and northwest Study

Area are indicative of the majority of activity (see Figure 12-3). However, data does not represent vessel activity for under 15 m vessels, which are likely to target the nearshore area.

12.70 Very low intensity activity targeting lobster is reported for the Study Area (Figure 12-3). Lobster is likely targeted by few vessels, inshore and as part of the pot/creel fishery. The species is generally landed in low quantities but has high market value source (see landings in Table 12-9). However, activity again is not represented for the under 15 m inshore fleet.

12.71 Low intensity scallop dredgers or tows may operate in the Project boundaries, while the majority of activity in this north coast area is concentrated east off Brims Ness to Thurso and west off Strathy Point (see Figure 12-3).

12.72 There is a low level of squid fishing intensity in the vicinity of the Project boundaries (Figure 12-3), landings are very low for the study area (Table 12-9) and the majority of activity is concentrated further west or north in other ICES rectangles. This species is likely caught as part of by-catch in trawl or pot fisheries but may be targeted occasionally by a dedicated nomadic fleet.

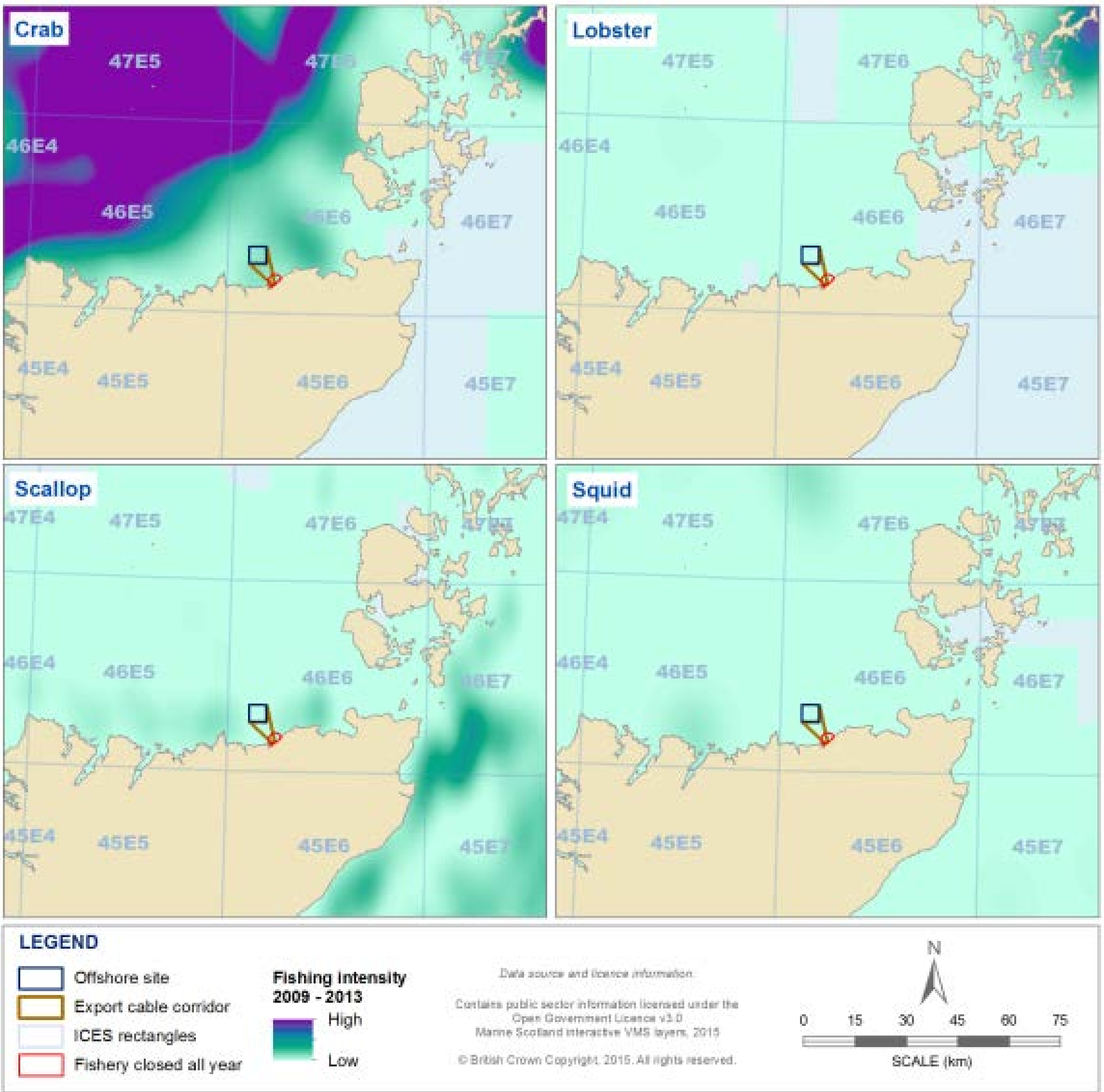


Figure 12-27 VMS fishing intensity – shellfish (over 15 m fleet) (Marine Scotland, 2015d)

12.73 The Offshore Site may be on the limits of or just south of low intensity activity for demersal mobile gear (Figure 12-4), a pattern of which is concentrated in the western and north west extent of the Study Area. Low level demersal static gears may also operate within the Study Area.

12.74 Pelagic gears targeting mackerel to a low extent may operate in the wider north coast area (Figure 12-4). The Offshore Site is on the edge of fishing grounds for the pelagic herring fishery, which is concentrated between Whiten Head and Strathy Point and some activity in the northwest of the Study Area and further north (Figure 12-4).

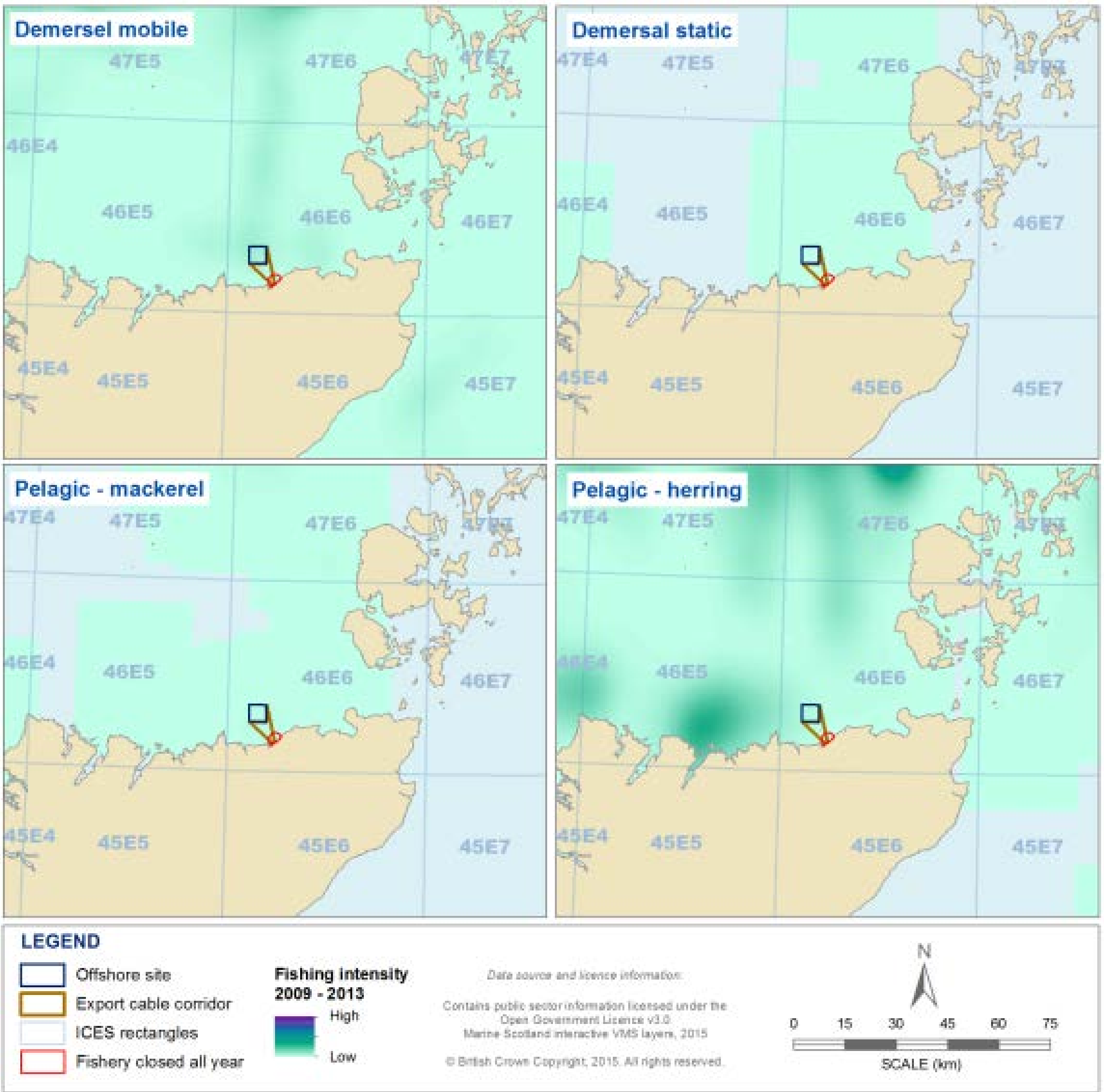


Figure 12-28 VMS fishing intensity – finfish (over 15 m fleet) (Marine Scotland, 2015d)

12.75 Consultation with SFF representatives supports the findings of the VMS spatial datasets whereby the Project boundaries are believed to be located within an area that is not intensively fished and the southern boundaries generally avoid known fishing grounds for the over 15 m fleet (see Section 12.5.2).

Fishing vessel activity (under 15 m vessels)

12.76 VMS and AIS are not currently a requirement for fishing vessels under 15 m overall length (vessels which represent a significant proportion of the Scottish inshore fleet) (see Section 12.8.2). Marine Scotland's ScotMap data[29] can be used to identify the general distribution and types of fishing activity by these smaller vessels in Scotland's inshore waters (see Section 12.7) (Marine Scotland, 2014). The ScotMap data for all vessel types (Figure 12-5) indicate that the Project area is not subject to intense fishing activity by small inshore vessels (under 15 m overall length).

12.77 The majority of vessels use pot and creel gears, with a small number operating in the Offshore Site (1-3 vessels) and low to medium number (1-5 vessels) within the export cable corridor (Figure 12-5). Activity along the wider Scottish north coast appears to be generally concentrated further east off Thurso and Dunnet Head and westwards towards Armadale Bay. At least one scallop dredging vessel may operate in the area, including the western boundary of the Offshore Site (Figure 12-5). No scallop diving activity is reported for vessels under 15 m in the vicinity of the Offshore Site or export cable corridor (Figure 12-5).

12.78 Fisheries are restricted around the export cable corridor where there is a 2 km fisheries exclusion zone (as shown by the red boundary in Figure 12-5). Anecdotal reports suggest that fishing by creel vessels occurs up to the boundary (see Section 12.5.2). The spatial distribution of vessels presented in Figure 12-5 indicates that the data are not highly accurate or may reflect the rendering process in presentation of the data and effort to anonymise individual fishing grounds.

12.79 The value of the Offshore Site to the under 15 m inshore fleet appears to be relatively low compared to the nearshore area and particularly further east off Thurso and Dunnet Head and westwards towards Armadale Bay for all fishing vessel types (Figure 12-6). The majority of landing value within the project area is derived from pot and creel gear types, most of which is focused around the cable route corridor (Figure 12-6). However this data should be treated with caution given the boundary of the fisheries exclusion zone.

[29] ScotMap provides spatial fisheries data for vessels under 10 m overall length (average activity during 2007-2011) using an interview-based approach conducted by Marine Scotland as part of an inshore fisheries mapping project.

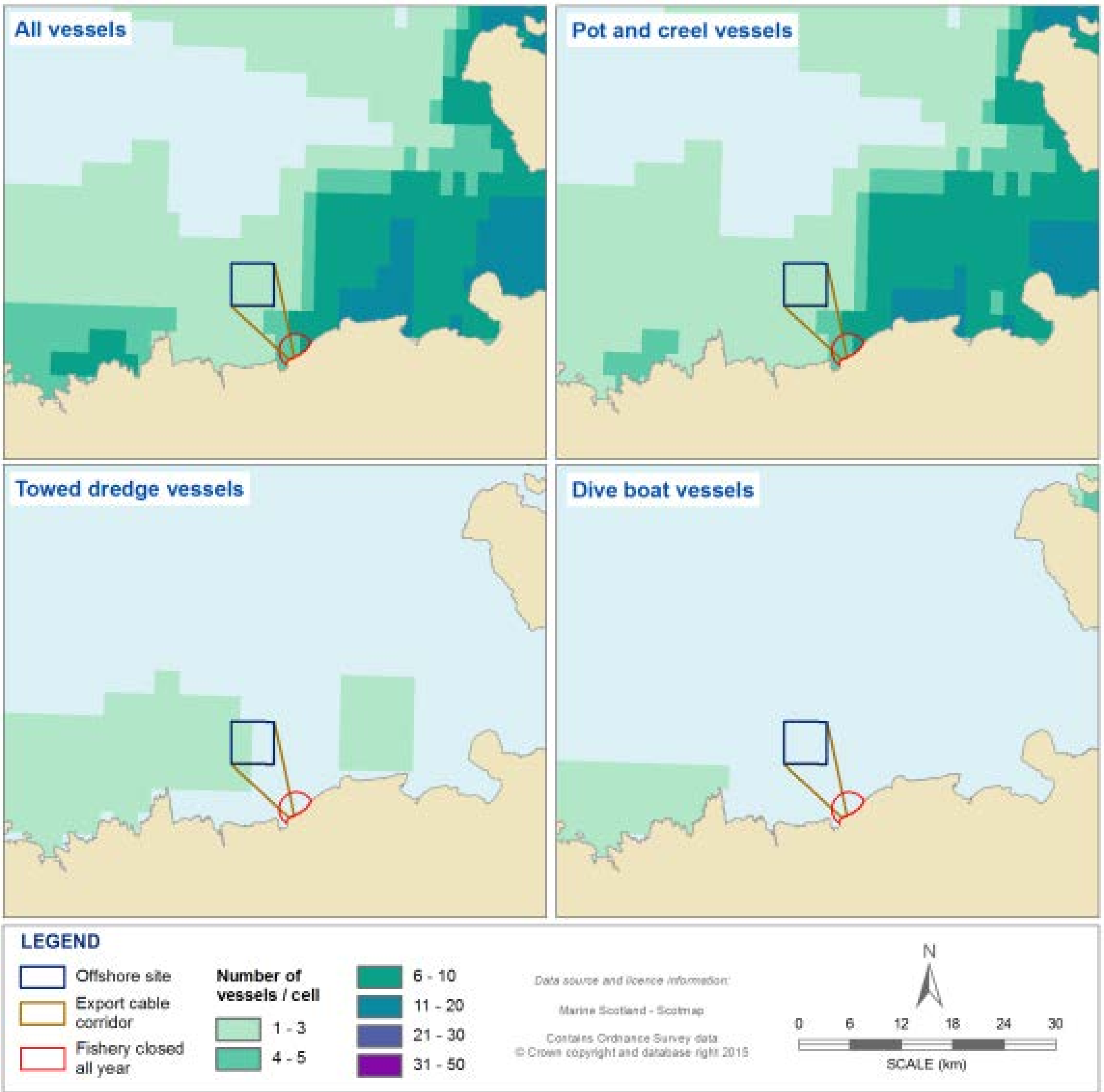


Figure 12-29 ScotMap data, vessel numbers by gear type in Study Area (Marine Scotland, 2014)

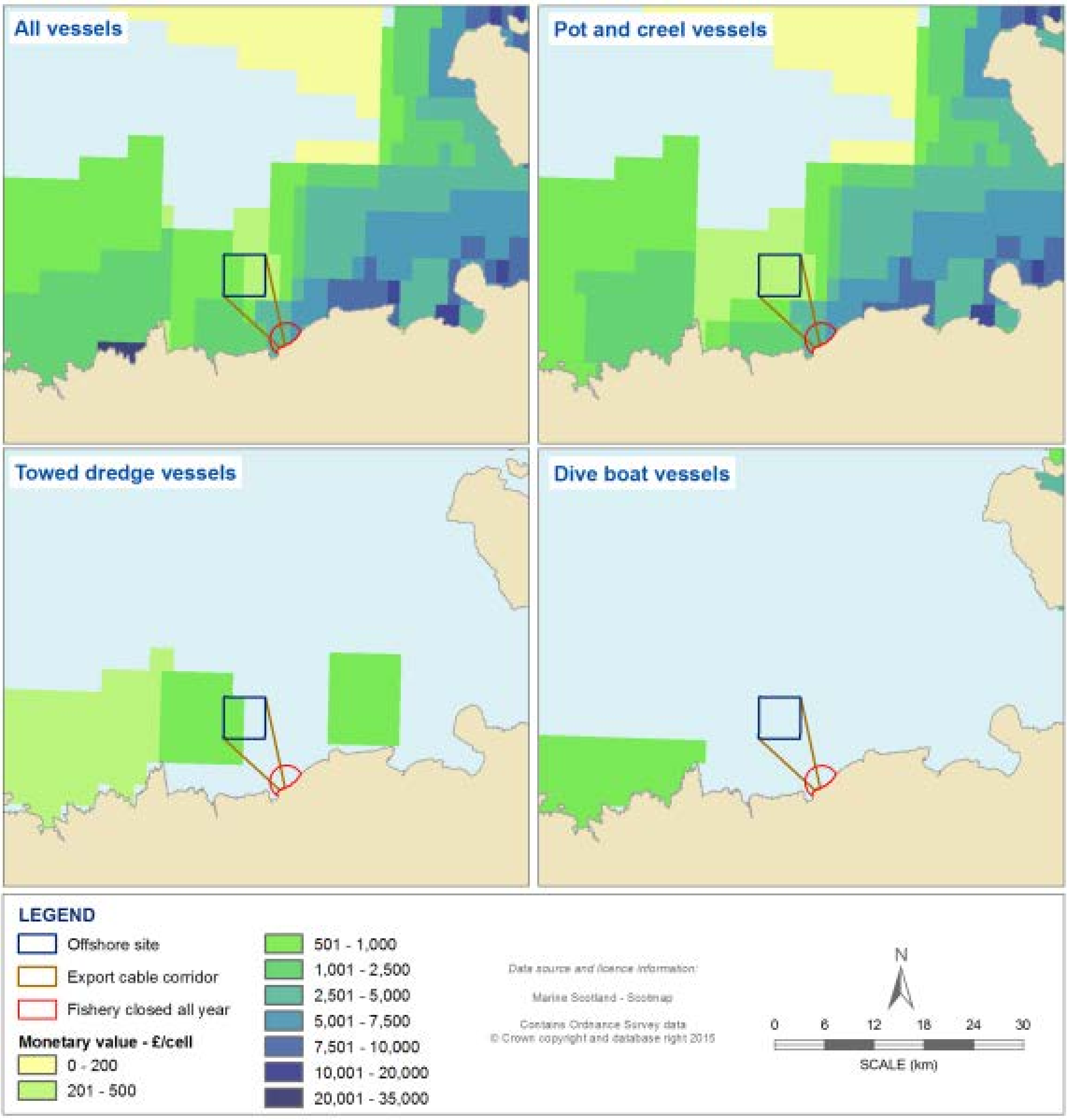


Figure 12-30 ScotMap data, monetary value by gear type in Study Area (Marine Scotland, 2014)

Summary of important fisheries within the Study Area

Demersal fishery

12.80 Haddock is one of the most important demersal species to the Scottish industry (Barreto and Bailey, 2015) and is targeted in the northern and central North Sea and west of Scotland in coastal and offshore waters by a range of gear types including demersal trawls and Scottish seine. The species is often caught in mixed demersal fisheries alongside cod, whiting, saithe and monkfish. The Study Area does not account for a significant proportion of Scottish landings of demersal species (see Section 12.8.2 and Table 12-7).

12.81 While haddock is one of the most important species landed in the Study Area and demersal trawl/seines account for a large proportion of landings (52 % landings and 37 % value, see Table 12-8), vessels targeting haddock and other demersal species appears to be relatively widespread with low intensity within and around the Project boundaries (see Figure 12-4).

Consultation with SFF indicates that the Project Offshore Site is not intensively fished and that the southern extent avoids known fishing grounds (see Section 12.5.2).

Shellfish – creel fishery

12.82 The brown crab (edible crab) and the European lobster are commercially important species for the Scottish fishery (Barreto and Bailey, 2015) and are typically targeted by mixed creel fishing in inshore waters and along coastal fringes by vessels under 15 m length. Species caught as part of the mixed creel fishery may also include velvet crab and green crab, among others. Brown crab are also targeted further offshore by larger vessels (over 15 m) with vivier tanks[30]. The creel vessels use static gear (creels or pots) which are set on ropes of up to 50 creels per rope for smaller vessels and up to three times that on the larger vessels. The brown crab is fished year round and although generally not seasonal, weather conditions can reduce fishing effort or shift target to species found in more sheltered inshore waters such as velvet crab or green crab. Market prices can also influence target species.

12.83 Lobsters live from the lower shore down to 60 m on a hard bedrock or boulder substrate with holes, caves and overhangs which are used as safety retreats. The entire north coast of Sutherland and Caithness provides abundant suitable habitat (see Chapter 8 Benthic and Shellfish Ecology for further information).

12.84 While traditionally caught by the under 10 m inshore fleet, which is the most important fleet in terms of size and gear type both nationally and locally (see Section 12.8.2 and 12.8.3), in recent years the over 10 m offshore fleet now account for over half of all brown crab landings in Scotland (Barreto and Bailey, 2015). In the Study Area, pot and creel gears account for 40 % of landings and 52 % of value (over and under 10 m vessels, Table 12-8).

12.85 Landings relevant to the Project boundaries are most likely to be predominantly attributed to smaller vessels that typically target the inshore waters, as shown by the distribution of over 15 m vessels in Figure 12-3 and under 15 m vessels in Figure 12-5 for brown crab. It is estimated that up to 5 vessels, under 15 m length, may operate in and around the Project boundaries (Figure 12-5). The monetary value of landings are estimated to be very low compared to further east of the Project boundaries (Figure 12-6). The ScotMap monetary figures provide an indication of the relative importance of particular areas of the inshore waters for the local fleet.

Shellfish – scallop fishery

12.86 King or Great scallops (*Pecten maximus*) have a patchy distribution and are generally found in shallow depressions in the seabed on a mix of sediment types including firm sand, fine or sandy gravel and occasionally on muddy sand (see Chapter 8 Benthic and Shellfish Ecology for further information). Scallops are fished mostly by specialised dredgers, smaller vessels inshore and fewer larger vessels in offshore waters and a small percentage by divers along coastal fringes.

12.87 Landings in the Study Area are not high (6 % of overall landings and 8 % of value, (Table 12-9), a proportion of which may be attributed to the scallop fishery based in Orkney waters (as discussed in Section 12.8.4).

12.88 Low level scallop dredging or trawling activity may be undertaken by the over 15 m fleet around but very little is apparent within the Project boundaries (Figure 12-3). ScotMap data indicates that there may be up to 3 vessels under 15 m that operate towed dredges in the

[30] Vivier tanks keep shellfish alive and enable vessels to fish for longer periods offshore in deeper waters.

western boundary of the Offshore Site (Figure 12-5). The estimated monetary value per square (4.2 km^2) is low compared to landings from the east coast of the Orkney Islands[31].

Pelagic fishery

12.89 The Atlantic Herring is a pelagic species, fished with single and pair refrigerated mid-water trawls primarily by the large vessels of the pelagic fleet and occurring in surface waters down to a depth of 200 m. Herring tend to stay away from immediate coastal waters apart from during the spawning season when they move closer inshore (See Chapter 9 Fish Ecology for further information).

12.90 Pelagic landings are very low in the Study Area and represent a very small proportion of Scottish landings (see Section 12.8.2 and Table 12-7). Herring accounts for 23 % of the overall landings in the Study Area and just 6 % of value (Table 12-9) but it is apparent from Figure 12-4 that very little relevant vessel activity is likely within the Project boundaries. Consultation with SFF indicates that the Project Offshore Site is not intensively fished and that the southern extent avoids known fishing grounds (see Section 12.5.2).

Summary of baseline conditions

12.91 The most important fisheries relevant to the project boundaries and surrounding vicinity is the pot and creel fishery, particularly for the under 15 m fleet (predominantly under 10 m vessels). There may be some activity by the demersal and to a lesser degree the pelagic and scallop dredging fleet.

12.10 Identification of Potential Impacts

12.92 The following impacts have been considered in the assessment. These have been identified through scoping and the consultation process.

Potential Impacts in the construction phase

- Loss of access to fishing grounds due to the presence of vessels and safety zones during construction;
- Obstruction of regular fishing vessel transit routes due to the presence of vessels and safety zones during construction; and
- Change in the abundance or distribution of target species and resulting impact on fisheries resource due to construction activities.

Potential Impacts in the operations and maintenance phase

- Loss of access to fishing grounds due to the presence of floating platform, associated moorings and safety zone;
- Displacement to other fishing grounds resulting in increase pressure on resources or conflict with other sea users, due to the presence of floating platform, associated moorings and safety zone;
- Obstruction of regular fishing vessel transit routes due to the presence of floating platform, associated moorings and safety zone;

[31] See Marine Scotland's National Marine Plan Interactive ScotMap data for the full distribution of inshore fishing activity in Scottish waters: https://marinescotland.atkinsgeospatial.com/nmpi/

- Potential for fishing gear to become entangled with floating and subsea structures, resulting in damage or loss of fishing gear;

12.93 The impact as a navigational risk is addressed in Chapter 13: Shipping and Navigation and the NRA; and

- Change in the abundance or distribution of target species and resulting impact on fisheries resource due to the presence of operational infrastructure.

Potential Impacts in the decommissioning phase

- Impacts during the decommissioning phase will be similar to, but not exceeding those during the construction phase.

12.11 Impact Assessment – Construction Phase

Loss of access to fishing grounds due to the presence of vessels and safety zones during construction

12.94 Construction activity could reduce the potential available fishing grounds over an extended sea area and could result in a loss of revenue for those that regularly fish the area during construction.

12.95 Installation activity and construction vessel presence will be temporary, lasting up to 3 months. Safety zones around the construction sites will limit the movements of all non-project vessels to ensure operations are managed safely. The extent and duration of safety zones will be agreed with the Northern Lighthouse Board (NLB) and the Maritime Coastguard Agency (MCA). The area of restriction could be up to 5 km^2 (20 % of the Offshore Site or 0.16 % of the Study Area), almost twice the footprint of the operational Site (see Table 12-3), while the offshore infrastructure is being installed.

12.96 Installation of the platform and associated infrastructure in the Offshore Site will take up to 3 months, requiring up to 9 vessels. Export cable installation should take approximately 1 week, requiring 2 vessels.

12.97 The implementation of a 500 m safety zone will ensure construction activities are managed safely and that there is no risk posed to the safe navigation of vessels including commercial fishing vessels transiting or fishing in the study area. Navigation and safety issues relating to increased vessel activity is addressed in Chapter 13 Shipping and Navigation and the Navigational Risk Assessment (Appendix 13.1), which together outline the range of safety mitigation measures that will be implemented.

12.98 Fishing activity within the Project boundaries is relatively low intensity for the pelagic, demersal and scallop fleet relative to the wider sea area (Figure 12-3 and Figure 12-4). The creel fishery is likely to have greater sensitivity to the proposals, however the area concerned is shown to only be fished at relatively low intensity compared to other areas along the coast (Figure 12-5). The Project Site is also likely to form part of wider available fishing grounds for all fisheries. The pelagic, demersal and scallop fisheries are considered to be of low vulnerability. The creel fishery is considered to be of medium vulnerability, as a precaution, due to some uncertainty about vessel activity for the under 10 m fleet and given the small-scale nature of their fishing activity and greater sensitivity to change in available fishing grounds.

12.99 Construction activity will result in a temporary loss of access to fishing grounds, covering a very small footprint relative to wider available fishing ground and therefore resulting in a minor alteration to baseline conditions for a relatively short period. The magnitude of effect is therefore considered low.

12.100 Effects are considered minor for all four fisheries and therefore not significant.

Obstruction of regular fishing vessel transit routes due to the presence of vessels and safety zones during construction

12.101 Construction activity may obstruct local navigation and transit routes for fishing vessels resulting in increased steaming time to and from fishing grounds.

12.102 Obstruction of transit routes will be temporary in nature and last for a period of up to 3 months. A safety zone around the extent of the offshore infrastructure and cable route will limit all non-project vessels from entering these areas, covering up to 5 km^2 (including platform infrastructure) within the Offshore Site and a 500 m buffer around installation of the export cable in the export cable corridor. Therefore, there should be no interaction between fishing vessels and project vessels within these areas. The range of proposed communications with stakeholders is described in Chapter 13 Shipping and Navigation to ensure awareness of the development. Disruption to fishing vessel transit routes during the installation of the export cable (13.8 km maximum length) is expected to occur for a period of up to 1 week.

12.103 Construction traffic may undertake slower speeds than normal vessel traffic in the area, which could temporarily disrupt fishing activity to allow safe transit of these vessels, however should not halt or impede fishing vessel activity to a degree which is over and above normal variation of navigational obstacles experienced.

12.104 Fishing activity in and immediately surrounding the Offshore site is of relatively low intensity (Figure 12-3, Figure 12-4 and Figure 12-5), therefore access requirements through the Project area are not likely to be high. Fishing vessels may be transiting to and from Scrabster Port and others from fishing grounds west and north of the Offshore Site or beyond the Study Area and could therefore be obstructed by construction activity. AIS data shows that a number of vessels transit the Offshore Site, most of which do so three times or less in the year (90 % in the study period, see Figure 12-2). It is apparent that the majority of fishing vessels (over 15 m) transit north of the Offshore Site in the Pentland Firth shipping channel.

12.105 Fishing vessels are accustomed to the consideration of other sea users and given the nature and frequency of vessel transits in and around the Pentland Firth shipping lane and general inshore waters, vessel traffic and safety zones associated with construction of the project are unlikely to constitute an additional significant disruption to fishing activity and navigation. Furthermore, construction activity is temporary and there will be sufficient sea space for smaller vessels to pass south of the Offshore Site during the platform installation and north of the export cable corridor during export cable installation.

12.106 Pelagic, demersal and scallop fisheries sectors are considered to be of low vulnerability, while the creel fishery is considered to be of medium vulnerability. Construction activity is likely to result in a low magnitude of effect given the relatively small scale and duration of construction activities and the availability of sea space to navigate around established safety zones. Impacts are subsequently expected to be of minor significance for all fisheries.

Change in the abundance or distribution of target species and resulting impact on fisheries resource due to construction activities

12.107 The addition of new structures or material; on the seabed may provide suitable shelter and habitat for some commercial species, potentially increasing abundance in the longer term.

However construction activities including the placement of anchors, the excavation of an export cable corridor, placement of the cable and of protection material will cause disturbance of the seabed and may have a detrimental effect on species' habitats, particularly for spawning or juvenile species. Direct impacts on commercially important fish species and associated habitats are assessed in Chapter 8 Benthic and Shellfish Ecology and Chapter 9 Fish Ecology.

12.108 A direct loss of fish or shellfish in the local area or damage to habitat providing important spawning or nursery grounds for commercial fish species may indirectly impact commercial fisheries by reducing the available resource or resulting in increased effort by fisheries to maintain landings.

12.109 The impact assessments for fish and shellfish species both conclude no significant residual effects of Project construction activities on the distribution and abundance of commercially targeted species. Therefore no notable changes in the abundance or distribution of target species is anticipated given the small footprint of the Project relative to the available habitat for species concerned, resulting in a negligible magnitude of effect. All fisheries are considered to be of low vulnerability given the lack of sensitive or isolated spawning and nursery habitats within the Project boundaries, those identified are widespread and not unique to the Study Area (see Chapter 8 and Chapter 9). Impacts are therefore anticipated to be of negligible significance.

12.12 Impact Assessment – Operations and Maintenance Phase

Loss of access to fishing grounds due to the presence of floating platform, associated moorings and safety zone

12.110 Throughout the lifetime of the project there will be permanent loss of access to fishing grounds from an area which includes the floating platform footprint, its associated mooring footprint and safety zone established around the infrastructure (up to 2.3 km^2, 9 % of the Offshore Site or 0.07 % of the Study Area).

12.111 A 2 km fishing exclusion buffer from the Dounreay Nuclear Site's outflow pipe already limits fishing activity within the proposed export cable corridor. The export cable will be buried or covered with cable protection material (up to 20 %) along the entire route, therefore access to currently available fishing ground within the cable corridor will be maintained following completion of installation.

12.112 Fishing activity within the Project boundaries is of relatively low intensity for the pelagic, demersal and scallop fleet relative to the wider sea area (Figure 12-3 and Figure 12-4). The creel fishery is likely to have greater sensitivity to the proposals, however the area concerned appears to only be fished at relatively low intensity compared to other areas along the coast (Figure 12-5). The Project Site is also likely to form part of wider available fishing grounds for all fisheries.

12.113 Target species including haddock and herring are mobile and wide-ranging, therefore it is unlikely that loss of grounds of this small scale will result in a discernible change in landings of these species. The seabed sediment found within the proposed project footprint is widespread and relatively homogenous to fishing ground in the wider area for species targeted by the creel and scallop fisheries.

12.114 The footprint of the floating platform and associated moorings is relatively small in proportion to the extensive fishing grounds available within the Study Area and other grounds in Scottish waters, such that any change to commercial fishing activity is likely to be highly localised.

12.115 As the development proposals will result in a long term loss of access to fishing grounds, albeit at a very small scale, the magnitude of effect is assessed as medium. The vulnerability of the pelagic, demersal and scallop fisheries is considered low and the creel fleet (under 10 m vessels) is assessed as medium vulnerability given the small-scale nature of their fishing activity and greater sensitivity to change in available fishing grounds.

12.116 Impacts on the pelagic, demersal and creel fisheries is therefore considered to be of minor significance, while impacts on the creel fishery is considered moderate.

Displacement to other fishing grounds resulting in increased pressure on resources or conflict with other sea users, due to the presence of floating platform, associated moorings and safety zone

12.117 Displacement of fishing activity from traditional fishing grounds to grounds outside the Project footprint may result in increased pressure on other existing grounds or conflict with other sea users. This has the potential to impact existing local fishing management practices and relationships between existing sea users. Navigational impacts are addressed in Chapter 13 Shipping and Navigation and the NRA (Appendix 13.1).

12.118 The project footprint will result in a displacement from up to 2.3 km^2 of fishing grounds for the duration of the Project lifetime. The footprint of the floating platform and associated moorings is relatively small in proportion to the extensive fishing grounds available within the overall Offshore Site (66 km^2) and other grounds in inshore waters, such that any changes to commercial fishing activity is likely to be highly localised.

12.119 The level of displacement is likely to be relatively small and competition likely to be very low in the given area. The Pelagic, demersal and scallop fisheries are likely to be of low sensitivity to change given the scale of fishing grounds they operate within, however there is potential for the under 10 m creel fleet to be of greater sensitivity to displacement in local waters and is therefore considered to be of medium vulnerability.

12.120 The magnitude of impact is likely to be low given the size of the project footprint in relation to wider available fishing grounds. Furthermore, the offshore project area (and potentially wider study area) is not considered a primary or exclusive fishing ground for fishing vessels that use the local area.

12.121 The impact significance is therefore assessed as minor for all fisheries.

Obstruction of regular fishing vessel transit routes due to the presence of floating platform, associated moorings and safety zone

12.122 The presence of the floating platform, associated moorings and safety zone may obstruct local navigation and transit routes for fishing vessels resulting in increased steaming time to and from fishing grounds.

12.123 Obstruction of transit routes will be permanent, in terms of the project lifetime. A safety zone around the extent of the offshore infrastructure and cable route will limit all non-project vessels from entering these areas, covering up to 2.3 km^2 (including platform infrastructure) somewhere within the Offshore Site. Therefore, there should be no interaction between fishing vessels and project vessels within this area. The range of proposed communications with stakeholders is described in Chapter 13: Shipping and Navigation to ensure awareness of the development. Following construction, there will be no obstruction to fishing vessel traffic through the export cable route corridor.

12.124 Maintenance vessel traffic will generally operate within the safety zone, therefore limiting the area of additional obstruction, however should not halt or impede fishing vessel activity to a degree which is over and above normal variation of navigational obstacles experienced.

12.125 Fishing activity in and immediately surrounding the Project boundaries is of relatively low intensity (Figure 12-3, Figure 12-4 and Figure 12-5), therefore access requirements through the Project area not likely to be high. Fishing vessels may be transiting to and from Scrabster Port and others from fishing grounds west and north of the Offshore Site or beyond the Study Area and could therefore be obstructed by construction activity. AIS data shows that a number of vessels transit the Offshore Site, most of which do so three times or less in the year (90 % in the study period, see Figure 12-2). It is apparent that the majority of fishing vessels (over 15 m) transit north of the Offshore Site in the Pentland Firth shipping channel.

12.126 Fishing vessels are accustomed to the consideration of other sea users and given the nature and frequency of vessel transits in and around the Pentland Firth shipping lane and general inshore waters, vessel traffic and safety zones associated with construction of the project are unlikely to constitute an additional significant disruption to fishing activity and navigation. Furthermore, there will be sufficient sea space for smaller vessels to pass south or north of the Offshore Site given that the operational footprint will be a maximum of 2.3 km^2, just 9 % of the Offshore Site.

12.127 Pelagic, demersal and scallop fisheries sectors are considered to be of low vulnerability, while the creel fishery is considered to be of medium vulnerability. The magnitude of effect is assessed as low given the relatively small scale of the footprint and the availability of sea space to navigate around the established safety zone. Impacts are subsequently expected to be of minor significance for all fisheries.

Potential for fishing gear to become entangled with floating and subsea structure, resulting in damage or loss of fishing gear

12.128 There is potential for fishing gear to become snagged on or entangled with floating and subsea structures, including any unburied export cable or on cable protection material which could result in the damage or loss of gear and thus impact fishing activity and subsequent landings. The export cable (up to 13.8 km length) will be buried to a depth of 1-2 m and up to 20 % (2.8 km) may require cable protection with a number of materials including rock placement. There will be up to 8 mooring lines and 16 anchors deployed to secure the floating platform.

12.129 The snagging or entanglement of fishing gear is a potential navigational hazard for some commercial fishery vessels and this aspect is addressed in Chapter 13: Shipping and Navigation and the NRA (Appendix 13.1). Fishing vessels potentially affected by the export cable, cable protection material or anchors are those that come into contact with the seabed and include scallop dredgers, bottom trawlers and possibly vessels with pot or creel gears. All fishing gear types could be affected by mid-water mooring lines or electrical cables and the floating platform.

12.130 Fishing activity is of low intensity within the project boundaries for all fisheries, however due to the risks associated, all fisheries are considered medium vulnerability to any loss or damage of gear. The magnitude of effect is considered medium as loss of or damage to gear for any of the fisheries is likely to be detrimental to overall fishing activity for any vessel concerned.

12.131 The impact significance is therefore considered moderate.

Change in the abundance or distribution of target species and resulting impact on commercial fisheries resource due to the presence of operational infrastructure

12.132 Operational impacts include those arising from the presence of structures or material on the seabed, electromagnetic fields (EMF) and thermal loading from mid-water cables and export cable, underwater noise from the operation of the turbines and platform.

12.133 The addition of new structures or material; on the seabed may provide suitable shelter and habitat for some commercial species, potentially increasing abundance. Other impacts resulting in disturbance, behavioural change or direct fatality may negatively impact the abundance and distribution of target species, thus reducing the available resource for commercial fisheries interests. The direct impacts on the commercial species is assessed in Chapter 8: Benthic and Shellfish Ecology and Chapter 9: Fish Ecology.

12.134 A direct loss of fish or shellfish in the local area or damage to habitat providing important spawning or nursery grounds for commercial fish species may indirectly impact commercial fisheries by reducing the available resource or resulting in increased effort by fisheries to maintain landings.

12.135 The impact assessments for fish and shellfish species both conclude no significant residual effects of Project operational components on the distribution and abundance of commercially targeted species. Therefore no notable changes in the abundance or distribution of target species is anticipated given the small footprint of the Project relative to the available habitat for species concerned, resulting in a negligible magnitude of effect. All fisheries are considered to be of low vulnerability given the lack of sensitive or isolated spawning nursery habitats within the Project Site, those identified are widespread and not unique to the Study Area (see Chapter 8 and Chapter 9). Impacts are therefore anticipated to be of negligible significance.

12.13 Mitigation Measures

12.136 Project Commitments, described in Chapter 4: Project Description, which comprise general measures relevant to the mitigation of impacts on Commercial Fisheries include:

- GM18 - Cable Laying Strategy and Method Statement
- GM2 - Construction Environmental Management Document
- GM3 - Operational Environmental Management Plan
- GM22 - Vessel Management Plan (VMP)
- GM23 - Construction Safety Zone
- GM24 - Operational Safety Zone
- GM31 - Navigational aids

12.137 Receptor specific mitigation measures are summarised in Table 12-10.

Table 12-53 Receptor specific mitigation measures

Mitigation Measures Specific to Commercial Fisheries		
Ref	**Title**	**Description**
CF01	Fisheries Management Plan (FMP)	The Applicant will develop, manage and implement a Fisheries Management Plan that will be reviewed and monitored over a defined timescale. The FMP will be implemented by a working group whom will focus on minimising disruption, particularly during the construction phase, and displacement of the relevant commercial fisheries and ensure dissemination of project information and activities to the wider fishing community.
CF02	Appointment of a Fisheries Liaison Officer (FLO)	The FMP will be actioned by a dedicated fisheries liaison working group, coordinated by an appointed Fisheries Liaison Officer (FLO) for the planning and duration of installation activities and any operational maintenance or repairs. This person, appointed by the fishing community, will be the key point of contact between the fishing community and Dounreay Trì Limited. The FLO will ensure that all fisheries sectors operating in the area are aware of planned and ongoing construction activities to reduce potential periods of disruption or allow affected fisheries to plan fishing activity elsewhere or at different times. The FLO will also ensure any concerns raised by fisheries are brought to the Applicant and addressed as soon as possible.
CF03	Cable Protection Monitoring	Operational performance and safety inspections of the export cable will ensure that the cable remains buried, any protection material remains in place and that the cable is not vulnerable to snagging or damage from fishing gear or anchors and that no debris hazardous to fishing activity is present.
CF04	Advisory Zone	SFF (2016) suggest that the project could be marked on charts as an operational "Advisory Zone". The Advisory Zone would extend 50m from the anchors and encompass the platform and mooring system. An Advisory Zone is marked on the "Fish Safe" system and would trigger an alarm that there is a high risk of snagging when approaching the zone. Advisory zones have been used for decommissioned oil and gas platforms and are being considered for the Hywind project.

12.14 Residual Impacts

12.138 The majority of impacts are assessed as having minor or negligible significance, with two assessed as moderate. Dounreay Trì Limited is committed to reducing impacts wherever possible. Those impacts that were assessed as moderate will have mitigation measures applied thus reducing impact significance of all impacts to minor or negligible i.e. not significant. Impacts assessed as minor will be reduced further through the implementation of project and receptor specific mitigation measures to ensure they remain not significant.

Construction phase

Loss of access to fishing grounds due to the presence of vessels and safety zones during construction

12.139 The Applicant will develop a Fisheries Management Plan (FMP)(CF01) to minimise the potential loss of important fishing grounds during construction. The FMP will include input from local fishermen to inform the identification of an appropriate site to avoid important grounds, where possible, and maintain the economic value of the relevant commercial fisheries in order to ensure that residual effects due to any loss of fishing grounds do not become significant.

12.140 The Fisheries Liaison Officer (FLO) (CF02) will ensure that all fisheries sectors operating in the area are aware of planned and ongoing construction activities to reduce potential periods of disruption as a result of the implementation of safety zones around the proposed site, or allow affected fisheries to plan fishing activity elsewhere or at different times. The FLO will also ensure any concerns raised by fisheries are brought to the Applicant and addressed as soon as possible.

12.141 Furthermore, Project Commitment mitigation measures including: the implementation of a Construction Environmental Management Document (GM2), which will include a Vessel Management Plan (VMP) (GM22); the use of navigational aids (GM31); and the application of safety zones (GM23 and GM24) will ensure disturbance to commercial fisheries is minimised while safety is prioritised.

12.142 These mitigation measures will ensure that the magnitude of impact remains low or is negligible and residual impacts are not significant.

Obstruction of regular fishing vessel transit routes due to the presence of vessels and safety zones during construction

12.143 The FMP (CF01) and FLO (CF02) will aim to minimise disruption or obstruction of regular fishing vessel transit routes during construction by ensuring that all fisheries sectors operating in the area are aware of planned and ongoing construction activities to reduce potential periods of disruption or allow affected fisheries to plan fishing activity elsewhere or at different times. The FLO will also ensure any concerns raised by fisheries are brought to the Applicant and addressed as soon as possible.

12.144 Furthermore, Project Commitment mitigation measures including: the implementation of a Construction Environmental Management Document (GM2), which will include a VMP (GM22); the use of navigational aids (GM31); and the application of safety zones (GM23 & GM24) will ensure disturbance to commercial fisheries is minimised while safety is prioritised.

12.145 These mitigation measures will ensure that the magnitude of impact remains low or is negligible and residual impacts are not significant.

Operational phase

Loss of access to fishing grounds due to the presence of floating platform, associated moorings and safety zone

12.146 The FMP (CF01) will aim to minimise the potential loss of important fishing grounds due to the presence of the Project infrastructure and operational safety zone by including input from local fishermen to inform the identification of an appropriate site to avoid important grounds, where possible, develop actions to minimise displacement and maintain the economic value of the relevant commercial fisheries in order to ensure that residual effects due to any loss of fishing grounds do not become significant. The FLO (CF02) will also ensure any concerns raised by fisheries are brought to the Applicant and addressed as soon as possible.

12.147 The residual impact magnitude on the creel fishery is therefore considered low and impact significance assessed as minor.

12.148 These mitigation measures will ensure that the magnitude of effect remains low or is negligible for all fisheries and residual impacts are minor or negligible and not significant.

Displacement to other fishing grounds resulting in increase pressure on resources or conflict with other sea users, due to the presence of floating platform, associated moorings and safety zone

12.149 The FMP (CF01) will aim to minimise the potential displacement to other fishing grounds due to the presence of the Project infrastructure and operational safety zone by including from local fishermen to inform the identification of an appropriate site to avoid important grounds, where possible, develop actions to minimise displacement and maintain the economic value of the relevant commercial fisheries in order to ensure that residual effects due to any displacement from fishing grounds do not become significant. The FLO (CF02) will also ensure any concerns raised by fisheries are brought to the Applicant and addressed as soon as possible.

12.150 These mitigation measures will ensure that the magnitude of effect remains low or is negligible for all fisheries and residual impacts are minor or negligible and not significant.

Obstruction of regular fishing vessel transit routes due to the presence of floating platform, associated moorings and safety zone

12.151 The Applicant will develop a Fisheries Management Plan (FMP) (CF01) to minimise unnecessary obstruction of fishing vessel transit routes for access to other fishing grounds.

12.152 The FLO (CF02) will ensure that all fisheries sectors operating in the area are aware of planned maintenance activities to reduce potential periods of disruption or allow affected fisheries to plan fishing activity elsewhere or at different times. The FLO will also ensure any concerns raised by fisheries are brought to the Applicant and addressed as soon as possible.

12.153 Furthermore, Project Commitment mitigation measures including: the implementation of an Operational Environmental Management Document (GM2) which will include a VMP (GM22); the use of navigational aids (GM31); and the application of safety zones (GM23 & GM24) will ensure disturbance to commercial fisheries is minimised while safety is prioritised.

12.154 These mitigation measures will ensure that the magnitude of effect remains low or is negligible for all fisheries and residual impacts are minor or negligible and not significant.

Potential for fishing gear to become entangled with floating and subsea structures, resulting in damage or loss of fishing gear

12.155 Snagging on the export cable is mitigated by appropriate cable protection measures. Several options for laying the cable on the seabed are under consideration and the final method selected will depend on seabed type and environmental conditions. The cable will be buried where feasible and cable protection utilised where burial is not possible. Discussion on the nature of any cable protection will be an integral part of the Cable Laying Strategy and Method Statement (GM18) which should include a Cable Burial Strategy and the FMP (CF01).

Cable monitoring (CF03) will ensure that protection measures are maintained and the cable is not exposed. Fishermen will be informed of the location of the cable through the FLO (CF02) and it will be publicised on kingfisher or other navigational notification sources.

12.156 Entanglement or snagging on the floating platform, mid-water moorings and cables is mitigated by the application of a safety zone of 50 m around the infrastructure (GM24).

12.157 The NRA assesses the impact as low risk therefore the residual effects are low/negligible.

12.158 There should be no interaction with the pelagic trawling, other midwater trawl fisheries or creeling in the export cable corridor area and are likely to continue to take place safely in this area. However fisheries such as demersal trawling and scallop dredging may choose to avoid it to reduce snagging risk.

12.159 While cable protection measures will minimise the risk of fishing gear becoming snagged on the export cable (see impact on fishing gear snagging), some cable protection materials could themselves present a hazard for certain fisheries, particularly scallop dredgers and demersal trawlers. It is likely that these fisheries will avoid the cable corridor area, resulting in displacement of or disruption to fishing activity by scallop dredgers and bottom trawlers across the cable route corridor. In the event that gear can be lifted from the seabed while traversing the protected cable, then the impact is considered to be disruption rather than displacement and is likely to have a minor or negligible impact on the fisheries in question.

12.15 Cumulative Impacts

12.160 There is potential for cumulative impacts to arise from the development of a number of other projects in the nearby area:

- The Orkney-Caithness interconnector cable;
- Brims Tidal Array;
- MeyGen;
- Westray South;
- Lashy Sound; and
- HIE Dounreay Demonstration Centre (DDC).

12.161 The consideration of projects that could result in potential cumulative impacts is assessed based on the results of the impact assessment, a review of the status of other projects, together with professional judgement of the specialist consultants.

12.162 The approach to the cumulative and in-combination impact assessment is described in Chapter 5: Environmental Impact Assessment Methodology.

Westray South and Lashy Sound

12.163 Commercial vessels fishing over 15 m within the Project area are unlikely to also fish grounds within the inner Orkney Islands, in areas associated with the proposed Lashy Sound and Westray South marine renewable energy sites, and vice versa. The over 15 m fleet generally fish grounds further offshore as shown in VMS intensity data (Figure 12-3, Figure 12-4 and see Marine Scotland's VMS data layers (2015d) for a wider scope of vessel activity throughout Scottish waters).

12.164 A predominantly under 10 m vessel fleet with pot and creel gears fishes Orkney's inshore waters (Marine Scotland, 2015b). The Scoping Report and Preliminary Hazard Analysis for Lashy Sound report that the area is predominantly fished by vessels under 15 m with creel gears or undertaking scallop diving (Scotrenewables, 2014). Similarly in the Scoping Report and Preliminary Hazard Analysis for the Westray South proposals, vessels recorded in the development area are relatively low and most fishing in the area is likely to be focussed around creeling and scallop diving (SSE Renewables, 2011). It is unlikely that these vessels fishing in the Lashy Sound and Westray areas would fish in grounds along the north coast or within the vicinity of the Project area. Similarly, it is unlikely that creel vessels or others under 15 m fishing the north Caithness coast would fish within the inner Orkney Islands.

12.165 It is therefore anticipated that there would be no cumulative impacts arising from these marine energy projects.

MeyGen

12.166 Impacts on commercial fisheries from the MeyGen project were all assessed as not significant, particularly due to the low intensity or infrequent fishing activity in the Inner Sound area and predominantly minor magnitude of impacts associated[32]. A small number of inshore vessels were identified as fishing in areas around the MeyGen site. Due to the small Project footprint, relative to the wider available fishing grounds, it is considered that there are unlikely to be cumulative effects associated with the Project and the MeyGen site.

Brims Tidal Array

12.167 The planning application and Environment Statement have not yet been submitted for the Brims Tidal Array project, however it is of sufficient distance from the Dounreay Trì project (30 km) such that significant cumulative impacts on commercial fishing interests are not likely to occur. The Brims Tidal Array area is expected to be fished primarily by a local inshore fleet that would not fish the north Caithness coast and vice versa. The Brims Tidal Array Scoping Report and PHA suggested that fishing activity is limited to creeling and the PHA shows that very few vessels over 15 m have been recorded in and around the project boundaries (Brims Tidal Array Ltd, 2013). In the Scoping Opinion for the Brims Tidal Array, OFA state that the inshore waters around Hoy are fished by local creel fishermen, particularly for lobster as a high value catch (MS-LOT, 2014).

12.168 The Project VMS density figures (Figure 12-3 and Figure 12-4) also indicate that the Brims Tidal Array area is not intensively fished by the larger fleets.

12.169 It is therefore anticipated that there would be no cumulative impacts arising from this marine energy project.

Orkney-Caithness Interconnector and DDC

12.170 There is potential for cumulative impacts to arise from the development of the Project, the Orkney-Caithness interconnector cable and the DDC. However, there is limited information available about these projects, therefore it is difficult to fully assess the extent of potential impacts (see further information in Chapter 17 Other Users of the Marine Environment).

12.171 Construction impacts will be temporary and unlikely to overlap due to the early stage of development for the DDC and Orkney-Caithness cable. However, should progress be made and construction works were to coincide, there could be temporary disturbance within a relatively local area which could have a greater impact on small, local inshore vessels than the larger fleet.

[32] Refer to the Environmental Statement on the Marine Scotland Licensing page: http://www.gov.scot/Topics/marine/Licensing/marine/scoping

12.172 Operational impacts relate to the combined footprint of the DDC and Project areas occupied by turbines, platforms and associated moorings and infrastructure. Loss of fishing grounds from these sites combined is likely to impact the small inshore fleet. The location of export cables, and depending whether buried or protection material used, could have impacts if not grouped to similar area. However the combined project footprint is likely to be very small, relative to wider available fishing grounds. At this time, the exact scale of the proposed DDC is not certain, however it is known that the site would comprise demonstration structures only and not a full scale commercial array. Therefore cumulative impacts are anticipated to be not significant based on information currently available.

12.16 Summary and Conclusions

- Four key fisheries have been identified in relation to the Project Site and Study Area: a low intensity pelagic fishery targeting herring; a low intensity mixed demersal fishery, primarily landing haddock and monkfish; a low intensity scallop dredging fishery; and a low intensity inshore creel fishery, predominantly composed of the under 10 m fleet, targeting crab and lobster;
- No significant impacts to the pelagic, demersal and scallop fisheries have been identified as arising from the Project proposals in terms of loss of fishing grounds, obstruction of fishing transit routes, displacement to other fishing grounds or indirect impacts on the fisheries resource due to the low intensity of activity and availability of fishing grounds in the wider sea area;
- There is the potential for moderate impacts to the inshore creel fishery in terms of loss of access to fishing grounds during operation, given the small-scale and localised nature of their fishing activity and greater sensitivity to change in available fishing grounds;
- Potential moderate impacts were identified for all four fisheries from the risk of gear damage or loss as a result of snagging gear on project infrastructure, however this will be mitigated through the application and monitoring of an operational safety zone (discussed further in the NRA, Appendix 13.1);
- Where there is potential for fishing grounds to be impacted for any of the four fisheries, to a moderate or minor degree, these will be mitigated through the development and implementation of a FMP and appointment of a FLO to ensure any concerns of fisheries are raised and addressed appropriately. The FMP will aim to minimise potential loss of important fishing grounds, avoid displacement to other grounds or unnecessary obstruction of fishing vessel transit routes for access to other fishing grounds;
- All residual impacts have subsequently been assessed as minor or negligible;
- No significant cumulative or in-combination impacts on Commercial Fisheries have been identified, particularly due to the lack of connectivity between projects and spatial coverage of the inshore under 10 m fleet, most likely to be affected by the Project proposals, that tend to fish in local, coastal waters; and
- A summary of residual impacts for Commercial Fisheries is presented in Table 12-11.

Table 12-54 Summary of residual impacts

Potential Impact	Fishery	Magnitude	Vulnerability	Overall significance
Construction				

Potential Impact	Fishery	Magnitude	Vulnerability	Overall significance
Loss of access to fishing grounds due to the presence of vessels and safety zones during construction	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Obstruction of regular fishing vessel transit routes due to the presence of vessels and safety zones during construction	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Change in the abundance or distribution of target species and resulting impact on fisheries resource due to construction activities	Pelagic, Demersal, Scallop, Creel	Negligible	Low	Negligible
Operation and Maintenance				
Loss of access to fishing grounds due to the presence of floating platform, associated moorings and safety zone	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Displacement to other fishing grounds resulting in increase pressure on resources or conflict with other sea users, due to the presence of floating platform, associated moorings and safety zone	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Obstruction of regular fishing vessel transit routes due to the presence of floating platform, associated moorings and safety zone	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Potential for fishing gear to become entangled with floating and subsea structures, resulting in damage or loss of fishing gear	Pelagic, Demersal, Scallop, Creel	Low	Medium	Minor

Potential Impact	Fishery	Magnitude	Vulnerability	Overall significance
Change in the abundance or distribution of target species and resulting impact on fisheries resource due to the presence of operational infrastructure	Pelagic, Demersal, Scallop, Creel	Negligible	Low	Negligible

13 Shipping and Navigation

13.1 Introduction

13.1 This chapter presents the assessment of the impacts of the Project on shipping and navigation procedures within and around the offshore Study Area as defined in in Figure 13-1.

13.2 A Marine Safety Navigational Risk Assessment (NRA) was undertaken by Aquatera. The NRA includes a description of key features of the marine environment including port and harbour facilities, navigational aids and restrictions and identified and assessed potential hazards, measures to mitigate these hazards and the level of risk of each hazard.

13.3 All potential navigational safety issues are considered fully in the NRA, this information is not repeated in this chapter. The purpose of this chapter is to consider potential effects on the existing environment with regard to shipping and navigation interests.

13.4 This chapter has linkages with, and should be read in conjunction with Chapter 12 Commercial Fisheries, Chapter 17 Other Users of the Marine Environment and Chapter 18 Socio-economics, Recreation and Tourism.

13.5 This chapter considers the current shipping and navigation activity within the Study Area (see 13.8) and includes an assessment of the potential impacts to shipping and navigation during construction, operation and decommissioning. Potential cumulative impacts are also considered (see Section 18.13). In order to avoid, minimise or remove these potential impacts, mitigation measures are proposed where appropriate.

13.2 Study Area

13.6 The offshore site (the 'Site') comprises a 5 by 5 km offshore area located approximately 6 km from the north coast of Scotland in the Pentland Firth and an export cable corridor running from the Site to the coast, immediately to the west of the Dounreay Restoration Fenceline (Figure 13-1).

13.7 The Study Area is defined as the Site and export cable corridor combined. The Study Area lies off the north coast of mainland Scotland in north-west Caithness, Highland Region. The nearest town is Thurso, some 12km to the east, and the village of Reay is approximately 1km to the south.

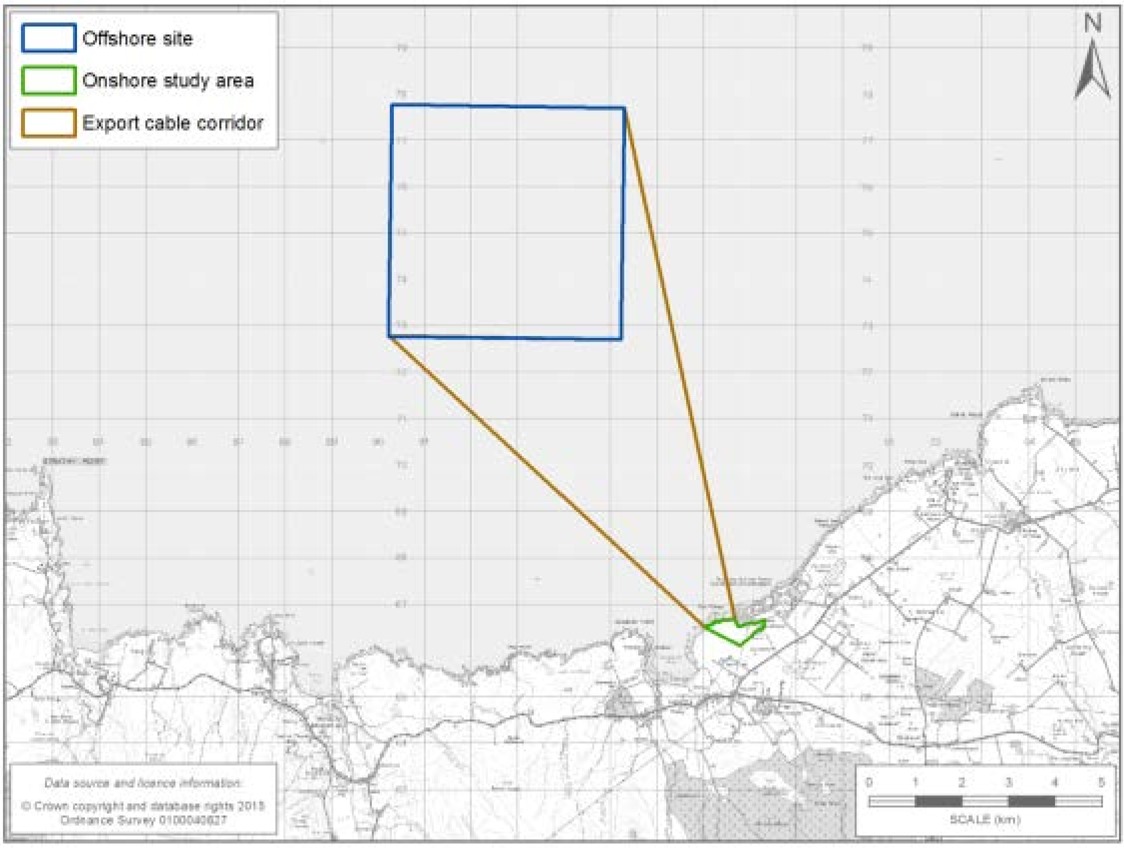


Figure 13-31 Offshore site and export cable corridor

13.3 Legislation and Guidance

13.8 The following relevant guidance provides advice as to how to consider impacts on shipping and navigation interests and was used in preparation of this chapter:

- Maritime and Coastguard Agency (MCA) Marine Guidance Notice 543: 'Offshore Renewable Energy Installations (OREI) - Guidance on UK Navigational Practice, Safety and Emergency Response Issues';
- MCA Marine Guidance Notice 372: 'Offshore Renewable Energy Installations (OREIs) - Guidance to Mariners Operating in the Vicinity of UK OREIs';
- DTI, 2013: 'Methodology for Assessing the Marine Navigational Safety & Emergency Response Risks of Offshore Renewable Energy Installations (OREI)';
- The Crown Estate, 2014: Pentland Firth and Orkney Waters Strategic Area Navigational Appraisal (SANAP) report;
- RenewableUK, 2014. H&S Guidelines: Offshore Wind and Marine Energy H&S Guidelines;
- HSE 2001: Health & Safety Executive Offshore Technology Report on Marine Risk Assessment; and
- DNV, 2003: RP-H101- Risk Management in Marine and Subsea Operations.

Sources of information

13.9 A detailed review was undertaken of the existing literature and data relating to this assessment and was used to provide an overview of the existing environment. The main data sources used in the preparation of this chapter are described below in Table 13-1.

Table 13-55 Key data sources

Source	Content
Preliminary Hazard Analysis (PHA) and Marine Safety Navigational Risk Assessment (NRA)	Shipping and navigation hazards brought about by the proposed Project
Marine Management Organisation	Automatic Identification System (AIS) data
Marine Scotland	Vessel Monitoring System (VMS) data for fishing vessels over 15 m and over 12 m from 2013.
Marine Scotland ScotMap data	Marine Scotland inshore fisheries mapping study of fishing activity of commercial vessels under 15 m overall length, including vessel numbers by gear type.
Marine Scotland (2012)	Shipping Study of the Pentland Firth and Orkney Waters (PFOW)
RYA Coastal Atlas	Information on sailing routes by density of sailing vessel traffic and local yachting organisations
Marine Accident Investigation Branch (MAIB) incident data	A review of maritime incidents occurring within 10 nm of the proposed development area from 2005-2015
Royal National Lifeboat Institution (RNLI)	Call out data

13.4 Surveys and Studies Carried out to Date

13.10 Sources of information used to inform the assessment are summarised in Section 15.4. In this section further context is provided. Those surveys of the wider area and/or research to this assessment include:

- AIS data from the Project site, export cable corridor and surrounding PFOW area gathered between October 2014 and September 2015 and analysed specifically for the Project;
- Vessel Monitoring System (VMS) data for the years, 2011, 2012 and 2013, the most recent data available;
- Data on small fishing vessel movements from ScotMap Inshore Fisheries Mapping in Scotland: Recording fishermen's use of the sea; and
- A review of maritime incidents occurring within 10 nm of the proposed development area from 2005-2015.

13.5 Consultation

13.11 A full listing of consultation feedback can be found in Appendix 13.2 PAC Report. Relevant consultee feedback received during pre-application consultation is summarised in the following sections.

Scoping feedback

13.12 The following stakeholder responses in Table 13-2 were received specifically relating to this chapter.

Table 13-56 Summary of scoping feedback

Consultee	Comment relative to shipping and navigation	Relevance/Cross Reference
Northern Lighthouse Board (NLB)	Require that a full Navigational Risk Assessment be carried out	See Appendix 13.1
	Suggest that as well as shipping density, it is important to take regard of type and cargo, draught and number of persons on board	See Section 13.8 and Appendix 13.1
	Anticipate that the Site will be marked with Aids to Navigation, based on IALA recommendations, installed on the turbines during the operational phase	See Table 13-13
Maritime and Coastguard Agency (MCA)	Supply detail on the possible impact on navigational issues for both commercial and recreational craft, viz: • Collision risk • Navigational safety • Visual intrusion • Risk Management and emergency response • Marking and lighting of site and information to mariners • Effect on small craft navigational and communication equipment • Risk to drifting craft in adverse weather or tidal conditions • The likely squeeze of small craft into the routes of larger vessels Analysis of radar data to ensure that vessels lower than 300 gt are captured in the assessment	See Section 13.10 and Appendix 13.1

UK Chamber of Shipping	Although the Project area is not a particularly busy area for commercial shipping, concerns were raised over the proposed novel concept of floating turbine structures, particularly in contingency planning and safety zones were part of the structure to break free, as these had not been considered in scoping Consider past and present as well as any future increase in traffic due to potential projects in the wider area	See Section 13.10, Risk of floating platform breaking free is discussed See Section 13.8 for past and present traffic levels and Appendix 13.1 considers potential future traffic levels
Royal Yachting Association (RYA)	Noted that the Project was unlikely to pose a huge risk to recreational vessels. Suggested using the PFOW shipping study for reference as it provides more comprehensive information on recreational shipping routes compared to RYA coastal Atlas Although recreational vessels do pass through the Study Area it should not pose a problem provided the floating platform and WTGs are marked and lighted to NLB specifications	See Section 'RYA routes' See Section 13.11, platform and WTGs will be marked and lighted according to IALA recommendations
Pentland Firth Yachting Club (PYFC)	Noted that none of their members had expressed any concern about the Project and that, generally the club supports renewable energy projects.	N/A
UK Hydrographic office (UKHO)	Noted that UKHO has a neutral position on such developments and that analysis of the largest scale chart of the Study Area identified nothing charted that night impact on the Project.	N/A

Preliminary Hazard Analysis Feedback

13.13 The following feedback in Table 13-3 was received in relation the PHA.

Table 13-57 Summary of PHA feedback

Consultee	Comment relative to shipping and navigation	Relevance/Cross Reference
Maritime and Coastguard Agency (MCA)	Consider traffic data for all vessel types	See Section 13.9 and Appendix 13.1
	Up to date AIS data beyond 2012 (ideally 2015/16 data)	AIS data has been used (see Section 13.8)
	In the identification of vessels that don't carry AIS MCA are content to receive analysis of Orkney Harbours Authority Vessel Traffic Service (VTS) radar data to identify peak vessel movements and routes	Radar data retrieved from Orkney Harbours, however it did not cover the site so could not be used in the assessment, see NRA and paragraph 13.99
Royal Yachting Association (RYA)	Noted that the Project was unlikely to pose a huge risk to recreational vessels.	N/A
	Suggested using the PFOW shipping study for reference as it provides more comprehensive information on recreational shipping routes	See Section 'RYA routes'
	Although recreational vessels do pass through the Study Area it should not pose a problem provided the floating platform and WTGs are marked and lighted to NLB specifications	See Section 13.11, platform and WTGs will be marked and lighted according to IALA recommendations

Pre-application consultation

13.14 Additional consultation that was carried out to inform the assessment of shipping and navigation is described in Table 13-4.

Table 13-58 Other consultation

Consultee	Comment relative to shipping and navigation	Relevance/Cross Reference
Scottish Fishermen's Federation (SFF)	The site is not intensively fished and the platform is small so fishermen may avoid the platform and anchors once installed An AIS transmitter on the platform is essential so the platform remains clearly visible on electronic charts, regardless of sea conditions Suggested that the site could be marked on charts as an operational "Advisory Area" that extends 50 m from the anchors and encompasses the whole mooring system. This advisory area would be marked on the "Fish Safe" system and would trigger an alarm that there is a high risk of snagging when approaching the zone	N/A See Section 13.12 which notes AIS as being an additional mitigation See Section 13.12
Northern Lighthouse Board (NLB)	NLB will require additional information regarding the layout, mooring arrangement and deployment sequence in order to recommend marking and lighting that will provide safe warning through any transition from construction to operation	Once the detailed design phase of the Project is defined further consultation will be held with the NLB to discuss marking and lighting of the structure and site
RYA	Notified that: A floating wind farm is no more dangerous to recreational craft than an anchored vessel; The type of sailor who passes through the Pentland Firth is skilled in seamanship and knowledge of the COLREGS and is used to noticing and avoiding obstacles whether charted or not; This is the third floating wind site so experience has already been gained; and The RYA is opposed to safety zones except during construction.	See Section 13.11 and Section 13.13

Local Fisherman	Consultation with this fisherman highlighted that as far as he was aware his was the only vessel that fished in the Project area. Discussions about the creation of an “advisory zone” extending out to 50m beyond the anchors to warn fishermen of the heightened snagging risk were held. It was noted that the AoS for the Project was purposefully large to allow the developer flexibility in choosing a site in order to avoid or offset any conflicts. It was noted that the vessel uses long-lines in the north-west quadrant of the offshore site and the possibility of locating the floating platform away from the north-west quadrant was discussed as a potential mitigation. Consultation will continue with the vessel operator directly as the Project progresses.	NRA and paragraphs 13.99 and 13.100 See Section 13.12 See paragraphs 13.99 and 13.100

13.6 Assessment Methodology

13.15 The overarching approach to the Environmental Impact Assessment is described in detail in Chapter 5 EIA Methodology. This section sets out the specific criteria which have been used to evaluate the impact of the proposals on shipping and navigation.

Design Envelope Considerations

13.16 The Project Description is set out in Chapter 4. Specific assumptions relevant to this chapter are identified in Table 13-5 below.

13.17 In order that the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are considered by proxy.

Table 13-59 Design envelope parameters

Design Envelope Parameter	Value/description
Turbine envelope	Maximum rotor tip height (above LAT) – 201 m Maximum number of turbines – 2 m Maximum rotor diameter – 154 m Maximum hub height (above LAT) – 124 m Air draft (above LAT) – 22 m
Parameters of drag anchors (Including dredging)	Maximum 16 anchors (9 m x 9 m). Anchors will be dragged to penetrate 10-15 m into the seabed It is likely that no scour protection will be required, however if it is required, the footprint would extend no more than 20 m from each anchor
Parameters of clump weight	50 x 50 m

Design Envelope Parameter	Value/description
(Including dredging)	600 tonne Dredging 70 x 70 m area to depth of 5 m and fill in with gravel to create level plinth Clump weight will rest on seabed during installation before being raised off the seabed During operation, clump weight will be suspended in the water beneath the platform.
Export Cable (Including Dynamic cable)	Maximum footprint: less than 0.2 km^2 Cable will be buried up to 2 m where possible Where seabed conditions prohibit the burial of the cable, rock dumping, mattressing may be required to protect the cable. Dynamic cable approximately 250 m long with "lazy-wave" configuration
Parameters of mooring lines	The mooring system shall consist of up to 8 mooring lines which are anchored to the seabed. The mooring lines shall pass through the clump weight The mooring lines are most likely to be chain, steel wire or a combination thereof. Offshore grade mooring chains of 100 mm to 160 mm diameter may be used.
Vessels used during construction, operation, maintenance and decommissioning	1 medium size Cable laying vessel (cable installation) 1 dive support vessel (platform installation) 4 Anchor Handling Tug Supply (AHTS) vessels (platform installation) 1 ocean going tug (anchor installation) 1 barge (scour protection installation) 1 Crew boat/specialised vessel (to be used in the case of maintenance/repair)
Project design life	25 years

Shipping and Navigation Design Envelope (worst case)

13.18 As described in Chapter 5 EIA Methodology the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst-case scenario for that specific receptor.

13.19 Increased vessel traffic during construction has the potential to affect shipping and navigation. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed, which ensures that all other variations within that maximum parameter are assessed by proxy.

13.20 Table 13-6 describes the Design Envelope parameters specific to shipping and navigation.

Table 13-60 Platform footprint

Principal Dimensions	
Platform length	230 m

Platform width	135 m
Height of platform above water surface	15 m
Draught (operating)	15 m
Draught (Transit)	10 m
Degree of free movement	360°
Sea surface footprint	The maximum length of platform (230m) (including the 360° turn radius) plus a 20% tolerance to lateral movement to allow for the pendulum to swing then: 0.17km^2
Mooring and anchor footprint	2 km^2

Methods of prediction

13.21 Baseline conditions defined in Section 13.8 are mainly informed by the NRA (see Appendix 13.1) and consultation with stakeholders (refer to Section 13.5). The impact assessment presented in Section 13.9 uses the baseline conditions to assess the risks the Project may pose to marine navigation.

13.22 For shipping and navigation potential effects are identified and the significance of each impact is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions.

13.23 A matrix approach has been used as a tool to inform the impact assessment, while professional judgement has also been used following best practice, best available understanding and relevant EIA guidance (SNH, 2013).

13.24 Significance is attributed using the following key attributes:

Magnitude of effect

13.25 The magnitude of effect is assessed by judging the amount of deviation from the previously established baseline the impact would cause. The definitions of magnitude are defined in Table 13-7.

Table 13-61 Assessment of magnitude of effect

Category	Description
High	Total loss or very major alteration to internationally important shipping lanes (i.e. International Maritime Organisation (IMO) routing).
Medium	Loss or alteration to lower use navigable channels from baseline conditions.
Low	Minor shift from baseline conditions.
Negligible	No change to baseline conditions

Vulnerability of receptor

13.26 The vulnerability of the receptor to effects of the Project is also taken into account and the definitions of vulnerability are defined in Table 13-8.

Table 13-62 Assessment of vulnerability of receptor

Category	Description
High	Feature of international importance (i.e. IMO routeing measure such as the West of Hebrides Deep Water Route)
Medium	Feature of national importance (i.e. Port approach channels, used by medium/large vessels)
Low	Feature of regional importance (i.e. Other notable navigational channels used by smaller vessels)
Negligible	Feature of local importance (i.e. Coastal shipping/ sailing routes used by smaller ships (yachts and fishing vessels)

Significance of impact

13.27 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact (Table 13-9). The significance of impact is assessed based on best practice and professional judgement. Any impacts of 'moderate' or above are considered significant, in accordance with SNH's EIA guidance (SNH, 2013). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor. The evaluation of impact significance is informed by the matrix and by the professional judgement of the assessment team.

Table 13-63 Impact significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

13.7 Data gaps and uncertainties

13.28 A range of data sources have been utilised which endeavour to capture the range and frequency of vessel activity within the vicinity of the Project Site. Data confidence is discussed in detail in the NRA (Appendix 13.1).

AIS data

13.29 For the Navigation Risk Assessment (see Appendix 13.1), twelve months of AIS data for the north of Scotland were gathered between October 2014 and September 2015. These data provide a representative 'snapshot' of activity in the area for one year, identify individual vessels and their tracks. The data are also useful for identifying the frequency of activity by larger fishing vessels within the vicinity of the Project boundaries but do not capture the under 15 m vessels.

VMS data

13.30 Scottish fisheries are regulated by the Scottish Government which uses the satellite based Vessel Monitoring System (VMS) to gather automatic data on vessel movements for vessels greater than 12 m from 2013. Data are available for vessel location and speed; however individual vessels, vessel type or gears used cannot be identified. The speed of the vessels at the time of data capture is recorded and can be used to make inferences about whether a vessel is fishing or steaming. This data also omits the activity of fishing vessels under 12 m.

ScotMap data

13.31 The ScotMap source provides an insight into the likely distribution of fishing activity by smaller fishing vessels under 15 m overall length (see Chapter 12: Commercial Fisheries for further information). However, data are collated using an interview-based methodology and for the period 2007-2011, which the dataset is now becoming dated. The Scrabster district interviewed 67% of target list vessel owners/operators (50/75 vessels). Approximately 77% of landings were accounted for from vessels under 15 m overall length in the district (Marine Scotland, 2014).

13.32 ScotMap provides the best available data source on the likely use of the Project area by smaller fishing vessels. As a precaution, it is assumed that these vessels will make use of the majority of inshore waters.

13.8 Description of the Current Environment

13.33 This section includes a brief overview of the relevant natural features of the marine environment and a description of the navigational features of the Study Area including: navigational channels, navigational aids, aquaculture facilities, existing cables, ports and harbours, anchorages, military practice areas, wrecks and disposal sites.

Relevant Natural Features of the Study Area

13.34 Tides in the area are of semi-diurnal tidal pattern with a mean spring tidal range of 3 - 4 m and 1 - 2 m during neap tides (ABPMer, 2008).

13.35 Tidal currents in the Study Area are generated by water moving between the North Atlantic and the North Sea through the Pentland Firth. Although tidal currents within the Pentland Firth itself are very strong the Study Area lies to the west and peak tidal current flow during mean spring tides is relatively low at 0.5 - 0.6 m/s (0.2 - 0.3 m/s for neap tides) for the Site and 0.5 m/s or less (0.3 m/s or less for neap tides) within the export cable corridor (ABPMer, 2013).

13.36 Annual mean wind speeds in the Study Area are estimated to be between 7.5 - 9.25 m/s (at 100 m) (ABPMer, 2008). The strength of wind and the frequency of wind directions vary considerably over time, but, in general, winds in the north of Scotland are predominantly from the south and west. The highest mean wind speeds and gusts are typically recorded during the winter months (December to February).

13.37 The average significant wave height (average of the largest third of waves) expected in the Study Area ranges from 1.5 m close to the shore to 1.9 m further offshore (ABPMer, 2008).

13.38 A full description of the relevant natural features of the marine environment e.g., bathymetry, seabed conditions, tidal currents and wave climate is provided in Chapter 6: Physical and Coastal Processes.

Navigational Features of the Region

13.39 The navigational features of the wider region around the Study Area, such as ports and harbours are shown in Figure 13-2 and are described in the following sections.

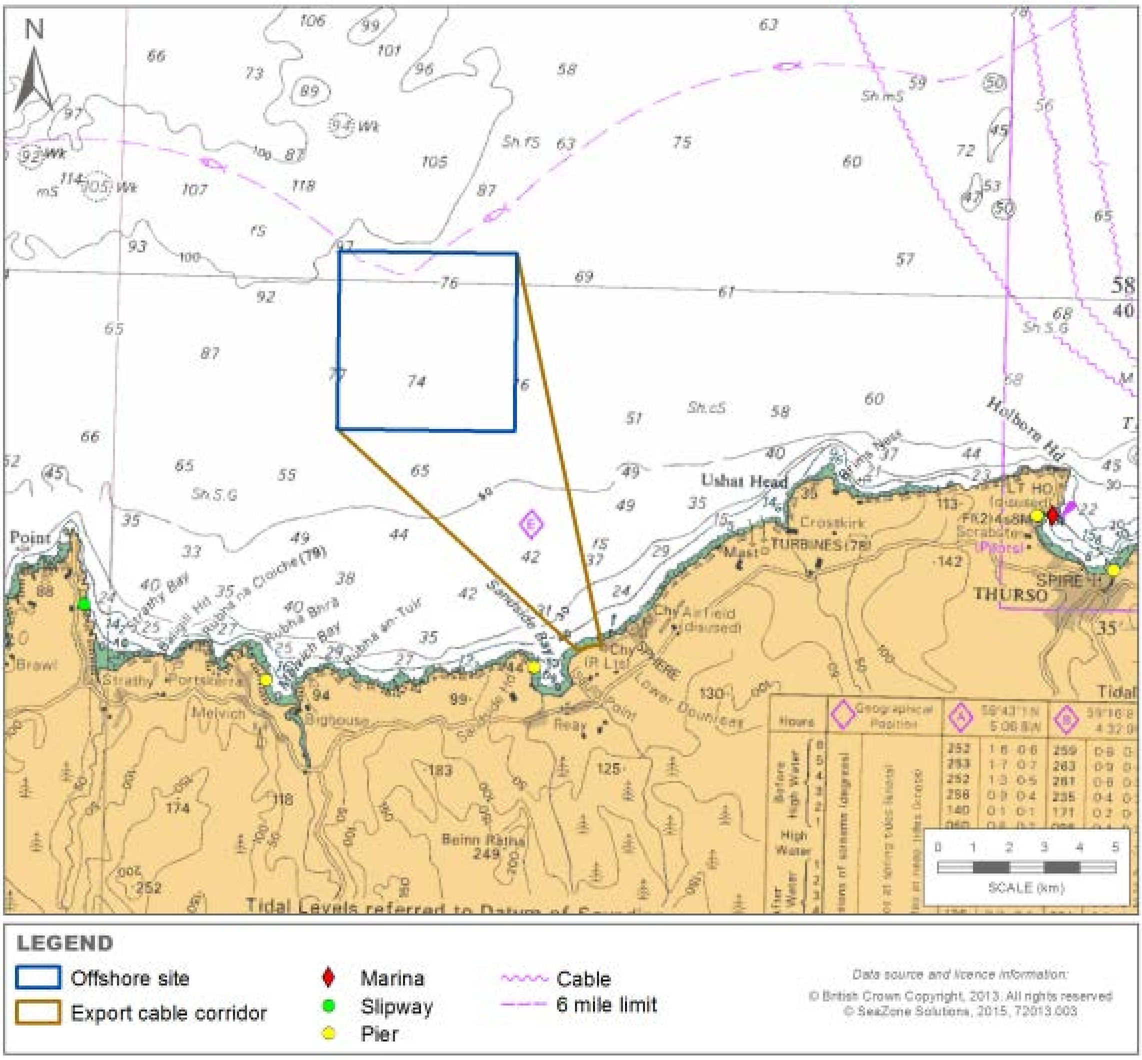


Figure 13-32 Site surrounding navigational features

Shipping Routes

13.40 The Study Area lies within the Pentland Firth and Orkney Waters Strategic Area (PFOWSA) but is outside the Pentland Firth itself, lying approximately 14 nm to the western boundary at Dunnet Head. No navigational channels are marked on Admiralty charts for the region surrounding the Study Area. However, a strategic area navigation appraisal for the PFOW[33] (Anatec, 2014) and AIS data (Section 15.8.4) records a higher density of shipping to the north of the Project site for vessels navigating through the Pentland Firth between the North Sea and North Atlantic.

13.41 The Pentland Firth itself is subject to a voluntary ship reporting system whereby vessels are advised to contact the Aberdeen Coastguard one hour before entering the Firth and again on leaving. There are Admiralty Chart warnings about the very strong tidal streams within the Pentland Firth. These warnings also specify an Area to be Avoided (ATBA), advising laden

[33] The Strategic Area Navigation Appraisal (SANAP) is a strategic approach to NRA, involving a working group formed by the NLB, MCA, Marine Scotland and The Crown Estate, to identify potential impacts of offshore wave and tidal deployments on shipping and navigation and is intended to support and inform developers undertaking their NRA for offshore renewable energy schemes in the PFOW.

tankers not entering Scapa Flow to avoid the Pentland Firth in adverse weather or restricted visibility.

13.42 A daily passenger ferry route transits 9.2 nm east of the Study Area from Scrabster to Stromness and further east from Gill's Bay to St Margaret's Hope and a seasonal service operates from John O'Groats to Burwick, Orkney; none of which transit the Study Area.

Services

13.43 The nearest vessel traffic service is operated by Orkney Harbour Authority, who operate a 24 hour service (Orkney VTS) for vessels navigating into Scapa Flow and Kirkwall Bay. The radar-based vessel traffic management system combines radar coverage with active interrogation by VHF of vessels entering the harbour area. Vessels under 12 m overall length do not need to report to the VTS. The service provides information on all aspects of port operations including pilotage, traffic movements, navigation warnings, weather forecasts and berth availability[34].

Aquaculture

13.44 There are no aquaculture sites in the immediate vicinity of the Study Area. There are two salmon farms and one mussel farm in Loch Eriboll approximately 50km to the west, which is also a classified shellfish harvesting area. The Kyle of Tongue approximately 36km west has two mussel farms and is also a classified shellfish harvesting area. The east coast of Hoy to the north-east of the Study Area has six active fish farms, the nearest of which is approximately 45km from the Study Area.

Existing Cables

13.45 There are no subsea cables or pipelines that intersect with the offshore Project site or export cable corridor. There are two active telecommunication cables located east of the Site; one from Dunnet Bay to Bay of Skaill on Orkney and another connecting Dunnet Bay to the Faroe islands. Two active unburied power cables (a 33 kV line and 33 kV cable) also run north, east of the Site from Murkle Bay near Thurso to Rackwick Bay, Hoy, Orkney. All existing cables are at least 6 nm (11 km) east of the Study Area.

13.46 New transmission infrastructure is required between Orkney and Caithness to enable the export of electricity from renewable energy generation in Orkney into the national grid. Scottish Hydro Electric-Transmission (SHE-T) is planning to develop a 70 km 220 kV sub-sea electricity transmission cable connection from the existing connection site at Dounreay to the Bay of Skaill on the west coast of Orkney[35]. Construction of this new network is expected in 2018/19, however this is subject to the progress of current wave and tidal energy generation sites in Orkney and dependent on the submission of a needs case and approval by OFGEM.

13.47 Refer to Chapter 17: Other Users of the Marine Environment for further details on proposed cables.

Pilotage

13.48 Pilotage into Scrabster Harbour is appointed by the Scrabster Harbour Trust and is not mandatory, however is recommended for first arrivals and vessels carrying dangerous goods.

[34] http://www.orkneyharbours.com/port_vts_services.asp

[35] http://www.gov.scot/resource/0044/00444758.pdf

Navigational aids

13.49 Seven lighthouses are present along the north coast of the Scottish mainland and PFOW, namely Cape Wrath, Loch Eriboll, Strathy Point, Holburn Head, Dunnet Head, Stroma and Duncansby Head.

Ports and harbours

13.50 The nearest industrial/fishing ports are Scrabster, Stromness and Lyness to the east, north and north east, respectively and Kinlochbervie to the west.

13.51 There are also small slipways along the North Coast including:

- Durness and Cape Wrath area: Keoldale West, Keoldale East, Rispond, Port Chamuill, Ard Neakie and Portnancon;
- Tongue and Bettyhill: Talmine, Skerray, Bettyhill and Kirtomy; and
- Strathy Point to Thurso: Port Grant, Portskerra, Sandside, Scrabster and Thurso.

13.52 With the exception of the large port development at Scrabster, most of the harbour facilities across the north coast comprise small jetties, semi natural harbours, harbour walls and slipways. Use of these facilities includes dedicated passenger ferries (Keodale West and East), small scale fishing activities (Ard Neakie, Talmine, Port Grant, Portskerra), and small scale tourism (Skerray). Some jetties are no longer used commercially but may be used for ad hoc leisure or small scale fishing activities (Bettyhill, Kirtomy, Sandside). Sandside Harbour is located on the west coast of Sandside Bay. Several facilities are privately owned (e.g. Rispond, Portnancon). There are limited opportunities west of Scrabster for berthing medium sized vessels or marina facilities available until Kinlochbervie, south of Cape Wrath.

Anchorages

13.53 There are no noted commercial vessel anchorage sites in the immediate vicinity of the Study Area (Marine Scotland, 2012).

13.54 The main anchorage sites for sailing vessels are in the area around Loch Eriboll, Loch Tongue and Scrabster and are used by yachts navigating along the north Coast (Marine Scotland, 2012).

Military Practice Areas

13.55 The Project site is approximately 19 nm east of Cape Wrath Training Centre and Firing Danger Area. See Chapter 17: Other Users of the Marine Environment for further details.

Wrecks

13.56 There are no known partially submerged or surface piercing wrecks within the Study Area that would present a navigational hazard. More detail of the offshore archaeology features of the surrounding area can be found in Chapter 16: Archaeology and Cultural Heritage.

Disposal sites

13.57 There are no recorded disposal sites in the Study Area.

13.9 Vessel traffic analysis

13.58 An analysis of the vessel types that were identified in the Study Area is provided. The Vessel Traffic Analysis is based primarily on data gathered from vessels carrying AIS equipment, VMS data and stakeholder consultation.

13.59 Tracking vessels by AIS is useful but there are limitations. Those vessels required to fit and use AIS are:

- All vessels greater than 300 gross tonnes;
- All passenger vessels regardless of size; and
- All fishing vessels greater than 15 m length from May 2014.

13.60 Twelve months of AIS data gathered between October 2014 and September 2015 have been analysed by Aquatera and used in this analysis. They provide a useful overview of vessel traffic within the Study Area as well as in the wider Pentland Firth area.

13.61 The 12 month AIS analysis for the Study Area shows the relative traffic densities. Figure 13-3 shows that the Study Area averages between 0.05 - 0.5 AIS tracks per day, much lower than the area located north of the Site which clearly indicates vessels transiting east-west to and from the Pentland Firth shipping channel.

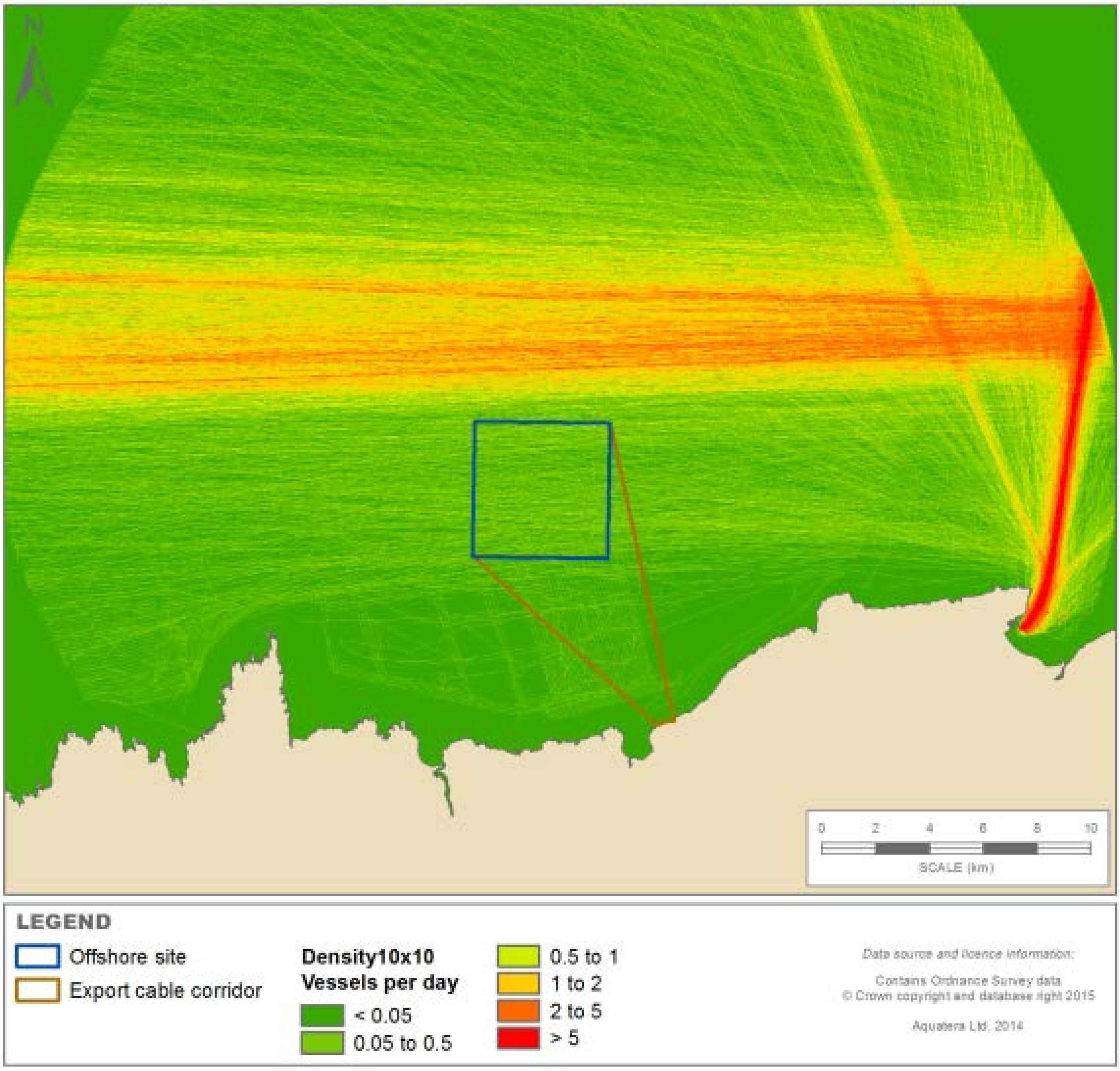


Figure 13-33 Vessel traffic densities for the Project site and export cable corridor

13.62 Up to 13 different types of vessel transited the area, including: cargo vessels, tankers, tugs, dredgers, fishing vessels, passenger ferries, search and rescue, law enforcement, military, research vessels and recreational crafts.

13.63 Vessel traffic in the Study Area comprised of:

- 177 individual vessels during the study year;
- 125 vessels transited on only one day in the year (71% of all vessel traffic);
- 35 vessels on two to three days (20%); and
- 17 vessels on four days or more (9%).

13.64 Table 13-10 Vessel type by distribution provides a breakdown of the AIS data and the vessels that make up those illustrated in Figure 13-3. The analysis indicates that the main shipping activity in the Study Area is associated with cargo and fishing vessels.

Table 13-64 Vessel type by distribution

Vessel type	Number recorded in study area	Percentage of total traffic (%)
Fishing vessels	91	51
Cargo	45	25
Tankers	2	1
Tugs	11	6
Passenger ferries	4	2
Search and rescue	5	3
Law enforcement	1	1
Military	2	1
Recreational crafts	7	4
Other (research, dredgers, survey and marine support vessels)	9	5

Fishing vessels

13.65 AIS tracks for the study period indicate that approximately 51% of vessels (91 vessels) transiting the Study Area were fishing vessels, of these vessels:

- 60 transited one day in the year;
- 21 on two to three days; and
- 10 on four or more days.

13.66 The fishing vessel tracks are widespread throughout the offshore Site and occasional throughout the export cable corridor. There are clear densities of traffic north of the offshore site in the Pentland Firth shipping channel (east-west) and transits between Scrabster port and to offshore fishing grounds further north and north-west.

13.67 Further detail, such as information gathered from VMS and ScotMap data which provides detail on the activity of smaller fishing vessels can be found in Chapter 14: Commercial Fisheries and in the NRA (Appendix 13.1).

13.68 In summary, VMS and ScotMap data indicates that there is a low intensity pelagic, demersal and scallop dredging fishery likely to be operating in and around the Project Site. A very low intensity squid fishery may occasionally pass through the Site.

13.69 A low intensity creel fleet (predominantly under 15 m fleet) may operate in and around the Project Site. Activity is likely to be very low in the Offshore Site for this fleet but greater towards the coast, within the cable route corridor.

13.70 Part of the cable corridor will not be fished by any fleet due the fisheries exclusion zone in operation (2 km from the Dounreay outflow pipe). See the Chapter 14: Commercial Fisheries and in the NRA (Appendix 13.1) for further details.

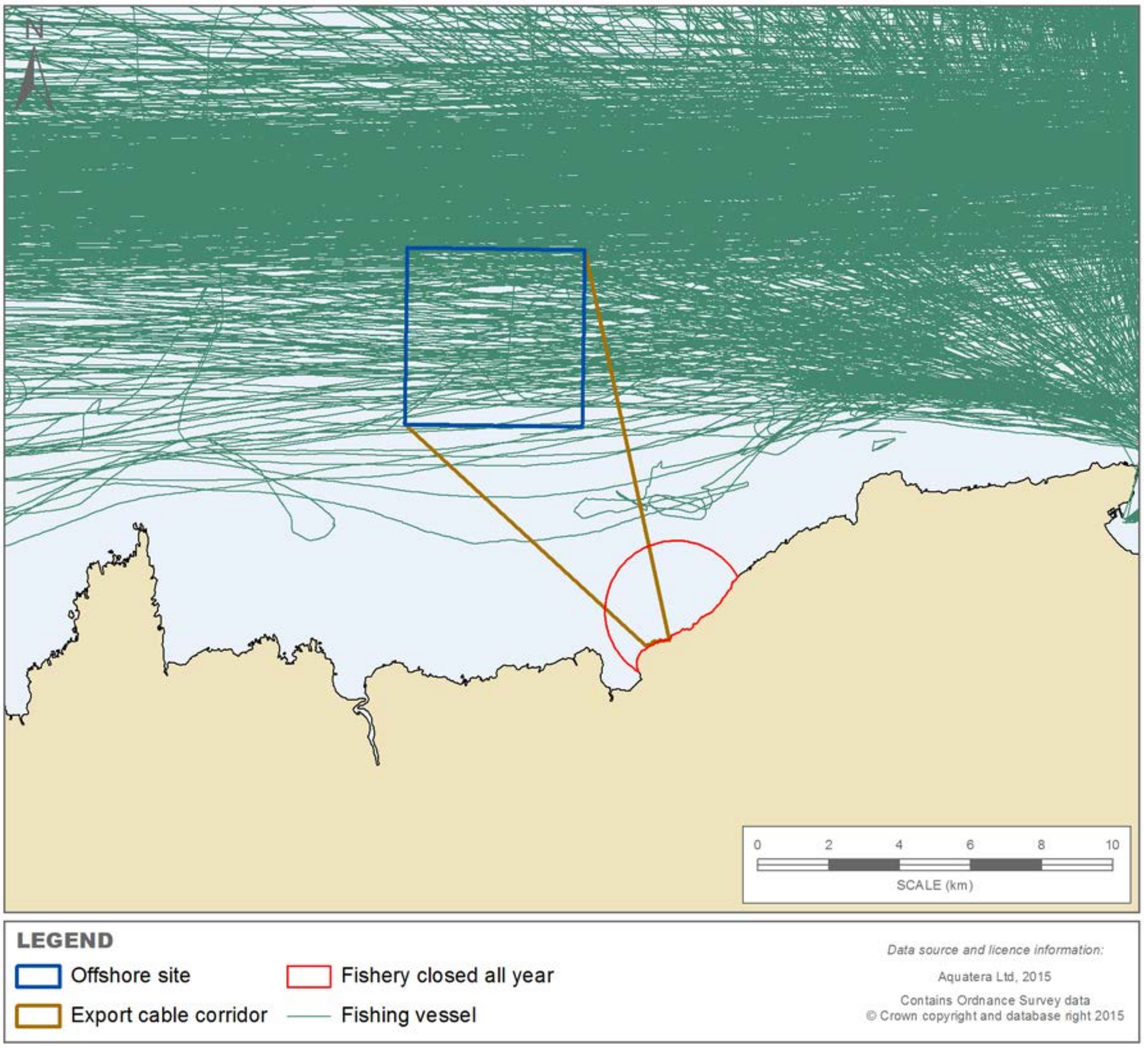


Figure 13-34 Fishing vessel AIS tracks throughout the Study Area

Cargo Vessels

13.71 Cargo vessel traffic in the Study Area during October 2014 and September 2015 comprised of:

- 45 cargo vessels in the study year;
- 33 vessels transiting the area once;
- 8 vessels transiting 2-3 times; and
- 3 transiting 5 times or more.

13.72 AIS data analysis of the wider offshore area indicates relatively low cargo traffic levels compared to the main Pentland Firth shipping channel north of the Study Area (Figure 13-5).

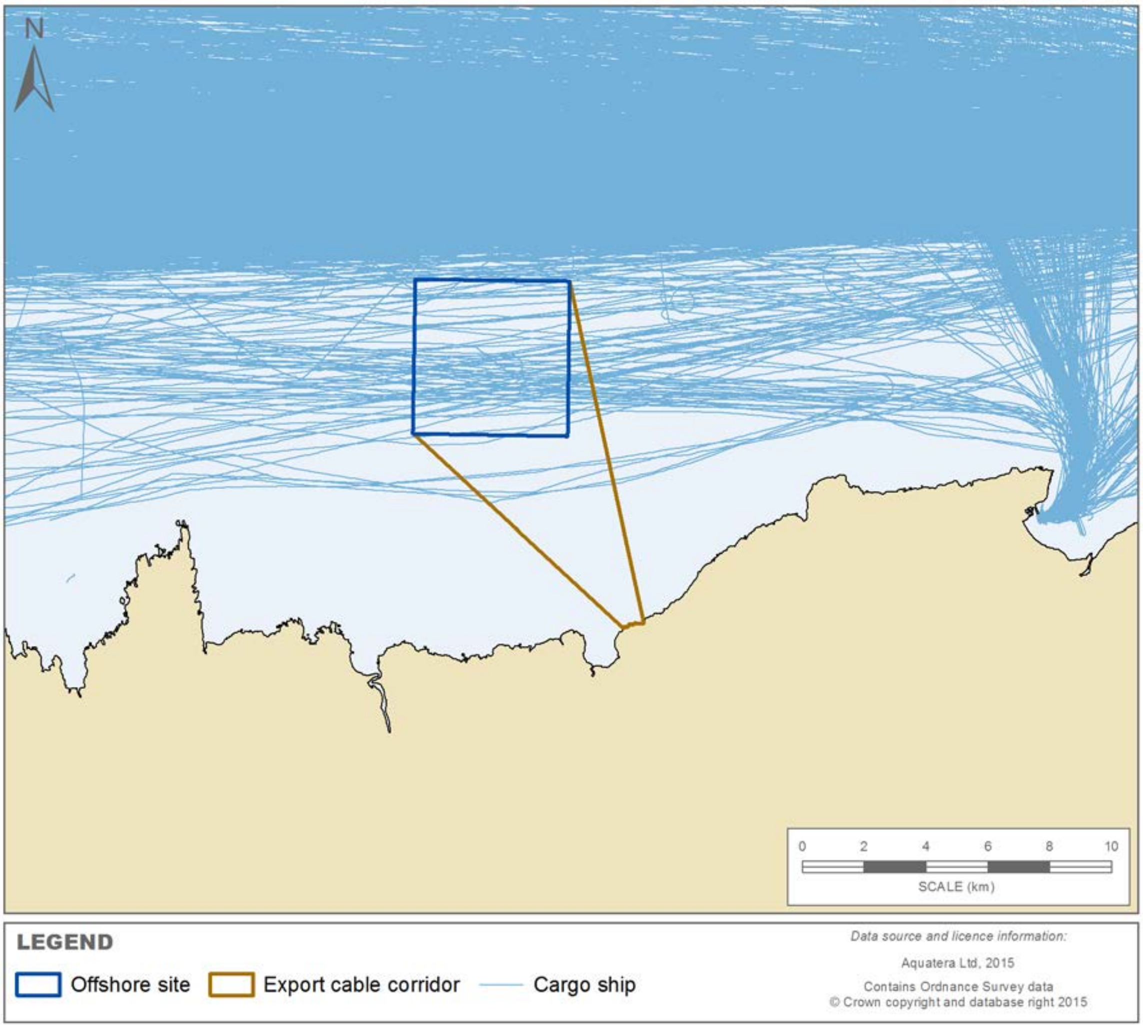


Figure 13-35 Cargo vessel AIS tracks

Tankers

13.73 Two oil product tankers transited the Study Area throughout the study year; one on one occasion and the other on six days. The majority of tanker vessel traffic transited north of the Study Area through the Pentland Firth shipping channel, avoiding inshore waters.

Tugs

13.74 Tug vessel traffic in the Study Area comprised of:

- 11 individual tug vessels;
- 9 transiting the area on one day of the study year; and
- 2 transiting the area on two days of the study year.

13.75 The majority of tug vessels in the wider area were seen transiting north of the Study Area in the Pentland Firth shipping channel and into Scrabster port.

Passenger vessels

13.76 AIS data from the study period showed four passenger vessels transiting the Study Area, each on one occasion throughout the study year.

Law enforcement vessels

13.77 One law enforcement vessel transited the Study Area on two days of the study period.

Search and rescue vessels

13.78 AIS data recorded RNLI search and rescue vessel activity in and around the Study Area. Five lifeboats were recorded transiting the Study Area throughout the study year. The nature of their activity is not clear; however a review of historical incident data in Section 15.8 provides information as to the number and nature of any incidents that occurred in the Study Area or wider PFOW area.

Military vessels

13.79 Two military vessels transited the Study Area, one on three days and another on one day in the study period. These vessel tracks appear to deviate slightly from a main flow of vessel transits north of the Study Area.

13.80 The Study Area is approximately 19 nm east of the Cape Wrath Training Centre. There is also a practice and exercise area (PEXA) within Loch Eriboll, Sutherland (within the Cape Wrath Firing Range area). Twice a year, Europe’s largest military exercise, Joint Warrior is undertaken off the north, north-east and north-west coasts of Scotland. Joint Warrior involves the three Armed Forces and aircraft, navy vessels, submarines and army personnel and occurs in March/April and October each year over a period of 10 - 15 days.

13.81 Consultation shall continue with the MOD as the Project progresses as military vessels have certain dispensations regarding switching off their AIS tracks and jamming GPS during some exercises, therefore vessel tracking data will not always be available. Nevertheless, MOD vessels should still be cognisant of the platforms presence via maps, watch and the AIS transmitter on the platform.

Recreational vessels

13.82 Recreational craft includes sailing vessels, pleasure craft and diving boats. Seven of these vessels were recorded in the Study Area during the study year, each on one occasion, indicating that vessels are in transit on voyages along the coast, or to Orkney. It should be noted that the majority of smaller recreational craft may not be fitted with AIS transmitters and therefore some activity may not be captured.

RYA routes

13.83 The RYA Coastal Atlas indicates the Study Area as being south of a ‘medium use’ route. As the RYA notes, the routes shown are indicative only and not precise, traffic is also likely to vary by season and weather. The Shipping Study of PFOW (Marine Scotland, 2012) provides more comprehensive information by showing recreational shipping routes as corridors rather than lines. No specific concerns were raised by the RYA during consultation (see Section 13.5).

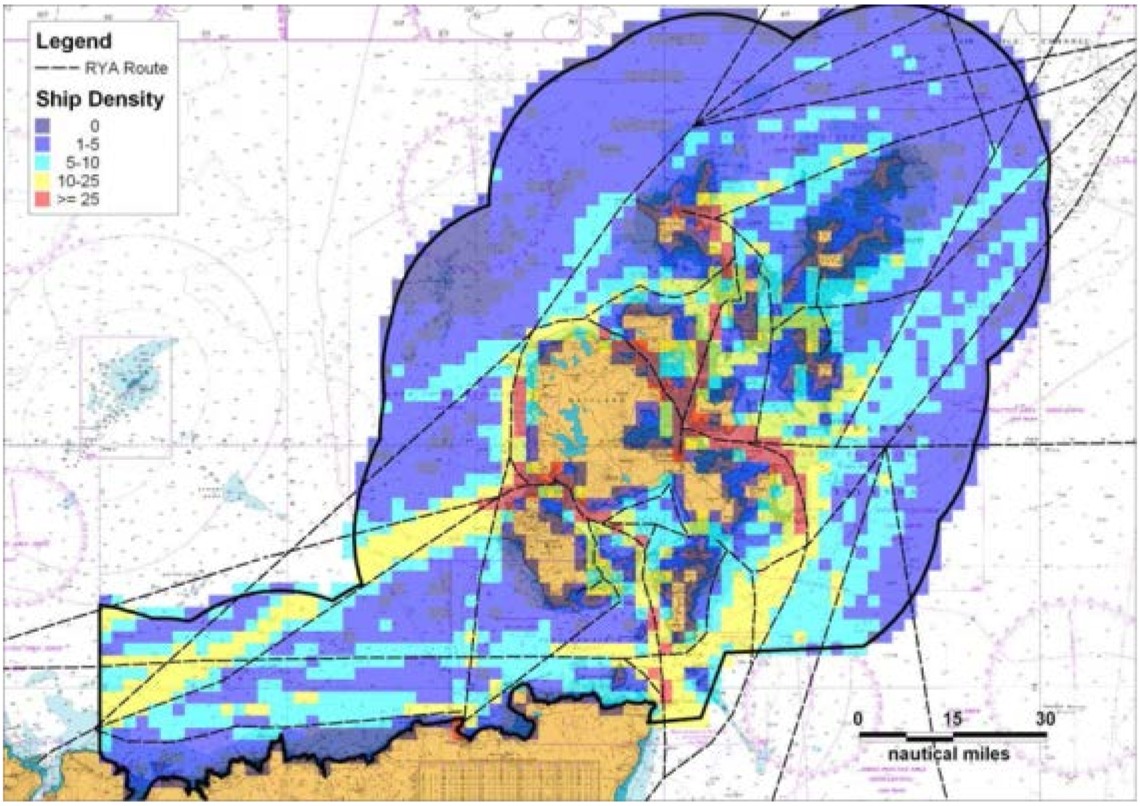


Figure 13-36 Recreational vessels AIS track density overlaid on RYA routes (Marine Scotland, 2012)

Other vessel types

13.84 Other types of vessels captured during the AIS analysis included marine support vessels, dredgers, survey and research vessels and other unconfirmed vessels. Nine vessels were recorded, all of which transited the Study Area once, except for three survey vessels on 2 - 6 days (two Scottish Government fisheries research vessels and one registered in the Netherlands).

Incident data

13.85 Incidents reported by MAIB were relatively few in number (Table 13-11). In order to get a useful listing, the search area for incidents was extended from the usual 5 nm zone around the Study Area to a zone of 10 nm. Even so, incidents were relatively few, perhaps reflecting the low volume of commercial, fishing and leisure craft. There was, on average, around 1.3 incidents per year recorded by MAIB in the 10 nm buffer zone.

13.86 Thirteen incidents were logged and are presented in Table 13-11. Only two incidents were recorded within the vicinity of or close to the Project boundaries, both of which were ‘machine failures’. See the NRA (Appendix 13.1) for further details.

Table 13-65 Review of historical incident data in the vicinity of the Study Area over the last 5 years

Date	Type	Vessel	Latitude	Longitude	Outcome
13/02/ 2005	Heavy Weather Damage	UK Trawler, 57 m, 783 GRT	5847 N	347 W	Bridge windows broken during storm force winds and 8-10 m swell. Escorted to harbour by FV Prowess. All electrical power lost, and steering in hand.
08/02/ 2007	Machinery Failure	UK fishing vessel, 18.2 m, 150 GRT	5846.6 N	343.8 W	Towed to port. No damage. No fatalities/injuries
01/06/ 2011	Machinery Failure	UK twin rig trawler, 24 m, 216 GRT	5838.5 N	347.3 W	Towed to port. Minor damage. No fatalities/injuries.
03/12/ 2011	Cargo Handling Failure	Isle of Man timber cargo carrier, 91 m, 2601 GRT	5835 N	358.5 W	Partial loss of cargo. No fatalities/injuries.
10/12/ 2006	Machinery Failure	UK fishing vessel	5481.5 N	337 W	Towed to port. No damage. No fatalities/injuries
14/05/ 2011	Machinery Failure	UK pleasure craft, 14 m	5834 N	347 W	Vessel towed to port. No damage. No fatalities/injuries.
22/09/ 2005	Flooding /Foundering	UK fishing vessel, 16.9 m, 62 GRT	5836.1 N	358.7 W	Ship initially grounded. Ship lost. No fatalities /injuries.
05/05/ 2015	Occupational Accident	Iceland survey vessel, 49.9 m, 935 GRT	5841.4 N	247.2 W	Survey technician sustained cut to hand. No damage. No fatalities. 1 injury.
13/01/ 13	Casualty with a ship	UK dredger, 18 m, 84 GRT	5838 N	401 W	Towed to port. No damage. No fatalities/injuries
23/10/ 13	Casualty with a ship	UK trawler, 17 m, 82 GRT	5839 N	332 W	Towed to port. No damage. No fatalities/injuries
19/12/	Casualty with	UK	5836 N	332 W	Vessel experienced

Date	Type	Vessel	Latitude	Longitude	Outcome
2014	a ship	passenger, Ro-Ro, 112, 8780 GRT			berthing difficulties, when it was hit by a sudden heavy squall which damaged a section of the weld. Damage not significant and vessel continued to destined port. No fatalities. No injuries
03/01/ 2015	Occupational accident	UK fishing vessel, 17 m, 119 GRT	5836 N	333 W	Son of skipper fell over in fish hold. No fatalities. 1 injury.
27/11/ 2015	Casualty with a ship	Dutch cargo vessel, 99 m, 4015 GRT	5847 N	333 W	Main engine failure which was able to be fixed and the vessel able to continue to its destination. No fatalities. No injuries

Search and rescue

13.87 The current SAR helicopter capability for the area is delivered from bases at Sumburgh, Stornoway and Lossiemouth which are in range of the Study Area.

13.88 The aircraft used (S-92) has an automatic Flight Control System and Auto Hover and has a speed of 0 - 139 knots long range, 0 - 153 knots cruise and has a radius of approximately 250 nm.

13.89 Wind limitations of the SAR Helicopter are as follows: Start/shutdown 45 knots any direction, for the hover in side/tailwind, limits are 35 knots any direction.

13.90 The aircraft has all-weather, full capability to carry out night SAR with thermal imaging. It carries hoists as rescue equipment together with a comprehensive inventory of first aid equipment and can deploy a 10-person droppable life raft.

13.91 Lifeboats are operated by RNLI along with the other nominated inshore rescue services. Crew and lifeboats are available from Thurso, Longhope, Stromness and Lochinver on a 24-hour basis throughout the year.

13.92 The RNLI stations at Thurso, Stromness and Lochinver use the Severn class lifeboat capable of a speed of 25 knots with a range of 250 nm which can operate in all weather. The Longhope lifeboat is a Tamar class vessel.

13.93 The Study Area is relatively close to the RNLI station at Thurso. The approximate distances to the different RNLI stations are given in Table 13-12.

Table 13-66 Distance from and approximate callout times of nearby lifeboat stations

Lifeboat station	Approx. distance (NM)
Thurso	13 NM
Stromness	30 NM
Longhope	32 NM
Lochinver	83 NM

13.94 If a medical emergency occurs at sea, the nearest Maritime Rescue Coordination Centre (MRCC) (Shetland Coastguard) will assist until help arrives. An MRCC centre can provide medical advice over the radio to ensure the safety of the casualty until a lifeboat or helicopter arrives to assist, or the casualty has arrived safely back to shore. The MRCC will then call an ambulance ready for the casualty arriving on land.

13.95 The MCA charters four Emergency Towing Vessels (ETVs) to provide emergency towing cover in winter months in the areas thought to pose the highest risk of a marine accident. These include the Western Isles and the Northern Isles, and these tugs would be within range of the Project site. However, response time would depend on the tugs' particular locations. The contract for these ETVs was due to end in February 2012 but has been extended until 2015. As it stands the current contract for the ETV 'Herakles' which is based in Orkney and services the north of Scotland is due to end on the 31st March 2016. There are currently no plans for renewal of the contract however there are ongoing discussions as to whether alternative vessels could be on standby to assist.

13.96 Each MRCC also holds a comprehensive database of harbour tugs available locally. Procedures are also in place with Brokers and Lloyd's Casualty Reporting Service to quickly obtain information on towing vessels that may be able to respond to an incident.

13.97 MCA has an agreement with the British Tug-owners Association (BTA) for emergency chartering arrangements for harbour tugs. The agreement covers activation, contractual arrangements, liabilities and operational procedures, should MCA request assistance from any local harbour tug as part of the response to an incident. The nearest participant in PFOW strategic area is Orkney Towage, based at Scapa, Orkney, which has three 55 tonne bollard pull tugs.

13.98 The Coastguard Rescue Service (CRS) is a network of volunteer teams around the coast who are equipped to deal with incidents and rescues appropriate to the local area. These teams will be sent to rescues by the local MRCC, and can respond to a variety of emergency situations. The nearest teams to the Project activities are located at Durness, Melness and Melvich.

Radar Data

13.99 During preliminary consultation with the MCA the potential to use radar data obtained from Orkney VTS was discussed as a possible means to assess vessel traffic <12m overall length and not carrying AIS. Discussions with Orkney Harbours indicated that radar data could be obtained from there VTS supplier and that it would cover the Study Area. The data was obtained, however on closer analysis it was discovered that the coverage of the data was not sufficient to reach the site, rendering the data unusable for analysis of vessels not carrying AIS.

13.100 A number of consultation events were held in order to reach e.g. local fishermen who may use vessels <12m overall length which are unlikely to use AIS (see Appendix 13.2 PAC report and Table 13-4). Consultation with RYA representatives indicated that the Project was unlikely to pose a huge risk to passing recreational vessels (Table 13-4).

Summary

13.101 The Vessel Traffic Analysis identifies a low frequency of vessel transits within the Project boundaries relative to the wider area. The Offshore site can be seen to be outwith the Pentland Firth shipping route.

13.102 Fishing vessels and cargo vessels represent the majority of vessel transits within the Project boundaries. A small number of fishing vessels under 15 m and recreational craft, not captured by AIS may navigate the area.

13.103 A low number of incidents have been recorded within the Project boundaries, with two noted in or nearby within the last 5 years

13.10 Identification of potential impacts

13.104 The NRA focuses upon the risks to navigation from the proposed development and assesses the likelihood of these events occurring. The assessment presented in this chapter differs from that presented in the NRA by looking at how the existing environment will be affected by the proposed development. Section 13.8 describes the existing environment in the study area with regards to shipping and navigation and it is assumed that if the development did not take place, this environment would continue as described.

13.105 A list of potential impacts to shipping and navigation has been identified:

Potential impacts in the construction phase

- Disruption to navigation created by support vessels during construction;
- Increased pressure on Search and Rescue services; and
- Project vessel collides with a third party vessel including when towing floating platform to site.

Potential impacts in the operations and maintenance phase

- Disruption to navigation created by floating platform or any ‘advisory zone’
- Increased pressure on search and rescue services;
- Vessel collides with floating platform;
- Project vessel collides with a third party vessel; and
- Disruption to navigation created by support vessels during operation and maintenance.

Potential impacts in the decommissioning phase

13.106 Potential impacts arising from decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase and would be temporary and of short duration.

13.11 Standard Mitigation Measures

13.107 Standard industry practice which will be applied to minimise navigational impacts is presented below. Baseline data analysis, consultation and results from the HIRA were considered in this assessment and the ranking of risks associated with the various hazards was subsequently carried out assuming basic (industry standard) mitigation measures (Table 13-13)

Table 13-67 Industry standard mitigation measures for shipping and navigation

Standard Mitigation measures specific to shipping and navigation	
Title	**Description**
Regulatory requirements	The Project will follow all the regulatory requirements for charting the site and will implement a comprehensive process to: 1) Inform vessels in transit using measures such as: a) Notification of the Project to the Clyde Cruising Club for incorporation in their Sailing Directions and Anchorages b) Notices to mariners c) Navtex d) Coastguard safety broadcasts e) Fishermen's notifications such as KIS-ORCA and FishSAFE f) Port notices 2) To inform local vessel operators of construction activities using the contacts built up during consultation 3) Fisheries Liaison: The FLOWW (Fishing Liaison with Offshore Wind and Wet Renewables Group) best practice guidance for fisheries liaison will be followed.
Design standards	The floating platform will be subject to Failure Modes and Effect Criticality Analysis process for survivability, which considers: • Collision risk; • Partial flooding; and • Consequential damage The design will be developed so that a low speed impact by a typical work boat or local fishing vessel will not sink the platform Dounreay Tri Ltd has employed an Independent Verification Body (IVB) American Bureau of Shipping (ABS) who will ensure the floating platform complies with floating wind design standards

Standard Mitigation measures specific to shipping and navigation	
Temporary safety zones during construction	Safety zones during construction are industry-standard to protect vessels and their personnel. Due to the novel nature of the technology, the extent of safety zones is unclear. Generally there is a safety zone of 500 m radii for offshore wind turbines during construction. Minimum air clearance: There will be a minimum air clearance of 22 m from sea level in all tidal states due to the floating nature of the structure. This is designed to help minimise the risk of rotor blade / yacht mast interaction in accordance with MCA and RYA guidance. Regarding operational safety zones, further consultation will be carried out with the MCA and BEIS regarding safety zones, or other methods of protecting against collision and fishing gear interaction during the operational phase.
Safety management plan	A comprehensive safety management system for marine operations, involving the deployment of devices will be developed for the proposed project. Of particular relevance to the risks of vessel collision during construction are the commitments to contractor selection processes and vessel audit. In addition, development of a Project HSE Plan will take place in full consideration of the contractors' own HSE systems, procedures and expertise. A Project Emergency Response Cooperation Plan (ERCOP) will be developed in liaison with MCA and RNLI.
Hazard identification and risk assessment	The Project is also committed to a continuing programme of hazard identification and risk assessment during detailed design and planning of operations. The hazard reviews will involve the marine contractors and representatives from other sea users, MCA/Coastguard, RNLI, Harbour Masters and others as appropriate.
Tool box talk	Before any construction activity commences Dounreay Tri Ltd's safety management system requires task risk assessment at a tool box talk with operations personnel on the tasks, risks and mitigations.
Floating platform interventions	Maintenance operations will only be undertaken during periods of forecast suitable weather conditions and the duration of an operation to retrieve or re-install a device will normally be less than half a day and scheduled for daylight. The Operating Procedures include detailed procedures relating to tow management, including definition of weather window requirements and weather forecast checks, and contingency plans and equipment for loss of tow including back up tow line deployment.

Standard Mitigation measures specific to shipping and navigation	
Maintenance notifications	Prior to each operation to bring the floating platform components to an appropriate harbour, notifications will be issued to cover vessels transiting the area and local vessels operating in and around the area. A comprehensive approach will be taken to inform not just UKHO for charting on Admiralty charts but also to KIS-ORCA for fisheries, Notice to Mariners and Navtex, and all relevant national and local stakeholders whether commercial, fisheries or recreational.
Advisory Zone	Discussions will continue with MCA on the site designation to be either a safety exclusion zone in operation or a site designated as an area to be avoided or an advisory zone.
Site marking and lighting	Site marking and lighting will be in compliance with regulatory requirements (IALA recommendation O-139) and on-going consultation with MCA and NLB.

13.12 Project specific mitigation measures

Mitigation Measures Specific to Shipping & Navigation		
Ref	**Title**	**Description**
SN01	AIS on floating platform	The floating platform will have AIS on board so will be visible to all vessels with electronic charts
SN02	Local tugs on standby	Local tugs will be on stand-by for the duration of the towage to ensure that vessels can assist, if required
SN03	Chartings and notifications when platform offsite	Hazard warning will emphasise that even when the floating platform is not on station the moorings and cabling on-site is a risk to fishing gear
SN04	Project vessel able to respond in an emergency	The Project vessel(s) based at the O&M base will be able to provide assistance to SAR operations in an emergency
SN05	Floating platform and WTGs remain lit even if the platform was to lose station	The platform shall have batteries to ensure navigational safety systems remain operational in the event that either the electrical or mooring system fails
SN06	Appointment of a marine co-ordinator	Appointment of a marine co-ordinator to manage construction traffic movements
SN07	AIS on work vessels	Work vessels will carry AIS making them visible to all vessels with electronic charting
SN08	Circulation of information	Targeted circulation of information directly to local ports, ship operators, fishermen, recreational organisations

Mitigation Measures Specific to Shipping & Navigation		
Ref	**Title**	**Description**
SN09	Advisory Area	The Project Site will be designated as an advisory area warning vessels not to enter the Site

13.13 Residual Impacts

13.108 This section provides a description of specific impacts, giving Project specific details in order to demonstrate the scale of the impact. Standard industry practice is assumed as embedded mitigation (see Table 13-13). Additional project specific (enhanced) mitigation measures identified during consultation and during the HIRA are presented specific to each impact and used to estimate the residual impact.

Construction phase

13.109 Work vessels will be required during construction and installation of the Project. These are detailed in Chapter 4 (Project Description).

Disruption to navigation created by support vessels during construction

13.110 Support vessels used in construction may be slow moving or of limited manoeuvrability when working onsite, hence have the potential to disrupt navigation. A safety zone may also be placed around the vessels whilst working, increasing the area of obstruction. Construction and associated support vessels will be present in the Study Area during device and infrastructure installation and the export cable route corridor during export cable installation.

13.111 The main construction phases are the installation of the export cable, followed by the installation of the anchors, moorings and cabling and then finally the installation of the floating platform itself. Construction activities are most likely to be planned during fair weather periods (May to September) which are likely to coincide with the times of highest recreational, fishing, passenger and offshore vessel activity (see Section 13.8).

13.112 Export cable installation will require a dedicated cable-laying vessel with dynamic positioning capabilities and up to two support vessels to assist operations; expected to be onsite for up to ten days. All other activities will be undertaken using a combination of anchor handling tug supply (AHTS) vessels and multicat vessels with activities such as towing of the platform requiring up to 4 AHTS (see Chapter 4 Project Description).

13.113 All vessels associated with construction will be present within the Study Area. Construction vessel traffic will therefore be confined to a limited area outwith the main shipping channel (see Section 13.8). The radius of the safety zones placed around all working vessels will be minimised as far as possible whilst providing the necessary protection. Discussions will take place with MCA and Contractors to agree the appropriate coverage of the safety zones. Working vessels will also display appropriate marking and lighting and be fitted with AIS transmitters. Notices to Mariners will be broadcast and local sea users informed of working vessels presence and all regulatory requirements for charting the site will be followed.

13.114 Given the likely time of year and results of the vessel traffic analysis; a vulnerability of medium for shipping and navigation activity is considered appropriate. Given the proposed mitigation measures, a magnitude of effect of low is assigned to the Project resulting in an overall significance of minor.

Increased pressure on Search and Rescue services

13.115 The Project covers a very small area adjacent to, but not within the main shipping lane along the North Coast. Therefore, it is unlikely to pose any significant hazard to SAR operations.

13.116 Additionally, because the scale of the Project's construction activities is small it is unlikely that they will add significantly to the existing load on SAR services in the area. The historical number of incidents recorded by MAIB and RNLI is relatively low within 10nm of the Project area.

13.117 The vulnerability of this receptor in relation to Search and Rescue is considered to be medium. The presence of the floating platform is therefore unlikely to cause a significant deviation from the baseline conditions and is assigned a magnitude of effect of low, resulting in an overall significance of minor.

Project vessel collides with third party vessel

13.118 The NRA identified collisions between Project associated vessels and other third party vessels, including when towing the floating platform to site as a potential impact during construction.

13.119 Vessel operators in the Pentland Firth are accustomed to the consideration of other sea users and given the nature and frequency of vessel transits in and around the Pentland Firth shipping lane and general inshore waters, vessel traffic associated with construction of the Project is unlikely to constitute an additional significant disruption.

13.120 The small size of the Project Site (a maximum area of $2km^2$) and large amounts of sea room surrounding the array provides many opportunities for alternative routes; it therefore presents very little obstruction to vessels. Project vessels that are working may have limited manoeuvrability; a safety zone will be placed around these vessels which will be broadcasted to other vessels transiting or working in the area.

13.121 Due to the low level of vessel activity in the Study Area the vulnerability of this receptor is considered to be negligible. A magnitude of effect of low is assigned to the impact resulting in an overall significance of negligible as it is not expected to cause a significant deviation from baseline conditions.

Operations and maintenance phase

Disruption to navigation created by floating platform or any advisory area

13.122 The presence of the floating platform has the potential to obstruct or change traditional navigation routes, resulting in affected vessels having to take alternative routes. The proposed development site will be at least 6 km off the mainland coast in open water with depths greater than 60m. The Project Site will not be greater than $2km^2$ and therefore presents very little obstruction to vessels. The main shipping channel runs to the north of the Study Area, with relatively few vessels travelling through the Site. Mitigation measures will be put into place to ensure that the mariners that do pass through the Project Site are well informed of the arrays presence.

13.123 It is expected that an 'advisory zone' will be established around the Site prior to construction for the lifetime of the Project, advising vessels not to enter within a certain distance of the Site. This distance is yet to be defined, but is likely to be 500 m, there is adequate sea room available surrounding the floating platform; hence it is not likely to cause disruption to navigation.

13.124 Due to the low level of activity in the area a vulnerability of low is considered appropriate for this receptor. Given the small nature of the Project infrastructure and the large amounts of sea room either side of the floating platform and any advisory zone a magnitude of effect of low is assigned to this impact, which results in an overall significance of minor.

Increased pressure on Search and Rescue services

13.125 The Project covers a very small area adjacent to, but not actually within the main shipping lane along the North Coast. The operations and maintenance phase will require a small workforce using one workboat, therefore, it is unlikely to pose any significant hazard to SAR operations.

13.126 Additionally, because the scale of the Project's operations and maintenance activities is small it is unlikely that they will add significantly to the existing load on SAR services in the area. The historical number of incidents recorded by MAIB and RNLI is relatively low within 10nm of the Project area.

13.127 A vulnerability of medium is considered appropriate for this receptor with regards to SAR. The presence of the floating platform is unlikely to cause a significant deviation from the baseline conditions and is assigned a magnitude of effect of low, resulting in an overall significance of minor.

Vessel collides with floating platform

13.128 The NRA identifies two main scenarios in which vessels may collide with the floating platform, these are; vessels losing propulsion and drifting into the floating platform, and vessels that are under control colliding with the floating platform.

13.129 Vessels losing propulsion or control are at risk of collision with the floating platform or any other hazard to navigation. The NRA identified that over a ten year period there were several incidents of machinery failure affecting fishing and recreational vessels within a zone 10nm (18.5km) around the Study Area; a sea area of approximately 1900km². The vessel traffic analysis shows a moderate traffic density of commercial vessels and fishing vessels generally transiting east-west to the north of the Study Area and within the Offshore Site; particularly in its northern part. During consultation it was noted that the area taken up by the floating platform will be very small (0.17 km^2). This was judged to be easy to avoid by consultees, either making a small diversion to offshore or (for vessels desiring an inshore track) to the inshore side where there will be large amounts of sea room available. Consultation with RYA also identified that the small size of the Project together with ample sea room on all sides (including inshore) posed little risk to yachtsmen.

13.130 Fishing activity as described in the traffic analysis broadly divides into offshore fishing beyond the 60 meter depth contour by vessels coming to trawl for squid or herring or to dredge for scallops and local vessels using static gear.

13.131 A Fisheries Liaison Officer will help to ensure all operators are aware of the site location, designation and the timing of activities on site. A Fisheries Management Plan will be developed to ensure liaison is inclusive of key ports, harbours and trade associations. It will be emphasised specifically that the site is potentially hazardous not only when the floating platform is installed but also when the subsea infrastructure of mooring systems and electrical cabling is in place and the floating platform is offsite. It is expected that an advisory area will be placed around the array in an attempt to stop vessels coming too close to the array. The radius of this advisory zone is likely to be 500 m. additionally, site marking and lighting will be in compliance with regulatory requirements and on-going consultation with MCA and NLB to ensure the Site is clearly visible.

13.132 The size of the floating platform at 0.17 km^2 constitutes a very small proportion of this 1900km² area. Therefore, the probability of machinery failure nearby the floating platform is very small and the actual collision risk even smaller. Additionally, the location and scale of the

Project makes it easily avoidable for vessels transiting the area. All regulatory requirements regarding notification of the floating platforms presence, AIS on-board the floating platform and lighting/marking will reduce the risk of vessels under control colliding with the floating platform.

13.133 Given the relatively low levels of vessel traffic in the Study Area a vulnerability of low is assigned to this receptor. The Project is assigned a magnitude of effect of low as only a small amount of change to the baseline conditions is expected resulting in an overall significance of minor.

Project vessel collides with third party vessel

13.134 The NRA identified collisions between Project associated vessels and other third party vessels as a potential impact.

13.135 Vessel operators in the Pentland Firth are accustomed to the consideration of other sea users and given the nature and frequency of vessel transits in and around the Pentland Firth shipping lane and general inshore waters, vessel traffic associated with operation and maintenance of the Project is unlikely to constitute an additional significant disruption.

13.136 The small size of the Project Site (a maximum area of $2km^2$) and large amounts of sea room surrounding the array provides many opportunities for alternative routes; it therefore presents very little obstruction to vessels. Project vessels will only attend the floating platform for maintenance operations throughout periods of good weather so will be able to manoeuvre in order to avoid third party vessels. Furthermore, it is likely that the platform will only be visited by the Project workboat on one occasion per week for planned maintenance, so this is unlikely to pose a significant hazard to third party vessels in the area.

13.137 A vulnerability of low is considered appropriate for this receptor. A magnitude of effect of low is assigned to the Project resulting in an overall significance of minor as it is not expected to cause a significant deviation from baseline conditions.

Disruption to navigation created by support vessels during operations and maintenance

13.138 Disturbance to navigation caused by the presence of maintenance vessels in the Study Area will be of a similar nature to that described in construction. However the level of vessel traffic associated with maintenance activity is likely to be less than those during the construction phase. Minor maintenance activities will be carried out on-site through access to the platform. Unplanned maintenance activities may at times require the floating platform to be towed to an appropriate harbour to facilitate repairs. Any maintenance operations requiring towing of the floating platform will result in similar impacts to the construction phase

13.139 The level of maintenance vessel traffic is anticipated to be low; approximately one visit per week during the first few months of operation, thereafter the service interval is expected to increase. It is likely that only one workboat will be required to service the floating platform for planned maintenance events so this is unlikely to provide any significant disruption to navigation. IMCA audits will be carried out on vessels under consideration.

13.140 Maintenance vessel traffic will be limited to within the Project Site and export cable route corridor and transit routes between the site and the O&M base. The O&M base is as of yet undefined so any potential disruptions specific to navigation at the O&M base cannot be assessed, however continuing consultation with local stakeholders should avoid potential conflicts.

13.141 It is anticipated that an ROV inspection of all offshore infrastructure will take place at least once per year and in the event that reactive maintenance intervention is required for any of the offshore infrastructure, the number and type of vessels required is likely to be broadly similar to those used during the construction period.

13.142 Maintenance operations will only be undertaken during periods of forecast suitable weather conditions and the duration of an operation to retrieve or re-install the floating platform will normally be less than half a day and scheduled during daylight. The Operating Procedures include detailed procedures relating to tow management, including definition of weather window requirements and weather forecast checks, and contingency plans and equipment for loss of tow including back up tow line deployment.

13.143 It is unlikely that the vessels involved in normal operations and maintenance activities will cause a deviation from baseline conditions.

13.144 Due to the low level of activity in the area a vulnerability of low is considered appropriate for this receptor. Given the proposed mitigation measures and the small, infrequent amount of vessel traffic introduced into the Study Area by maintenance activities a magnitude of effect of low is assigned to the Project. This results in an overall significance of minor.

Fishing Interaction with export cable, mooring lines or anchors

13.145 For impacts to commercial fisheries see Chapter 12 Commercial Fisheries. For further information relating to the navigational risks to fisheries see the NRA Appendix 13.1.

13.146 There is potential for fishing gear to become snagged on or entangled with floating and subsea structures, including any unburied export cable or on cable protection material. The export cable (up to 13.8 km length) will be buried to a depth of 1-2 m and up to 20 % (2.8 km) may require cable protection with a number of materials including rock placement. There will be up to 8 mooring lines and 16 anchors deployed to secure the floating platform.

13.147 Fishing vessels potentially affected by the export cable, cable protection material or anchors are those that come into contact with the seabed and include scallop dredgers, bottom trawlers and possibly vessels with pot or creel gears. All fishing gear types could be affected by mid-water mooring lines or electrical cables and the floating platform.

13.148 Snagging on the export cable is mitigated by appropriate cable protection measures. Several options for laying the cable on the seabed are under consideration and the final method selected will depend on seabed type, environmental conditions and consultation. The cable will be buried where feasible and cable protection utilised where burial is not possible. Discussion on the nature of any cable protection will be an integral part of the Cable Laying Strategy and Method Statement (GM18) which should include a Cable Burial Strategy and the FMP (CF01). Cable monitoring (CF03) will ensure that protection measures are maintained and the cable is not exposed. Fishermen will be informed of the location of the cable through the Fisheries Liaison Officer (FLO) (CF02) and it will be publicised on Kingfisher or other navigational notification sources.

13.149 Fishing activity is of low intensity within the project boundaries for all fisheries, however due to the risks associated, all fisheries are considered to be of medium vulnerability. Given the applied mitigation such as NTMs, charting of the site and its designation as an advisory zone the magnitude of effect of the Project is considered to be low, resulting in an overall significance of minor.

13.14 Cumulative Impacts

13.150 This assessment of cumulative effects considers the potential impacts that may potentially arise from development of the Dounreay Tri Ltd floating wind demonstration site, combined with existing baseline trends along with any future planned projects. An important factor for cumulative effects to shipping and navigation is which ports will be chosen as the construction and O&M base(s), for the proposed projects. The following proposed projects have the potential to result in cumulative effects to shipping and navigation receptors:

- SHE-T Orkney-Caithness interconnector cable;
- HIE Dounreay Demonstration Centre (DDC);
- Brims Tidal Array Limited, Brims Ness;
- Meygen, Inner Sound;
- Scotrenewables, Lashy Sound; and
- DP Energy, Westray South.

13.151 If one or more of the aforementioned projects was to be constructed at the same time as the Dounreay Tri Ltd Project and the same port was used as a construction base there is potential for conflicts to arise. This could lead to congestion in and around the ports, leading to an increased collision risk. If ports such as Stromness and Lyness were chosen as the construction base for more than one project and construction was to be carried out simultaneously, the limited ability of these ports to accommodate large numbers of commercial vessels for construction activities, compared to, for example, Scrabster could lead to an increased risk of collision. Furthermore, increased activity by project vessels in the Pentland Firth could lead to displacement or redirection of vessel traffic, e.g. commercial, fishing and recreational vessels, which could lead to an increased risk of collision.

13.152 Although the projects highlighted in this cumulative impact assessment have the potential to increase the risk of collision between all vessels, it is unlikely that the construction periods of these projects will overlap. Furthermore, the floating platform will be constructed in a dry dock away from site and towed to position, before being hooked up to pre-installed mooring lines and export cable, which is anticipated to take a period of 5 days. This represents a small period of time over which the risk of collision will be increased, if one or more of these projects were to be constructed simultaneously. Good port management and liaison with harbour authorities will help mitigate against any potential conflicts were one or more of the aforementioned projects to be constructed at the same time and to use the same port.

13.153 The ability of the nearby ports, Scrabster, Stromness, and Lyness to accommodate the relatively small number of vessels required for O&M of the aforementioned projects, means any cumulative impact throughout the operational phase is unlikely to be significant. Any potential conflicts can be mitigated by good port management and liaison with harbour authorities.

13.154 Having considered the information presently available in the public domain on the projects for which there is potential for cumulative impacts, and due to the localised nature of potential impacts associated with this Project, it is considered that from a shipping and navigation perspective there will be no significant cumulative impact from any of these projects.

13.15 Summary

- The shipping and navigation chapter provides a description of the baseline features based on data and consultation with relevant stakeholders for the Study Area;
- Maritime traffic surveys consisting of AIS and VMS observations were undertaken for the Project;
- The assessment identified the Study Area as being of relatively low vessel traffic levels compared to the wider Pentland Firth area;

- Potential impacts upon shipping and navigation associated with construction, installation, O&M and decommissioning of the Project have been assessed; and
- Based on the mitigation embedded in the Project design, and by applying standard industry practice and additional Project-specific mitigation, identified during consultation, no significant effects were identified.

13.155 A summary is provided in the following table (Table 13-14)

Table 13-68 Impact summary for shipping and navigation

Potential Impact	Magnitude	Vulnerability	Overall significance
Construction			
Disruption to navigation created by support vessels during construction	Low	Medium	Minor
Increased pressure on Search and Rescue services	Low	Medium	Minor
Project vessel collides with a third party vessel	Low	Negligible	Negligible
Operations and Maintenance			
Disruption to navigation created by floating platform or any 'advisory area'	Low	Low	Minor
Increased pressure on search and rescue services	Low	Medium	Minor
Vessel collides with floating platform	Low	Low	Minor
Project vessel collides with a third party vessel	Low	Low	Minor
Disruption to navigation created by support vessels during operation and maintenance	Low	Low	Minor
Fishing interaction with export cables, mooring lines or anchors	Low	Medium	Minor
Decommissioning			
Impacts during decommissioning are expected to be similar to but not exceeding those during construction			

14 Aviation and Radar

14.1 Introduction

14.1 This chapter describes the aviation and military conditions in the vicinity of the proposed Dounreay Trì Offshore Demonstrator Project – the 'Project', and presents an assessment of the potential impacts arising from the Project of the Project during its construction, operation and decommissioning with regard to aviation and radar systems.

14.2 This chapter identifies and assesses the potential impacts that the Project may have on civilian and military aviation and aviation safeguarding in the Study Area and, if required, the mitigation measures to be implemented to prevent, reduce or offset any potential adverse effects where possible.

14.2 Study Area

14.3 The Site comprises a 5 x 5 kilometre (km) offshore area located approximately 6 km from the north coast of Dounreay, Caithness and an export cable corridor running from the offshore site to the coast immediately to the west of the Dounreay Restoration Site fenceline (see Figure 14-1).

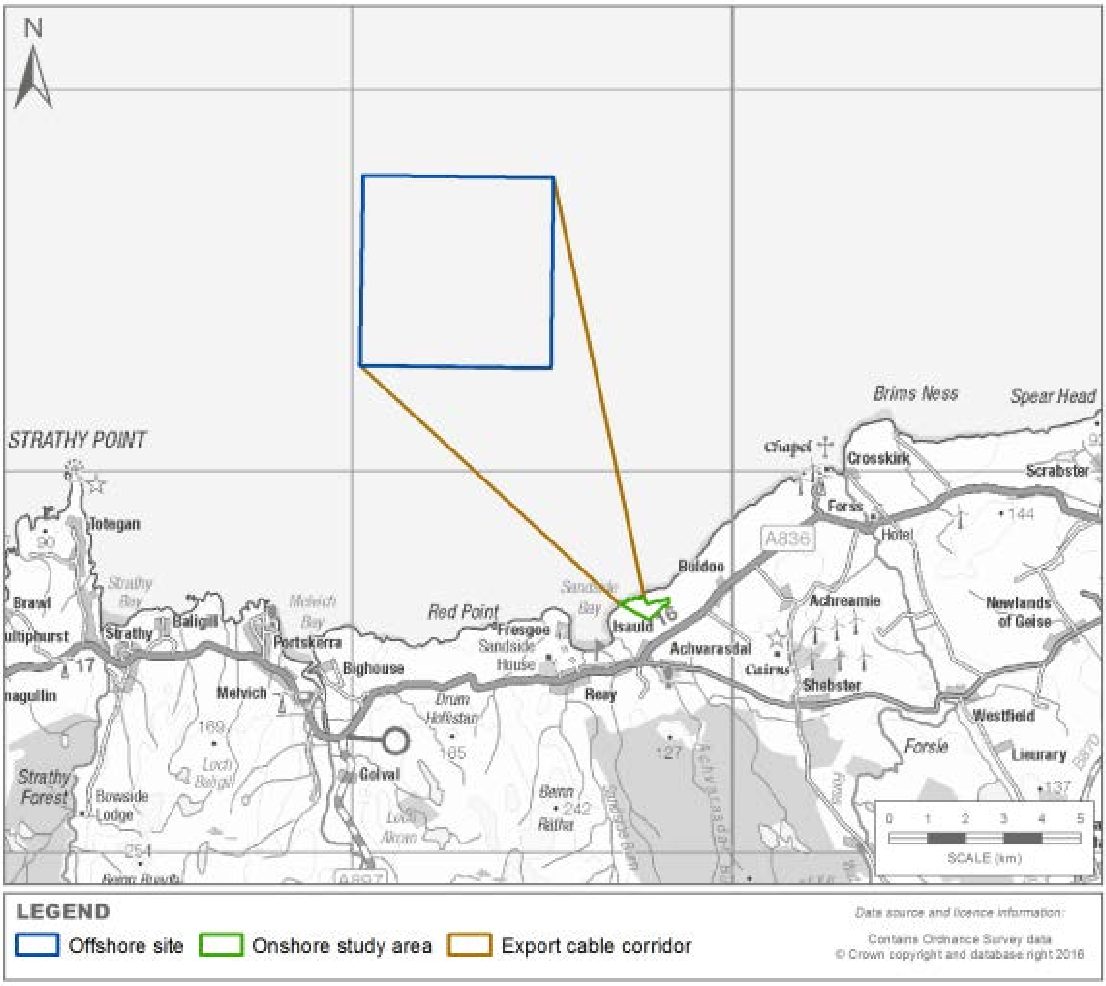


Figure 14-37 Offshore site and export cable corridor

14.3 Legislation and Guidance

14.4 The aviation industry and the provision of Air Navigation Services are regulated through extensive legislation, with the mechanism for wind development enabled through the consenting system in accordance with regulatory guidance. The following policy and guidance documents were considered during the aviation baseline definition and assessment activities:

- CAP 393 Air Navigation: The Order and the Regulations (known as the Air Navigation Order (ANO) (CAA, 2015 (a));
- CAP 764: CAA, Policy and Guidance on Wind Turbines (CAA, 2016);
- MOD Obstruction Lighting Guidance (MOD, 2014); and
- Renewable UK Guidance on Low Flying Activity and Onshore Tall Structures Including Anemometer Masts and Wind Turbines (RenewableUK, 2012).

Summary of relevant planning policy

14.5 Scottish Planning Policy (SPP) published by the Scottish Government, June 2014 (Government, 2014):

- Proposals for energy infrastructure developments should always take account of spatial frameworks for wind farms and heat maps where these are relevant. Considerations will vary relative to the scale of the proposal and area characteristics but are likely to include impacts on aviation and defence interests and seismological recording (paragraph 169 of SPP);
- Aviation Matters: UK Airspace is important for both civilian and military aviation interests. It is essential that the safety of UK aerodromes, aircraft and airspace is not adversely affected by new wind power infrastructure. As such, planning authorities should take the following into account:
- Wind turbines can have implications for the flight paths of aircraft due to the height of turbines and anemometers masts. This Project shall not require an anemometer mast;
- Planning authorities are requested to supply the Civil Aviation Authority (CAA) with information about approved new wind power developments involving obstructions as soon as permission has been granted, as the CAA is responsible for recording all air navigation obstructions in the UK for air safety;
- Depending on the wind turbine size, shape, construction materials and location, together with the amount of electromagnetic interference, there may be implications for airport radar and communications systems. Planning authorities should consult the Ministry of Defence (MOD) and National Air Traffic Services En-Route Ltd (NERL) who have a statutory duty to safeguard certain communication, navigation and surveillance (CNS) sites (including radars) from interference to signals caused by wind turbines in the interests of national security, and the continued safe operation of passenger and military aviation; and
- Planning authorities receiving applications affecting the areas identified in safeguarding maps will be required to consult the relevant aerodrome operator or, for en-route technical sites, National Air Traffic Services (NATS), of which NERL is a part. Further guidance on military aviation matters and other defence matters are covered, and planning authorities should also refer to the guidance on dealing with aviation objections and using suspensive conditions.

14.4 Sources of Information

14.6 Other data sources and guidance considered under a desktop review (within the Aviation Impact Assessment (AIA)) of the baseline environment definition include the following (see Table 14-1).

Table 14-69 Sources of information

Source	Content
CAA Visual Flight Rules Chart (CAA, 2015 (b))	Air Navigation chart utilised by General Aviation Pilots.
Military Aeronautical Information Publication (Mil AIP) (MOD, 2016)	The MIL AIP is the main resource for information and flight procedures at MOD operated aerodromes, and includes charts and other air navigation information.
MOD United Kingdom (UK) Low flying System (UKLFS) Priority Areas Map (MOD, 2011)	Chart showing the priority areas for military low flying operations relating to the Project of wind turbines.
CAA, CAP 32 UK Integrated Aeronautical Information Package (UKIAIP) (NATS, 2016)	The UK IAIP is the main resource for information and flight procedures at all licensed UK airports as well as airspace, en-route procedures, charts and other air navigation information.

14.5 Identified Aviation Stakeholders

NATS

14.7 NATS is the UK civil en-route Air Navigation Service Provider (ANSP). NATS operates a number of long-range radars positioned to provide maximum coverage of UK airspace, which are important for the safe provision of air traffic services to civil and military, national and international air traffic. The Site boundary is within the operational range of NATS Allanshill and Perwinnes Primary Surveillance Radar (PSR) systems.

Offshore helicopter operations

14.8 A network of Helicopter Main Routes (HMRs) is established to support the transport of personnel and logistics to offshore Oil and Gas (O&G) installations. HMRs provide a network of offshore routes as used by civilian helicopters and to facilitate an obstacle free zone for safe flight when in-flight visual meteorological conditions cannot be met. The HMR structure therefore provides both an identification of common flight paths and a safe means of traffic flow. Two HMRs are located in proximity to the Site boundary (see Figure 14-2). These routes are established specifically for helicopter flights from Aberdeen, via Wick to the O&G installations in the Atlantic Rim to the west of the Shetland Islands.

MOD air defence radar systems

14.9 The RAF Air Surveillance and Control Systems (ASACS) Force is responsible for compiling a Recognised Air Picture to monitor the airspace around the UK in order to launch a response to a potential airborne threat. This is achieved through a network of long-range radar systems. The Site is within the operational range of the Benbecula and Buchan Air Defence Radar (ADR) systems (see Figure 14-2).

RAF Lossiemouth

14.10 RAF Lossiemouth is considered to be the largest and busiest fast jet base in the RAF. The Station is home to three operational squadrons of Typhoon FGR4 aircraft and the Tornado GR4 Operational Conversion Unit. In addition, the location of RAF Lossiemouth, close to air weapons ranges on the Moray coast results in the hosting of large numbers of visiting aircraft for international military exercises on a regular basis. The Site is within the operational range of the Lossiemouth PSR system (see Figure 14-2).

Inverness Airport

14.11 Inverness Airport is considered a strategically significant gateway for the region and a major economic driver for the Inner Moray Firth and wider Highlands area. The airport provides regular scheduled domestic and international flights by a number of airline companies. The Site is within the operational range of the airport's PSR system (see Figure 14-2).

Other radar, communication and navigation systems

14.12 A wide range of systems, including navigation aids, Instrument Landing Systems (ILS), Precision Approach Radar (PAR) and VHF Omni-Directional Radio-Range/Distance-Measuring Equipment (VOR/DME), together with air-ground communications facilities, could potentially be affected by wind turbine developments.

Search and rescue helicopter operations

14.13 Bristow Helicopters is the leading provider of helicopter Search and Rescue (SAR) services in the UK. Regional SAR operations are based at Inverness, Stornoway and Sumburgh Airports, the Site is with the maximum radius of operations (250 NM) of these bases (see Figure 14-2).

MOD low flying

14.14 Low flying is a very challenging but essential skill for military aircrew, gained through progressive training and continuous practice within the UK Low Flying System (UKLFS). The ability to operate effectively at low-level by day and night is vital to fast jet, transport aircraft and helicopters as they support forces on the ground. The UKLFS covers the open airspace of the whole UK and surrounding oversea areas from surface to 2,000 ft above ground level (agl) or above mean sea level (amsl) (see Figure 14-3).

MOD training and exercise areas

14.15 Air Surveillance and Control Systems (ASACS), using ADR resources support training exercises on an almost daily basis in the region above the Zone. Temporary Reserved Area (TRA) 008B and the Northern Managed Danger Area (MDA) complex (D712 Areas A-D) lie above the Site (see Figure 14-2).

Wick Airport - Minimum sector altitude flight operations

14.16 The Minimum Sector Altitude (MSA) is the lowest altitude which may be used in providing a minimum clearance of 1,000 ft above all objects located in the area contained within a sector of a circle of 46 km (25 NM) radius centred on a radio aid to navigation.

14.6 Consultation

Pre-application consultation

14.17 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date

Scoping Feedback

14.18 The following stakeholder responses have been received specifically relating to this chapter (Table 14-2).

Table 14-70 Scoping feedback

Consultee	Comment	Relevance/Cross Reference
CAA	The appropriate aviation consultees (NATS, the MoD and Wick Airport) have been identified. Their formal positions should be established through consultation. As the maximum height of the structures is likely to be over 60 m above the level of the sea at the highest astronomical tide, there is a requirement for the turbines to be lit in accordance with the Air Navigation Order. There is an international civil aviation requirement for all structures of 300 feet (91.4 metres) or more to be charted on aeronautical charts. Accordingly such structures should be reported to the Defence Geographic Centre (DGC), which maintains the UK's database of tall structures, at least 10 weeks prior to the start of construction. The DGC will require the accurate location of the turbines/meteorological masts, accurate maximum heights, the lighting status of the turbines and/or meteorological masts and the estimated start/end dates for construction together with the estimate of when the turbines are scheduled to be removed. In addition, the developer should also provide the maximum height of any construction equipment required to build the turbines. In order to ensure that aviation stakeholders are aware of the turbines and/or meteorological masts while aviation charts are in the process of being updated, developments should be notified through the means of a '**Not**ice to **A**ir**m**en' (NOTAM). To arrange an associated NOTAM, a developer should contact CAA Airspace (AROps@caa.co.uk); providing the same information as required by the DGC at least 14 days prior to the start of construction.	Section 14.13. Notification of development in advance of construction activities.

Consultee	Comment	Relevance/Cross Reference
HIAL	As of 8 March, no Scoping Opinion has been received.	The Site is considered not detectable by HIAL radar systems and would not affect operations that utilise the systems. The Project is considered not to present as a physical obstruction effect on Wick Airport flight operations.
MCA - (SAR Operations)	Although noting this is a demonstrator site, and therefore could be considered as a small scale development with respect to SAR issues, particular consideration will need to be given to the implications of the site size and location on SAR resources and Emergency Response Co-operation Plans the latest version of which (November 2014) is available electronically on the MCA website.	Details Helicopter SAR activities and provides details on the lighting and notification process.
MOD	No Scoping Opinion has been received.	The Site is considered not detectable by MOD radar systems and would not affect operations that utilise the systems. The Site is not in an area of priority regarding Low Flying; therefore no effects expected. Sections 14.28 to 14.30 and 14.40 provide detail on Low Flying operations and mitigation strategy. Paragraph 14.56 provides details on the lighting and notification process.

Consultee	Comment	Relevance/Cross Reference
NATS	NATS attached general guidance regarding the potential impact upon their infrastructure and operations. Whether any potential impact might exist, can be ascertained through the use of on-line self-assessment maps or pre-planning service (http://www.nats.aero/services/information/wind-farms/self-assessment-maps/). NATS advice is for developers to familiarise themselves with the aviation aspects of wind farms and to include any evidence of assessments in their documentation. We would also advise developers to engage with NATS should they anticipate any issues, at the earliest opportunity.	The Site is considered not to be detectable by NATS systems and therefore will not affect operations.

14.7 Assessment Methodology

14.19 The overarching approach to assessment is described in Chapter 5: Environmental Impact Assessment Methodology. To support this, the following is a description of the specific criteria which are used, within the AIA, to evaluate the impact on Aviation and Radar.

14.20 Analysis has been conducted in accordance with Civil Aviation Authority (CAA) – Civil Air Publication (CAP) 764, Policy and Guidelines on Wind Turbines (CAA, 2016). Potential aviation stakeholders were identified and for each receptor, the physical obstruction and/or radar effect, and then subsequently the operational effects were evaluated. The operational effect assessment pays heed to, but is not limited to, consideration of: the orientation of airfield approach and departure routes; physical safeguarding of aircraft operations; and airspace characteristics.

14.21 Radar performance and propagation modelling has been undertaken to determine the theoretical detection of wind turbines by the region’s radar infrastructure. The ATDI ICS LT (Version 3.3.92) tool to model the terrain elevation profile between the identified radar systems and the Site Design Envelope, to provide a graphical representation of the intervening terrain and theoretical radar direct Line of Sight (LOS), in order to determine the effected radar systems within the baseline.

14.22 The project description is set out in Chapter 4: Project Description. Design assumptions about the project envelope (the Design Envelope) are summarised in Section 14.9.2. Specific assumptions relevant to the assessment in this chapter are:

- A two turbine offshore wind farm with an installed capacity of up to 16 megawatts approximately 9 kilometres (km) off the coast of Dounreay as shown in Figure 14-1; and
- The maximum turbine height of 210 m above the lowest astronomical tide (LAT).

14.23 Aviation stakeholders were identified in accordance with the guidance in the CAP 764 (CAA, 2016), with the suggested anticipated extents of impact utilised as a minimum. It is however, acknowledged that objections from beyond the recommended aviation stakeholder consultation distances may occur so the threshold used for identifying potential aviation stakeholders is not a definitive statement of the extent of potential impacts arising from the Project.

14.24 For the purposes of the assessment, a worst case scenario, and hence a precautionary approach was adopted. The assessment utilised the largest proposed turbine, across the lateral confines considered in the Design Envelope.

14.25 Consideration is given to any aviation infrastructure that is within operational range of the Site. Operational range varies with radar type or operations and therefore the study areas are defined on a case by case basis in this respect.

14.26 For a wind turbine to interfere with a radar system there must be LOS between the radar and some part of the turbine. This LOS can be blocked either by terrain or by the curvature of the earth. The analysis is designed to give an indication of the likelihood of the turbine being detected such that the operational significance of the wind farm's detectability relative to nearby aviation stakeholders can be assessed.

14.27 The analysis contained in the AIA involves a systematic review of the charts and data available through the Mil AIP (MOD, 2016), as well as utilisation of CAA Visual Flight Rules Charts (CAA, 2015 (b)). The AIA identifies all potential aviation stakeholders, the location of their operations and procedures relative to the Site and any potential effects associated with the Project. The analysis also considers the options that could mitigate the impact of the Site on the operations of identified aviation stakeholders. A detailed scope and methodology is provided in the full AIA in Appendix 14.1: Aviation Technical Report.

Design envelope

14.28 As described in Chapter 5: Environmental Impact Assessment Methodology, the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

- A two turbine offshore wind farm platform including turbines of a maximum height of 210 m above LAT, located within the area shown in Figure 14-1.

14.29 To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

14.30 Table 14-3 describes the Design Envelope parameters specific to Aviation.

Table 14-71 Design Envelope parameters

Design Envelope Parameter	Value/Description
Two turbine platform with a maximum height of 210 m above LAT	Turbines can present a physical obstruction at or close to an aerodrome or in the military Low Flying environment. In addition, turbine clutter appearing on radar display can affect the safe provision of air traffic services as it can mask unidentified aircraft from the air traffic controller and/or prevent him from accurately identifying aircraft under control. In some cases, radar reflections from the turbines can affect the performance of the radar system itself.

Magnitude of effect

14.31 The magnitude of the potential effects on aviation and radar receptors is assessed using the method and terminology given in Table 14-4.

Table 14-72 Magnitude criteria

Descriptor/Criteria	Description
High	Receptor unable to continue safe operations or safe provision of air navigation services (radar) in the presence of the wind turbines. Technical and/or operational mitigation of the effect is required.
Medium	Receptor able to continue safe operations but with some restrictions or non-standard mitigation measures in place.
Low	Receptor able to continue operations with standard mitigation in place.
Negligible	No impact on this receptor.

Vulnerability criteria

14.32 The vulnerability of a receptor is subjective in aviation terms and therefore difficult to quantify. Whereas an Air Defence Radar system would be an obvious high value and high vulnerability receptor (due to its role in UK national security), the vulnerability of a local aerodrome can also often be rated high if the Planning Authority considers the receptor to be a significant asset to the local area.

Significance of impact

14.33 Significance for aviation impacts are typically difficult to establish; they are not strictly based on the vulnerability of the receptor or magnitude of change but on whether the industry regulations for safe obstacle avoidance or radar separation (from radar clutter) can be maintained in the presence of the two wind turbines.

14.34 Any anticipated impact upon aviation stakeholders which results in restricted operations is considered to be of significance. The following approach identified in Table 14-5 is used and summarises the assessment of significance.

14.35 The determined effects have been informed by the results of the desktop assessment and additional consultation with reference to the existing evidence base regarding the effects of two wind turbines on aviation receptors.

Table 14-73 Significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

14.8 Description of the Current Environment

Study area - Aviation baseline environment

14.36 In the UK Flight Information Region (FIR) and Upper Information Region (UIR), airspace is classified as A to G in accordance with International Civil Aviation Organisation (ICAO) standards (Note: There is no airspace designated as Class B or Class F in UK airspace). Airspace Classes A to E are variants of Controlled Airspace (CAS) in which aircraft require an Air Traffic Control (ATC) clearance. Class G Airspace is airspace in which aircraft can operate autonomously without any clearance required.

14.37 Aviation stakeholders have been identified and are detailed in Section 14.5. The Project is shown in relation to the airports and radar systems operated by the identified Stakeholders in Figure 14-2.

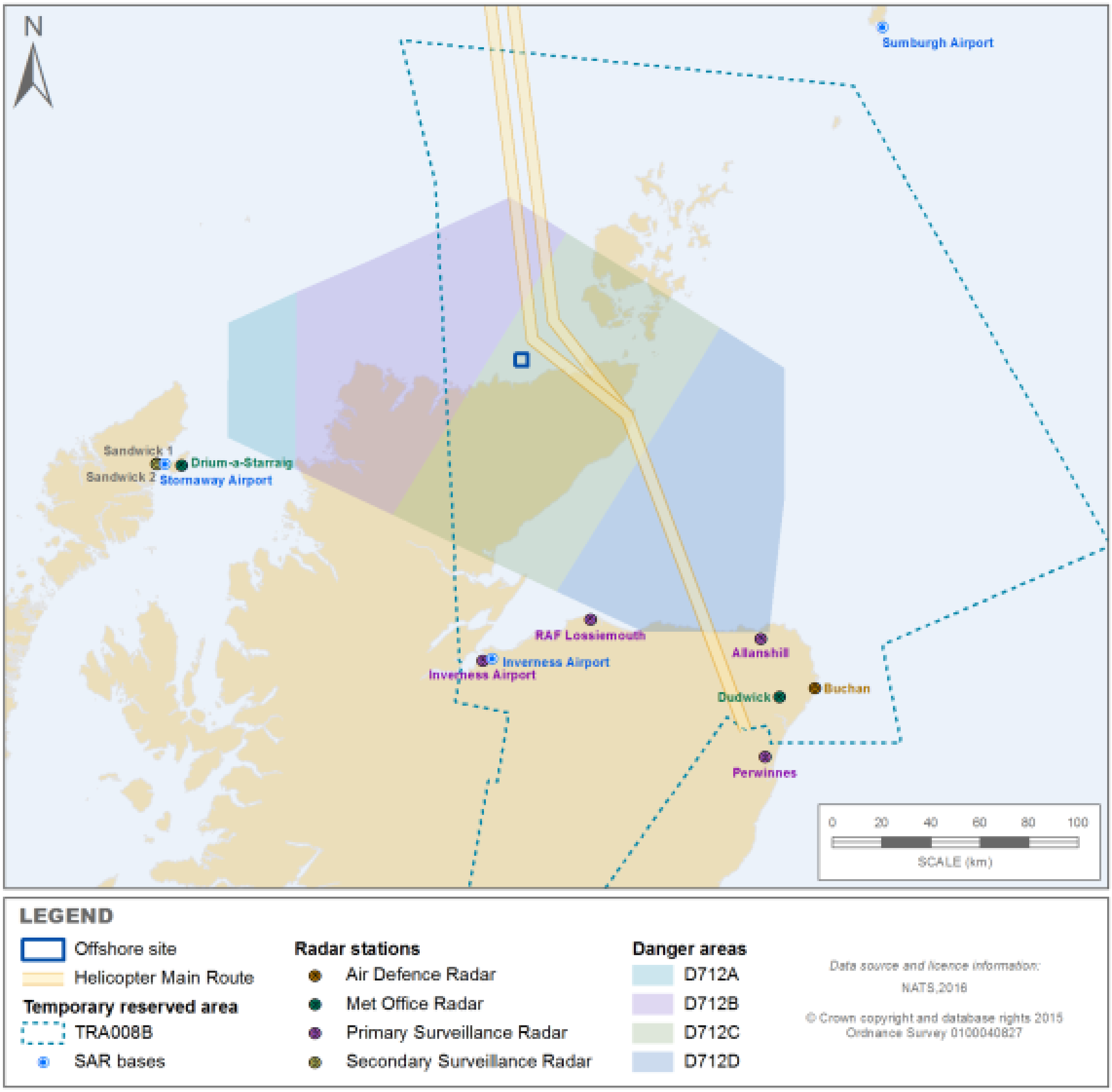


Figure 14-38 Identified Aviation and Radar stakeholders

14.38 This map shows estimated location data which may be subject to error and is provided for reference only.

14.39 The controlling authority of the various airspace sectors in the region of the Zone are described and categorised as follows:

- Class G Airspace up to Flight Level (FL) 195 immediately overhead the Wind Farm (approximately 19,500 feet (ft) above mean sea level); any aircraft can operate in this area of uncontrolled airspace without any requirement to be in communication with an

ATC Unit. Pilots of aircraft operating in Class G airspace are ultimately responsible for seeing and avoiding other aircraft and obstructions;

- Class C Controlled Airspace (CAS) established from FL 195 up to FL 245; all aircraft operating in this airspace must be in receipt of an ATC clearance and must fly strictly in accordance with that clearance. They must also be in receipt of an ATS from NATS or Military Controllers located at a NATS ACC, or Military AD Controllers;
- Temporary Reserved Area (TRA) 008B is established from FL 195 up to FL 245 (within Class C CAS). Promulgated activity within the TRA 008B includes Military air combat and training exercises and supersonic flight. Air Defence Units using radar data supplied from the Benbecula and Buchan ADR are responsible for navigation services and support to Military aircraft activity within TRA 008B during promulgated activity times.
- Class C CAS established above FL 245; again all aircraft operating in this airspace must be in receipt of an ATC clearance and an ATS from NATS or Military Controllers located at a NATS ACC, or Military AD Controllers.
- When required for military training, the airspace above the Zone from FL 245 up to FL 660 becomes the Northern MDA. The Northern MDA is utilised almost daily. Within the lateral and vertical confines of the MDA, air combat training, high energy manoeuvres and supersonic flight can be expected. When the MDA is not required for specific military training or exercise use, the airspace is then available for use for civil or military en-route operations.

14.40 In addition, the proposed turbines would be located within Low Flying Area (LFA) 14. This area covers Scotland, north of the central belt and includes all of the outer isles. A cross section of the airspace in the vicinity of, and above the Project is shown in Figure 14-3.

Figure 14-39 Cross section view of airspace structure

Summary

14.41 The approach to the assessment has identified those radar or systems and practices which have the potential to interact with the Site. Those with no identifiable interaction are not taken forward to the assessment phase. Table 14-6 highlights those systems which are considered in the assessment and indicates those that are taken to the assessment phase.

Table 14-74 Analysis effects conclusions

Receptor	Effects Analysis Conclusions	To Assessment Phase
Civil En-route Operations	Analysis indicates no LOS to Civil En-route Primary Surveillance Radar (PSR) systems; therefore, no effect on operations anticipated.	No
Civil Airport Operations	Analysis indicates no LOS to the Inverness Airport PSR system; therefore, no effect on operations is expected. The Zone boundary is approximately 24.5 nautical miles (NM) from the VHF Omni-directional Radio (VOR) navigation facility at Wick Airport. The Minimum Sector Altitude (MSA) at Wick Airport relating to the sector that contains the Zone is 2,000 ft amsl. Over 1,000 ft exists between the maximum blade tip height of the Project and the MSA. Therefore, no effect on the Wick Airport MSA is anticipated.	No
MOD Aerodrome Operations	Analysis indicates no LOS to MOD Aerodrome PSR systems; therefore, no effect on operations anticipated.	No
MOD Air Defence Operations	Analysis indicates no LOS to MOD Air Defence Radar (ADR) systems; therefore, no effect on operations anticipated.	No
Civil/Military Secondary Surveillance Radar (SSR)	Wind turbine effects on SSR can be caused due to the physical blanking and diffracting effects of the turbine towers depending on the size of the turbines and the wind farm, and that these effects are only a consideration when the turbines are located within 10 km of an SSR installation. No SSR facilities are within 10 km of the Zone boundary and are therefore no effect on SSR operations is expected.	No
Other MOD Aviation Operations	The Zone is not in an area of priority with regard to the effects of wind energy development on military low flying operations. It is considered that the MOD is therefore unlikely to raise concerns with regard to military Low Flying activities with turbines within the	Yes (Low Flying Operations)

Receptor	Effects Analysis Conclusions	To Assessment Phase
	Zone boundary. ADR systems that would provide control and monitoring of aircraft operations in practice and exercise areas above the Zone have been assessed, with the proposed turbines within the Zone not theoretically detectable by these systems. Consequently, operations within these areas are considered not to be affected.	
Meteorological (Met) Office Radar Systems	The Zone is not within the consultation zone whereby effects to Met Office radar may be encountered; therefore, Met Office radar systems are highly unlikely to be affected.	No
Helicopter Support to Offshore Oil & Gas (O&G) Industry Operations	Helicopter Main Routes (HMR) have no defined lateral dimensions, and 2 NM either side of the route centreline should ideally be kept obstacle free. The turbines that would be located within the Zone boundary would be greater than 2 NM from the centreline of the HMR; therefore, operations are anticipated not to be affected.	No
Search and Rescue (SAR) Operations	The wind farm may present a physical obstruction and affect SAR aircraft operations. However, when on an operational mission, SAR helicopters are not constrained by the normal rules of the air, operating in accordance with their Aircraft Operator Certificate (AOC). This allows pilots total flexibility to manoeuvre using their best judgement thus making them highly adaptable to any environment in which they operate.	Yes

14.42 The Site location is not considered to be in an area of priority with regard to military low flying operations, although such flights may occur on occasion.

14.43 The nature of SAR operations suggest that operations may be required to completed in the area of the Site.

14.9 Identification of Potential Impacts

MOD low flying operations

Impacts in the Construction Phase

14.44 The turbines shall be hoisted onto the platform onshore (location to be determined) and then the whole platform with the two turbines installed shall be towed to the Site so there shall be no cranes present on Site. Aviation authorities shall be notified of the platform route and movements once the fabrication yard is selected. Paragraph 14.56 provides details of the anticipated notification process. The magnitude of effect is low and the vulnerability of the receptor is medium; the overall potential effect of the Project, during the construction phase, on the UKLFS has been assessed as minor.

Impacts in the Operational Phase

14.45 Military low flying activities can take place down to a height of 250 ft (fast jets) and occasionally 150 ft (helicopters) above mean sea level. Consequently, the addition of significant physical obstructions into the low-level environment has the potential to affect low flying training.

14.46 Pilots are obliged to plan their flying activities in advance and to be familiar with any en-route obstacles they may encounter. During the flight, weather conditions or military exercises may necessitate route adjustments, however pilots are ultimately responsible for seeing and avoiding tall structures such as wind turbines. Despite this, it is acknowledged that there is an increased risk in low visibility conditions where pilots performing high energy manoeuvres could experience a delay in visually acquiring the turbines, hence resulting in a potentially unsafe situation.

14.47 The Project is located within an area identified as Low Priority in terms of the UK Low Flying System; however, non-standard mitigation may be requested by the MOD for the lighting of obstacles below 150 m amsl and hence, the magnitude of effect is low, the vulnerability of the receptor is determined to be medium; therefore, the overall potential effect of the Project on the UKLFS has been assessed as minor.

Impacts in the Decommissioning Phase

14.48 At this stage, the decommissioning process is not expected to use cranes onsite – rather the platform and turbines shall be towed to a dock to be dismantled. Aviation authorities shall be notified of the platform route and movements once the fabrication yard is selected. Paragraph 14.56 provides details of the anticipated notification process. The magnitude of effect is low, the vulnerability of the receptor is medium; therefore the overall potential effect of the Project, during the decommissioning phase, on the UKLFS has been assessed as minor.

SAR operations

Impacts in the Construction Phase

14.49 The turbines shall be hoisted onto the platform onshore (location to be determined) and then the whole platform with the two turbines installed shall be towed to the Site so there shall be no cranes present on Site. Aviation authorities shall be notified of the platform route and movements once the fabrication yard is selected. Paragraph 14.56 provides details of the anticipated notification process. The magnitude of effect is low, the vulnerability of the receptor is medium; therefore, the overall potential effect of the Project, during the construction phase, on SAR Operations has been assessed as minor.

Impacts in the Operational Phase

14.50 SAR operations could be affected by the presence of the Site. When on an operational mission, SAR aircraft are not constrained by the normal rules of the air and operate in accordance with their AOC. This allows them total flexibility to manoeuvre using the pilot's best judgement. The pilot is therefore is not prevented from operating in proximity to the Site.

14.51 While the SAR operations are of extreme importance, the vulnerability of the helicopter can be considered to be medium due to their adaptability to the environment in which they operate as they are not constrained by the normal rules of the air. The magnitude of effect is considered as low and the vulnerability of the receptor is medium; therefore, the overall potential effect of the Project is assessed to be minor.

Impacts in the Decommissioning Phase

14.52 At this stage, the decommissioning process is not expected to use cranes onsite – rather the platform and turbines shall be towed to a dock to be dismantled. Aviation authorities shall be notified of the platform route and movements once the fabrication yard is selected. Paragraph 14.56 provides details of the anticipated notification process. The magnitude of effect is considered low and the vulnerability of the receptor is medium; the overall potential effect of the Project, during the decommissioning phase, on SAR Operations has been assessed as minor.

14.10 Impact Assessment

MOD low flying operations

14.53 The Zone is located in Low Flying Area (LFA) 14, which covers Scotland to the north of the Scottish central belt. Fast jet and transport aircraft can fly down to a minimum of 250 ft MSD throughout the UKLFS. Helicopters normally operate down to 100 ft agl, but due to the nature of their task, and for specific training purposes, they may fly lower. However, the Site is not in an area of priority with regard to the effects of wind energy development on military low flying operations. It is considered that the MOD is therefore unlikely to raise concerns with regard to military Low Flying activities with turbines within the Site boundary.

SAR operations

14.54 The wind farm may present a physical obstruction and affect SAR operations. However, when on an operational mission, SAR helicopters are not constrained by the normal rules of the air, operating in accordance with their AOC. This allows pilots total flexibility to manoeuvre using their best judgement thus making them highly adaptable to any environment in which they operate.

14.11 Mitigation Measures

14.55 It is good practice to notify aviation stakeholders of the location and dimension of any wind turbines and the associated construction activities. Information regarding the tow path to site shall be passed to the Defence Geographic Centre (DGC) and the General Aviation Awareness Council at least 10 weeks in advance of the tow out and to follow up on the day with a confirmation that the activity has taken place. The data should include:

- Tow route, height (of all structures over 150 ft, date of erection, date of removal and lighting type (none, infra-red or lighting brightness);
- Local aerodromes identified during consultation should be notified, particularly any police helicopter or air ambulance unit; and
- RenewableUK should be copied on the submission of all such information as an independent record and that they might share the information with other relevant official agencies.

14.56 Appropriate information about the tow route and any associated lighting (where applicable), should be provided to the UK Aeronautical Information Service (NATS AIS) for promulgation throughout the UK IAIP (NATS, 2016).

Mitigation - low flying operations

14.57 Pilots of Military Low Flying aircraft operating in visual flight conditions are ultimately responsible for their own terrain and obstacle clearance. Pilots refer to aviation charts detailing the relevant terrain and any obstacles; this mapping will depict the location of the turbines and platform. Details of the Site are required to be promulgated through the DGC and the UK AIS, to enable the depiction of the platform and turbines on appropriate aviation charts and documentation as required. Lighting of turbines shall be in accordance with CAP 393 Article 220 (CAA, 2015 (a)).

Mitigation - SAR operations

14.58 An ERCoP will be in place for the tow out, operation and decommissioning phase of the Project. The ERCoP is completed initially in discussion between the developer and the Maritime and Coastguard Agency (MCA), SAR and Navigation Safety Branches. Detailed completion of the plan will then be in cooperation with the Maritime Rescue Coordination Centre (MRCC), responsible for maritime emergency response. The ERCoP must then be submitted to and approved by the MCA. The ERCoP will detail specific marking and lighting of the turbines. The SAR helicopter bases will be supplied with an accurate chart of the final turbine locations, and the platform yawing attributes.

14.59 Mitigation measures listed in Table 14-7 will be implemented to minimise potential impacts on aviation.

Table 14-75 Mitigation measures summary

Mitigation Measures specific to Aviation and Radar		
Ref	**Title**	**Description**
AR1	MoD Low Flying	Details of the Site are required to be promulgated through the DGC and the UK AIS, to enable the depiction of the platform and turbines on appropriate aviation charts and documentation as required. Lighting of turbines shall be in accordance with CAP 393 Article 220 (CAA, 2015 (a)).
AR2	SAR Operations	An ERCoP will be in place for the construction, tow out, operation and decommissioning phase of the Project. The ERCoP is completed initially in discussion between the developer and the Maritime and Coastguard Agency (MCA), SAR and Navigation Safety Branches, in cooperation with the Maritime Rescue Coordination Centre (MRCC). The SAR helicopter bases will be supplied with an accurate chart of the final platform location, and yawing attributes.

14.12 Residual Impacts

14.60 The mitigation measures relating to the notification of the Project to the appropriate aviation agencies for inclusion in documents and charts is anticipated to be sufficient in terms of Low Flying and SAR operations. Comprehensive formal consultation will follow and will identify the specific requirements for the fitting of aviation obstruction lighting. The magnitude of the residual effects are negligible and the vulnerability of the receptors are medium; therefore, the overall potential effect of the Project on the military Low Flying and SAR operations has been assessed as minor.

14.13 Cumulative Impacts

14.61 The fact that the two turbines within the Design Envelope are considered not detectable by any radar system, the Project will not present any cumulative effect on radar systems. The project is considered not to present any cumulative effect on MOD Low Flying operations in the region. It is not in an area of priority with regard to the effects of wind energy development on military low flying operations. SAR operations are of importance and can be required at any location. Consideration of the distance of the Project from known offshore and onshore developments conclude that the Project would not present a cumulative impact on Low Flying and SAR operations.

14.14 Summary and Conclusions

14.62 The following provides a summary of the conclusions reached during the assessment phase for the Site relating to Aviation and Radar (see below and Table 14-8).

- The Site is considered to be a location that military low flying operations could take place; however, such operations are unlikely to be routine. Mitigation in the form of appropriate notification, documentation and lighting of the two turbines is considered to be suitable.
- SAR operations are of importance and can be required at any location. When on an operational mission, SAR aircraft are not constrained by the normal rules of the air, which allows them total flexibility to manoeuvre to complete the task. An ERCoP, agreed by the MCA in cooperation with the MRCC, will be in place for the tow out, operation and decommissioning phase of the Project. The ERCoP will detail the location of the two turbines and their specific marking and lighting and would include yawing attributes of the platform.
- Two turbines within the Site shall be within the operational range of a number of civil and military radar systems. However, analysis indicated that two turbines positioned anywhere within the Site boundary would not theoretically be detectable by any of the systems due to distance, the curvature of the earth and intervening terrain.
- Two turbines within the Site are considered not to affect operations at any regional civil and military aerodromes.

Table 14-76 Summary of residual impacts

Potential Impact	Magnitude	Vulnerability	Overall Significance
Operational Phase			
The mitigation measures relating to the notification of the Project to the appropriate aviation agencies for inclusion in documents and charts is anticipated to be sufficient in terms of military Low Flying and SAR operations; therefore, ensuring negligible residual impacts on operations.	Negligible	Medium	Minor

15 Seascape, Landscape and Visual Amenity

15.1 Introduction

15.1 This chapter describes the key sensitivities and potential changes to the physical and visual environment arising from the offshore aspects of the Dounreay Trì Project – the 'Project'. The receptors within this chapter are categorised in the following sections:

- Seascape;
- Landscape; and
- Visual Amenity.

15.2 This chapter describes the areas of seascape, landscape and visual amenity of the local area; identifies what the likely effects on these resources will be; indicates measures to avoid, reduce or offset these effects and provides an assessment of the nature and significance of those effects. The effects studied involve both objective and subjective impacts such as changes in perception of the local landscape/seascape.

15.3 A development may change the character and quality of the seascape/landscape. The process of seascape/landscape character assessment (SLCA) is used to identify and assess potential change to enable better planning, conservation, restoration, management and enhancement. SLCA is based on the principle that all seascapes/landscapes have a range of features and characteristics which not only give them their appearance, but also contribute to their wider character, for example through historical, artistic and social associations. In combination, these features and characteristics provide seascapes/landscapes with their 'character' or 'distinctiveness'.

15.4 Visual impacts are a subset of landscape impacts. The assessment is a subjective process as it involves individual perception, aesthetic tastes and visual comprehension. It is possible, however, to bring objectivity to the assessment and treatment of visual impact by considering the factors which influence it, including height, colour, size and associations with nearby features, including, for example, the presence of rock outcrops and existing manmade features. These factors are ultimately influenced by meteorological, topographic position, season and observer characteristics. Related issues including the effects on the setting of cultural heritage features are covered in Chapter 16: Archaeology and Cultural Heritage.

15.2 Study Area

15.5 A core Study Area defined by a 45 km radius from the outer edge of the Project boundary is proposed for the seascape, landscape and visual impact assessment (see Figure 15.1). This will provide the focus for the assessment of potential seascape, landscape and visual effects and is in line with current EIA best practice including the guidance set out in Landscape and Visual Impact Assessment Third Edition (GLVIA3) (Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA), (LI and IEMA, 2013). The Core Study Area extends 45 km from the Project Site and as such represents a worst case scenario. The Study Area is not intended to identify the outer limit of visibility of the Project but to focus attention on where 'likely significant impacts' may occur.

15.6 An Extended Study Area of 60 km radius from the outer edge of the Project boundary has been adopted to consider the potential for visual effects from the full extent of two particularly sensitive receptors, the Hoy and West Mainland National Scenic Area, and the Kyle of Tongue National Scenic Area. (See Figures 15.1 and 15.7).

15.3 Legislation and Guidance

15.7 The following relevant guidance and legislation relating to Seascape/Landscape and Visual Effects (SLVIA) was used in the preparation of this chapter:

- "Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape" (SNH 2012a);
- "Guidance for Landscape/Seascape Capacity for Aquaculture" (SNH 2008); and
- "Guidelines for Landscape and Visual Assessment 3rd Edition" Landscape Institute and Institute of Environmental Management and Assessment 2013 (GLVIA3).
- The Highland Council. Highland-wide Local Development Plan, 2012

Other Sources of Information

15.8 A detailed review was undertaken of the existing literature and data relating to SLVIA and was used to give an overview of the existing environment. The major data sources used in the preparation of this chapter are listed below in Table 15-1.

Table 15-77 Data sources used

Source	Content
Commissioned Report No. 103: An assessment of the sensitivity and capacity of the Scottish seascape in relation to windfarms (SNH, 2005)	National Seascape Units and Character Types
Commissioned Report No. 466: Orkney Landscape Capacity for aquaculture: Scapa Flow and Wide Firth (SNH 2011).	Coastal Character Types and Local Coastal Character Types (Scapa Flow area)
Caithness and Sutherland Landscape Character Assessment (SNH, 1998)	Landscape Character Areas (Caithness and Sutherland)
Orkney Landscape Character Assessment" (SNH, 1998)	Landscape Character Areas (Orkney)
Assessment of Highland Special Landscape Areas (THC and SNH, 2014)	Special Landscape Areas Citations
The special qualities of the National Scenic Areas (SNH, 2010)	National Scenic Area Citation
Guidance on Coastal Character Assessment – Consultation Draft Carol Anderson Landscape Associates for Scottish Natural Heritage (February 2016)	Methodology for identification of Coastal Character Types and Local Coastal Character Types

15.9 In addition, the following documents have also been referenced in the preparation of this assessment:

- Information from the Project team;
- 1: 50 000 Ordnance Survey (OS) maps nos. 6, 7, 9, 10, 11, 12, 16 and 17;
- 1: 25 000 OS maps nos. 447, 448, 449, 450, 451, and 462;
- Site visits by the team in October and November 2015;
- Feedback from consultees (see Section 28.6);
- Desk based research including literature review; and
- Relevant documents e.g. guidance, commitments, LBAP etc.

15.4 Surveys and Studies Carried out to Date

Desktop surveys

15.10 Sources of information used to inform the assessment are summarised in Section 28.4. In this section further context is provided. Those surveys of the wider area and/or research studies relevant to this assessment include:

- Identification of draft Coastal Character types and Local Coastal Character Types ensuring 'nesting' with the National Seascape Units and Character Types; and
- Examination of Zones of Theoretical Visibility maps to 'scope out' receptors which will not be intervisible with the Project.

Field surveys

15.11 The following specific surveys have been undertaken and used to inform this assessment (see also Appendix 15.2 and 15.3):

- Site visits by two Chartered Landscape Architects to define Coastal Character Areas and Local Coastal Character Areas;
- Site visits to identify the visual amenity baseline; and
- Site visits to assess the effects of the Project on the SLVIA receptors.
- Night time effects were addressed during daylight hours using wireline images to locate the proposed lighting sources. The study area was also visited after dark to establish the baseline conditions of illumination emanating from the various settlements and developments along the coast.

15.5 Consultation

Pre-application consultation

15.12 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date.

Scoping feedback

15.13 The following stakeholder responses have been received specifically relating to this chapter (Table 15-2).

Table 15-78 Consultation comments

Consultee	Comment	Relevance / Cross Reference
SNH	Methodology to refer to 'Orkney and North Caithness Coastal Character Assessment' (NB not yet available)	Noted. Reference not added as document has yet to be published
SNH	Significant effects to be where a Major or Moderate impact has been assessed	Acknowledged. Detailed in Section 15.7.
SNH	To inform the consideration of viewpoint locations we request ZTV information in hard copy to a suitable scale, with and without viewpoint locations shown. It would also be useful to have existing and consented development indicated on one of these ZTV to inform the choice of cumulative viewpoints.	Acknowledged. Refer to Figure 15.2 for Viewpoints.
SNH	Any required lighting of the turbines and platform should be assessed, where they are likely to be visible to receptors.	Acknowledged. Refer to Detailed Assessments Appendix 15.4
SNH	Encourage consideration of draft advice on the production of *Design Statements for offshore wind development*	Acknowledged. Refer to Section 15.11
SNH	Impacts to wild land, in particular WLA 39 East Halladale Flows need to be considered. SNH assessment guidance for wild land is currently being reviewed and is due for publication later this year. Interim guidance is also available.	Acknowledged. Refer to Section15.12 and Appendix 15.4.
SNH	Viewpoint selection should be in line with the Landscape Institute’s guidance on LVIA and include consideration of ferry routes. Given the distance of the site and location further west, viewpoints from Orkney may not be required however this should be considered as part of the assessment process and justification provided as required. We would be happy to provide further input upon receipt of ZTVs (presented in both electronic and hard format). See Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape for further guidance.	Acknowledged. Refer to Section15.12 and Appendix 15.4
SNH	Cumulative Impact Assessment considerations need to be proportional, both in terms of the Study Area agreed and the developments to be included (including turbine numbers and heights). See Assessing the cumulative impact of onshore wind energy developments for further guidance.	Acknowledged. Refer to Section 15.13.

Consultee	Comment	Relevance / Cross Reference
SNH	We would expect any cumulative assessment to provide a robust assessment of cumulative impact, both with any offshore development and those onshore within the Study Area. Various scenarios of cumulative impacts (offshore, onshore, existing, consented and in planning) exist and should be clearly identified in the assessment of impacts.	Acknowledged. Refer to Section 15.13.
SNH	Production of visualisations should follow SNH guidance Visual Representation of Wind Farms (December 2014).	Acknowledged. Refer to Appendix 15.1.
SNH	All proposed turbine and platforms colours (and lighting where likely to be visible) should be modelled on the photomontages.	Acknowledged.
THC	Specific comments on the scoping report have not yet been provided by the Landscape Officer.	Noted.
THC	As outlined in the pre-app pack issued by THC in July 2015, the key issues in this case are the potential for significant adverse impacts on perception of key qualities of landscape character types, seascape character types, designated landscapes and local landscape character. The proposal is located within a sensitive setting, in close proximity to the coast and within relatively close proximity to locations including Farr Bay, Strathy Point and Portskerra Special Landscape Areas and East Halladale Flows are of designated Wild Land, and key tourist routes. This all needs to be addressed in the ES.	Acknowledged. Addressed in Section 15.12 and Appendix 15.4.

15.6 Assessment Methodology

15.14 The overarching approach to environmental impact assessment is described in Chapter 5: Environmental Impact Assessment Methodology. To support this, the following is a description of the specific criteria which are used to evaluate the impact on seascape and landscape.

15.15 The methodology for SLVIA is set out in full in Appendix 15.1. Key aspects are summarised under Methods of Prediction below.

15.16 The Project description is set out in Chapter 4. Design assumptions about the Project envelope (the Design Envelope) are summarised in Section 15.7.1.

SLVIA design envelope

15.17 As described in Chapter 5: Environmental Impact Assessment Methodology the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

15.18 In the case of SLVIA the two turbines have the potential to cause the greatest seascape, landscape and visual effect. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

15.19 Table 15-3 describes the Design Envelope parameters specific to SLVIA.

Table 15-79 Design Envelope parameters

Design Envelope Parameter	Value/description
Turbine tip height	201m
Location of Turbine Platform	Nearest corner of site quadrant to receptor being assessed
Installation vessel physical presence	Nearest corner of site quadrant to receptor being assessed
Maintenance vessel physical presence	Nearest corner of site quadrant to receptor being assessed

Methods of prediction

15.20 For SLVIA potential ***effects*** are identified and their significance is assessed for each stage of the Project lifecycle and significance attributed relative to the baseline conditions.

Sensitivity of receptors

Seascape Sensitivity to Change

15.21 The relative sensitivity of the seascape within the Local Coastal Character Areas is specific to the proposed change and is assessed in terms of two sets of criteria:

- Susceptibility to the change; and
- Value of the receptor.

Landscape Sensitivity to Change

15.22 The relative sensitivity of the landscape character within each character area is specific to the proposed change and is assessed in terms of two sets of criteria: (GLVIA3):

- Susceptibility to the change; and
- Value of the receptor.

Sensitivity of Visual Receptors to Change

15.23 All visual receptors are people. The relative sensitivity of the visual receptors is specific to the proposed change and is assessed in terms of two sets of criteria (GLVIA3):

- Susceptibility of visual receptors to the proposed change; and
- Value attached to views experienced by receptors.

Magnitude of change

Magnitude of Change to Seascapes

15.24 The magnitude of change to seascapes is assessed in terms of 3 sets of criteria: (GLVIA3)

- Size or scale;
- Geographical extent; and
- Duration and reversibility.

Magnitude of Landscape Change

15.25 The magnitude of change to landscapes is assessed in terms of 3 sets of criteria: (GLVIA3)

- Size or scale;
- Geographical extent; and
- Duration and reversibility.

Magnitude of Change to Views and Visual Amenity

15.26 The magnitude of change to views and visual amenity experienced by the receptor is assessed in terms of 3 sets of criteria: (GLVIA3).

- Size or scale;
- Geographical extent; and
- Duration and reversibility

Significance of impact

15.27 The sensitivity of the receptor and the magnitude of effect are combined to define the environmental consequence i.e. significance, of the impact. In this assessment, significant impacts are considered to be moderate or above.

15.28 For the purposes of the SLVIA methodology, the impact matrix is presented in Table 15-4 below. It is important to note that this significance matrix **differs** from that detailed in Chapter 5: Environmental Impact Assessment Methodology and is applicable specifically to this assessment methodology.

Table 15-80 Determination of environmental consequence

	Magnitude				
Sensitivity	**Major**	**Moderate**	**Minor**	**Negligible**	**Positive**
Very High	Major	Major	Moderate	Minor	Positive
High	Major	Major	Moderate	Minor	Positive
Medium	Major	Moderate	Minor	Negligible	Positive
Low	Moderate	Minor	Minor	Negligible	Positive

15.7 Description of the Current Environment

Seascape baseline

15.29 The Seascape Baseline is described in full in Appendix 15.2 and is illustrated on Figures 15.3 to 15.5. It identifies a total of 34 Coastal Character Areas as listed in Table 15-5. Those highlighted in grey do not have theoretical visibility of the Project and were therefore excluded from more detailed study at a local level. A total of 55 Local Coastal Character Areas as listed in Table 15-5 were also identified. Again, those highlighted in grey have been 'scoped out' due to there being no theoretical visibility.

15.30 It is important to note that the term Rackwick refers to the settlement and Rack Wick, the bay.

Table 15-81 Local Coastal Character Areas

National Seascape Area	National Seascape Character Types	Regional Coastal Character Areas (grey – scoped out)	Local Coastal Character Areas (grey – scoped out)
31 West Orkney	Type 1 Remote High Cliffs	CCA 1: West Mainland	LCCA 1: Lyre Geo to Neblonga
	Type 12 Deposition Coasts of Islands	CCA 2: Neblonga to Ness	LCCA 2 Neblonga to Breck Ness
			LCCA 3: Breck Ness to Ness
		CCA 15: West Hoy	LCCA 19: Tor Ness to Rack Wick
		CCA 16: Rackwick Bay	LCCA20: Rack Wick
		CCA17: North West Hoy	LCCA21: Rack Wick to Rora Head
			LCCA22: Rora Head to Kame of Hoy
32 East Orkney	Type 12 Deposition Coasts of Islands	CCA 3: Stromness/Clestrian Sound	
		CCA 4: Orphir	
		CCA 5: North East Hoy	
		CCA 6: Graemsay	
		CCA 7: Central East Hoy	
		CCA 8: Cava, Rysa Little and Fara	
		CCA 9: South East Hoy	
		CCA 10: Flotta	LCCA 4: Innan Neb to the pier
			LCCA 5:The pier to the jetty
			LCCA 6: The jetty to Tween the Wicks
			LCCA 7: Tween the Wicks to Quoy Ness
			LCCA 8: Quoy Ness to House Geo
			LCCA 9: House Geo to Innan Neb
		CCA11: Switha	
		CCA12: Swona	LCCA 10: West Swona
			LCCA 11: East Swona
		CCA13: North Bay/Longhope	LCCA12: Longhope
			LCCA13: North Bay

National Seascape Area	National Seascape Character Types	Regional Coastal Character Areas (grey – scoped out)	Local Coastal Character Areas (grey – scoped out)
		CCA14: Brims and South Walls	LCCA14: Point of Hackness to Crowtaing
			LCCA15: Crowtaing to Cantick Head
			LCCA16: Cantick Head to Aith Head
			LCCA17: Aith Head to Brims Ness
			LCCA18: Brims Ness to Tor Ness
9 Kyles And Sea Lochs	Type 4 Coastal Firths	CCA 18: Loch Eriboll	LCCA25: Loch Eriboll
		CCA 20: Kyle of Tongue	LCCA 29: Kyle of Tongue
	Type 1 Remote High Cliffs	CCA19: Loch Eriboll to Kyle of Tongue	LCCA26: Loch Eriboll to Achininver Bay
			LCCA 27 Achininver Bay
			LCCA 28 Achininver Bay to Ard Skinid
		CCA 21: Kyle of Tongue to Farr Point	LCCA 30: Kyle of Tongue to Aird Torrisdale
			LCCA 31 Torrisdale Bay
			LCCA 32 Creag Ruadh to Farr Point (High Cliffs)
8 North Caithness / Pentland Firth	Type 1 Remote High Cliffs	CCA 22: Farr Point to Sandside Bay	LCCA 33: Farr Point to Armadale Bay
			LCCA 34: Armadale Bay
			LCCA 35: Strathy Point
			LCCA 36: Strathy Bay
			LCCA 37: Strathy Bay to Melvich Bay
			LCCA 38: Melvich Bay
			LCCA 39 Melvich Bay to Sandside Bay

National Seascape Area	National Seascape Character Types	Regional Coastal Character Areas (grey – scoped out)	Local Coastal Character Areas (grey – scoped out)
		CCA26: Dunnet Head	LCCA46: Dunnet Head
		CCA 28: St John's Point to Gills' Bay	LCCA 48: St John's Point to Gills' Bay
	Type 2 Mainland Rocky Coastline with Open Sea Views	CCA23: Sandside Bay to Holburn Head	LCCA 40: Sandside Bay
			LCCA 41: Sandside Bay to Ness of Litter
			LCCA 42: Ness of Litter to Holburn Head
		CCA24: Holburn Head to Dunnet Bay	LCCA 43 Thurso Bay
			LCCA 44: Thurso Bay to Dunnet Bay
		CCA 27: Dunnet Head to St John's Point	LCCA 47: Dunnet Head to St John's Point
		CCA29: Gills Bay to Duncansby Head	LCCA 49: Gills Bay to Duncansby Head
	Type 3 Deposition Coastline with Open Sea Views	CCA25: Dunnet Bay	LCCA 45: Dunnet Bay
	Type 12 Deposition Coasts of Islands	CCA34: Stroma	LCCA 23: West Stroma
			LCCA2 4: East Stroma
7 East Caithness And Sutherland	Type 1 Remote High Cliffs	CCA30: Duncansby Head	LCCA50: Duncansby Head
	Type 2 Mainland Rocky Coastline with Open Sea Views	CCA31 : Duncansby Head to Sinclair's Bay	LCCA 51: Duncansby Head to Skirza Head
			LCCA 52: Freswick Bay
			LCCA 53: Ness Head to Sinclair's Bay
		CCA 33: Sinclair's Bay to Noss Head	LCCA 55: Sinclair's Bay to Noss Head
	Type 3 Deposition Coastline with Open Sea Views	CCA 32: Sinclair's Bay	LCCA 54: Sinclair's Bay

Landscape baseline

15.31 The landscape baseline is described in Appendix 15.3 and illustrated in Figures 15.6 and 15.7. A total of 30 Landscape Character Types (LCTs) were identified. Of these, Coniferous Woodland Plantation (5), Harbour (9), Inland Loch (13), Loch Island (14), Town (28), and Urban and Rural Development (29) are not considered to be LCTs; no descriptions are available for these and they have not been included in the assessment.

National scenic areas

15.32 There are three National Scenic Areas (NSAs) within, or partially within, the extended 60 km radius Study Area as shown on Figure 15.7. These are:

- Hoy and West Mainland;
- North West Sutherland; and
- Kyle of Tongue.

15.33 The NSAs are described in 'The special qualities of the National Scenic Areas. SNH Commissioned Report No.374, 2010 (SNH NSAs). The full citations are contained in Appendix 15.3.

15.34 The relationship of each NSA with the Project and the Study Area is shown in Table 15-6.

Table 15-82 NSAs within Study Area

NSA	Location and Extent
Hoy and West Mainland NSA	275 km^2 in extent. Located to the north east of the Project at around 30 km distant at its closest point. It lies wholly within the 60 km radius Study Area
North West Sutherland NSA	266 km^2 in extent and located <58 km distant at its nearest point. It lies to the west south west of the Project and a relatively small area (9.98 km^2) falls within the 60 km radius Study Area.
Kyle of Tongue NSA	Located to the west south west of the Project, c. 20 km distant at its nearest point. It is 260 km^2 in extent and lies wholly within the 60 km Study Area.

Special landscape areas

15.35 There are nine Special Landscape Areas (SLAs) within, or partially within, the 45 km core Study Area (see Figure 15.7). These are:

- Oldshoremore, Cape Wrath and Durness SLA;
- Eriboll East and Whiten Head SLA;
- Farr Bay, Strathy and Portskerra SLA;
- The Flow Country and Berriedale Coast SLA;
- Bens Griam and Loch nan Clàr SLA;
- Ben Klibreck and Loch Choire SLA;
- Loch Fleet, Loch Brora and Glen Loth SLA;
- Dunnet Head SLA; and
- Duncansby Head.

15.36 The SLAs are described in The Highland Council's "Assessment of Highland Special Landscape Areas report, 201"1 (THC SLA Report). The full citations are contained in Appendix 15.3.

15.37 The relationship of each NSA with the Project and the Study Area is shown in Table 15-7 and Figure 15.7.

Table 15-83 NSA location and extent

NSA	Location and Extent
Oldshoremore, Cape Wrath and Durness SLA	123 km^2 in extent and lies to the west of the Project at some 44 km distant at the closest point. The extreme eastern tip of the SLA lies within the core 45 km study area.
Eriboll East and Whiten Head SLA	This SLA is 59 km^2 in extent and lies to the west of the Project at some 30 km distant at the closest point. It lies wholly within the wider 60 km study area
Farr Bay, Strathy and Portskerra SLA	This SLA is 47 km^2 in extent and lies to the south south west of the Project at some 6 km distant at its closest point. It lies wholly within the core 45 km study area
Dunnet Head	This SLA lies to the east of the Project and is 2350Ha in extent. It lies wholly within the core 45 km study area and is approximately 22 km distant.
Duncansby Head	This SLA lies to the east of the Project at around 43 km distant. It extends to 900 Ha and lies wholly within the core 45 km study area.
The Flow Country and Berriedale Coast SLA	This SLA is 363 km^2 in extent and lies some 28 km to the south south east of the Project at its nearest point. It lies wholly within the wider 60 km study area
Bens Griam and Loch nan Clàr SLA	This SLA is 134 km^2 in extent and lies to the south south west of the Project at around 35 km distant at its closest point. It lies wholly within the core 45 km study area
Ben Klibreck and Loch Choire SLA	This SLA is 138 km^2 in extent and lies to the south west of the Project at around 45 km distant at its closest point. It lies wholly within the wider 60 km study area
Loch Fleet, Loch Brora and Glen Loth SLA	This SLA 9 is 210 km^2 in extent and lies to the south of the Project at around 54 km distant at its closest point. It lies partially within the wider 60 km study area occupying approximately 87.3 km^2.

Gardens and designed landscapes

15.38 The Inventory of Gardens and Designed Landscapes (GDLs) in Scotland identifies, in five volumes, specific gardens and designed landscapes of importance in terms of their artistic, historical, architectural, scenic and nature conservation value. Additional volumes identify Candidate Sites, which are considered worthy of inclusion in the Inventory. Planning policies generally provide a framework for the continued protection, conservation and use of these areas that does not prejudice their scenic or cultural value in accordance with national policy. Historic Scotland also provides a wide range of web-based information on these sites which has been used to establish the current baseline information on which to undertake the assessment of impact.

15.39 Reference to the Inventory indicates three GDLs lie within the study area (see Figure 15.7):

- Castle of Mey;
- Melsetter House; and
- Tongue House.

Castle of Mey

15.40 Castle of Mey GDL lies on the Caithness Coast between Dunnet Head and Duncansby Head some 34 km to the east of the Project. It is included in the inventory for the following reasons:

15.41 "Of outstanding historical value due to its association with the Royal Family and the Earls of Caithness, the designed landscape of Castle of Mey provides the setting for a category A listed castle and makes a major contribution to the surrounding scenery. The designed landscape of parkland, woodland, formal gardens and walled gardens, probably established in the early 19th century and improved in the latter half of the 20th century, embellishes the magnificent setting of the Castle of Mey."

15.42 The Inventory lists the importance of this GDL as follows:

- Works of Art – Some;
- Historical – Outstanding;
- Horticultural, Arboricultural, Silvicultural – Some;
- Architectural – Outstanding;
- Scenic – Outstanding; and
- Nature Conservation – Some.

15.43 The Inventory describes the location and setting as follows:

> "The Castle of Mey is situated on the north coast of Scotland approximately 5 miles (8 km) west of John O'Groats, and 15 miles (24 km) east of Thurso. The lands of Mey lie on the flat coastal plain of Caithness and are extremely exposed to the harsh climate and winds which blow off the Pentland Firth. The surrounding landscape is predominantly pasture land and there are few trees. Magnificent views can be gained west to Dunnet Head, the most northerly point of Scotland, and across the Pentland Firth to the Orkney Islands. The Castle and its woodlands are significant from the A836 and other minor roads between it and the coast, particularly from the east. The flat nature of the surrounding landscape limits views of areas covered by the policies which are enclosed within the woodlands to the south and the policy walls to the north.
>
> "The Castle of Mey commands a magnificent position some 500 yards from the shore of the Pentland Firth. The designed landscape extends south to the lodge, west to the edge of the walled garden and the woodlands flanking the west drive, and east to Barrogill Mains farm. To the north, a road links the Castle with a road running west to the pier at Harrow, approximately 1 km to the west of the Castle. To the south, a road runs due south from the lodge flanked by a beech/hawthorn hedge and a stone dyke to the A836. A shelterbelt has been established along the northern edge of the A836, but this is not part of the Castle of Mey property. The designed landscape includes some 100 acres (40.5 ha) of parkland, 11.64 acres (4.7 ha) of woodland, and 2.68 acres (1.08 ha) of formal garden which includes 1.25 acres (0.5 ha) of walled gardens."

Melsetter House

15.44 Melsetter House GDL is situated on south east Hoy at the south western end of North Bay, some 34 km to the east north east of the Project. It is included in the inventory for the following reasons:

15.45 "An early 20th-century Arts and Crafts style garden and landscape which forms the setting for a category A listed house and plays a very important role in the scenery of the Orkney Islands."

15.46 The inventory lists the importance of this GDL as follows:

- Work of Art – High;
- Historical – High;
- Horticultural, Arboricultural, Silvicultural – Little;
- Architectural – Outstanding;
- Scenic – Outstanding; and
- Nature Conservation – High.

15.47 The Inventory describes the location and setting as follows:

> "Melsetter House is situated at the head of North Bay at the south end of the Island of Hoy, Orkney. The town of Stromness lies some 11 miles (18 km) due north on mainland Orkney whilst mainland Scotland lies some 9.5 miles (15 km) due south across the Pentland Firth. The B9047, the main route across Hoy, forms the eastern boundary of the designed landscape. To the north, the landscape rises gently beyond Melsetter Hill to a height of 479' (146 m) at Ward Hill. Melsetter occupies one of the most sheltered parts of the island. The immediate surrounding landscape is rolling farmland which is important to the setting of the house. Also important to the setting is North Bay, a sea loch which lies beyond the B9047, between the islands of Hoy and South Walls.
>
> From within the Melsetter policies, fine views can be gained north across Hoy and east down to Longhope Bay; from the Burial Ground on the top of Melsetter Hill, views can be gained across the Pentland Firth to the Castle of Mey and the Scottish mainland. Melsetter is highly significant within the landscape looking south from the B9047; the buildings are seen on the skyline and the garden is visually exposed on its east-facing slope.
>
> Melsetter House stands in the lee of Melsetter Hill within 25 acres (10 ha) of designed landscape which is enclosed on all sides by walls and extends to the B9047 in the east. The kennels and gamekeeper's house stand on the shore to the north east of the policies. Published documentary map evidence of the designed landscape is confined to the 1st edition OS map of c.1850 and the 2nd edition map of 1906. Comparison of these shows that the extent of the designed landscape has remained constant over the last 135 years. There are two access drives: a main south drive to the house, and an access road on the north boundary."

Tongue House

15.48 Tongue House GDL lies on the eastern shore of Kyle of Tongue some 33 km to the west south west of the Project. It is included in the inventory for the following reasons:

15.49 "A mid-19th-century designed landscape which is scenically impressive and architecturally valuable as the setting for a category A listed house."

15.50 The inventory lists the importance of this GDL as follows:

- Work of Art – High;

- Historical – Outstanding;
- Horticultural, Arboricultural, Silvicultural – Some;
- Architectural – Outstanding;
- Scenic – High; and
- Nature Conservation – None.

15.51 The Inventory describes the location and setting as follows: “Tongue House is situated on the eastern shore of the Kyle of Tongue on the north coast of Sutherland 1 mile (2 km) north of the village of Tongue. The designed landscape is bounded on the east by the A836 and to the west by high walls which separate the policies from the shore. It is set at the base of the steep western slope of Ben Tongue 984' (300 m). To the south, Ben Loyal rises to a height of 2,509' (765 m) and, to the south west, Ben Hope 3,040' (927 m).

15.52 The valley setting of the Kyle of Tongue provides a milder climate than other parts of the exposed Caithness coastline. The surrounding landscape is largely rough moorland grazing. The Boathouse and store stand at the head of the pier opposite the western entrance of the site. Coniferous woodlands lie beyond the parkland enclosure to the north and down the eastern side of the A836. Magnificent views north and west across Tongue Bay can be gained from high points in the garden. From the end of the south avenue, views can be gained beyond the village to Castle Bharraich, with Ben Loyal and Ben Hope in the distance. Otherwise the designed landscape is relatively introspective and sheltered. The garden walls which form the western boundary are particularly significant from the western shore of the Kyle of Tongue and the coast road on the eastern shore. The policies are of little significance from the A836 in the east due to the nature of the landform. The policies lie within some 18,500 acres (7,493 ha) of the Kyle of Tongue designated as a National Scenic Area.

15.53 Tongue House stands within the walled enclosures of the immediate gardens. The designed landscape is enclosed by Tongue Wood on all sides, except to the west; stone walls form this boundary and extend along the shore road as far as the Signal House. Prior to c.1815, access to the site was mainly via the sea and entry to the house would have been gained by the north gate. Following the construction of roads in the area, other entry points were made. Castle Bharraich is an important feature in the view from the southern boundary. The designed landscape today includes some 157 acres (64 ha).”

Wild land areas

15.54 Wild Land can be described as extensive areas where the quality of wildness is best expressed. Scottish Planning Policy 2014 states: ‘Wild land character is displayed in some of Scotland’s remoter upland, mountain and coastal areas, which are very sensitive to any form of intrusive human activity and have little or no capacity to accept new development. Plans should identify and safeguard the character of areas of wild land as identified on the 2014 SNH map of wild land areas…In areas of wild land (see paragraph 200), development may be appropriate in some circumstances. Further consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation.’

15.55 SNH published a new map of Wild Land Areas in June 2014. This supersedes earlier maps which identified 'Search areas for wild land' in 2002, and ‘Core areas of wild land in 2013. Wild Land Areas are the most extensive areas of high wildness. They are identified as nationally important in Scottish Planning Policy, but are not a statutory designation.

15.56 There are seven Wild Land Areas within the study area (see Figure 15.7). At present there are no citations available for the Wild Land Areas.

WLA 35 – Ben Klibreck – Armine Forest

15.57 This WLA lies to the south west of the Project at a distance of around 39 km at its closest point. It is 530 km^2 in extent, with 504 km^2 within the wider 60 km radius study area.

WLA 36 – Causeymire – Knockfin Flows

15.58 This WLA lies to the south of the Project at a distance of around 28 km at its closest point. It is 514 km^2 in extent, lying wholly within the wider 60 km radius study area.

WLA 37 – Fionaven – Ben Hee

15.59 This WLA lies to the west south west of the Project at a distance of around 46 km at its closest point. It is 569 km2 in extent and 293 km2 lies within the wider 60 km radius study area.

WLA 38 – Ben Hope - Ben Loyal

15.60 This WLA lies to the west south west of the Project at a distance of around 33 km at its closest point. It is 221 km^2 in extent, all of which lies within the wider 60 km radius study area.

WLA 39 – East Halladale Flows

15.61 This WLA lies to the south of the Project at a distance of around 10 km at its closest point. It is 159 km^2 in extent and lies wholly within the core 45 km radius study area.

WLA 40 – Cape Wrath

15.62 This WLA lies to the west of the Project at approximately 54 km distant at its closest point. It is 221 km^2 in extent with 77 km^2 within the wider 60 km radius study area.

WLA 41 – Hoy

15.63 This WLA lies to the north east of the Project at a distance of around 31 km at its closest point. It is 50 km^2 in extent and lies wholly within the core 45 km radius study area.

Visual amenity baseline

15.64 A total of nine viewpoints were identified. The locations of these are shown on Figure 15.2. The baseline conditions are described in Table 15-8.

Table 15-84 Identified viewpoints

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for selection	Description of Existing Visual Amenity
Mainland					
1	Ben Ratha	NC94972 , 61078	251m	Hill Walkers	This viewpoint is located on the summit of the hill and is a view seen by hill walkers. The immediate foreground is occupied by gently undulating moorland vegetation which gives way to a mid-ground coastal shelf of mixed land uses including agricultural grazing, rough grassland, forestry and mixed woodland plantations, and scattered settlement. The buildings and structures at Dounreay are prominent features in views to the north north east. The moving turbines at Forss, to the north east, re seen against a backcloth of the Pentland Firth while those at Baillie Hill, to the east north east, are seen against a backcloth of mixed land use. In clear conditions, the island of Hoy can be seen across the Pentland Firth.
2	Strathy Point car park	NC82774 , 68503	62m	Residents Visitors, tourists Representative of Farr Bay, Strathy Point and Portskerra SLA	This viewpoint is located in the car park at Strathy Point and is representative of the view seen by local residents and visitors. The foreground of this view is occupied by agricultural grazing overlying undulating topography with rocky outcrops. Dounreay perched above the rocky coastline and Baillie Hill wind farm extending south across the skyline are prominent features in the view. The existing turbines at Forss are just discernible in the east. The high ground and coastal cliffs of Hoy are also prominent features in clear conditions.
3	Portskerra / Melvich	NC87745 , 66118	25m	Residents Visitors, tourists Local and regional road users on key coastal road	This viewpoint is situated in the car park adjacent to the memorial on the minor road east of the settlement of Portskerra. It is a view seen by visitors and residents. The direction of view is north and east. The immediate foreground is occupied by the waters of Melvich Bay backed by cliffs and the promontory at Rubha an Tuir, and the sandy beach at the mouth of Halladale River. Just beyond the cliffs, Dounreay is clearly visible with a backcloth of rising grassland and moorland. Further along the coast, the existing turbines

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for selection	Description of Existing Visual Amenity
				A836 Representative of Farr Bay, Strathy Point and Portskerra SLA	at Forss and Bailie Hill are visible. Dunnet head is visible in the distance and, in clear visibility conditions, the island of Hoy can be seen across the Pentland Firth.
4	Drum Holliston Car Park	NC93261 , 64623	90m	Local and regional road users on key coastal road A836 Cyclists on NCR1	This location is adjacent to the car park at Drum Holliston Moss and is representative of the view seen by road users. The foreground of the view is occupied by moorland and rough grass enclosed by deer fencing. The localised area of high ground at Cnoc na Moine is a notable landform feature to the east. Localised high ground south of the road screens views of the coastline to the west. To the right of the view, wood pole mounted overhead lines run approximately parallel to the A836 and draw the eye towards the mixed woodland plantation and the settlement of Reay. Beyond this, the hinterland is characterised by rough grazing and moorland on gently rising terrain. On the coast, Dounreay is a prominent feature. Beyond Dounreay, the existing turbines at Forss are clearly visible on the skyline. Baillie Hill wind farm also forms a prominent feature on the skyline behind Hill of Shebster. Hoy is also visible in clear conditions.
5	Sandside Head	NC29526 9, 966331	44m	Walkers on Core Path CA11.04 (including visitors, tourists)	This viewpoint is located near Sandside Head on the Core Path which leads north from the pier at Sandside. The view is representative of that seen by walkers on the path, which include tourists and visitors. The view encompasses the coastline to the west and east of Sandside Head, and northwards across the Pentland Firth. Views east across Sandside Bay include the power station at Dounreay and the existing turbines at Forss, which are seen as a dispersed group of three overlapping turbines, and Baillie Hill wind farm is also visible. The island of Hoy forms a more distant focal point to the north east.

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for selection	Description of Existing Visual Amenity
6	St Mary's Chapel , Forss	ND02504 , 70078	11m	Visitors, tourists	This location is on the footpath approaching the chapel from the east. This viewpoint offers a 360 degree panorama, for visitors to the chapel, which comprises the coast and seascape to the north and west, Crosskirk Bay and cliffs to the east with the cluster of dwellings and agricultural buildings around Crosskirk. A drystone wall snakes across the grassland to the south east. The existing wind turbines at Forss Technology Park are a less than 500 metres distant and dominate foreground views of the hinterland to the east and south. The Baillie Hill wind farm turbines are also seen in the mid ground of the view. Strathy Point and the peninsula to its south are prominent distant features to the west
7	Dunnet Head	ND20557 , 76518	127m	Recognised VP on OS map Visitors, tourists Representative of Dunnet Head SLA	From this viewpoint on Dunnet Head, expansive 360 degree views are obtained. In clear conditions, Orkney can be seen across the Pentland Firth to the north and the Island of Stroma to the east. The rugged north coastline, punctuated by sandy bays and scattered with coastal settlement, stretches to the east with the lighthouse at Duncansby Head marking the north-eastern corner of the British mainland. Moorland over Warth Hill, the highest elevation in the view, sweeps down to coastal farmland with dark blocks and bands of coniferous plantation forestry occupying large swaths of land to the southeast. The coastline is more dramatic closer to Dunnet Head, with towering cliffs, stacks and geos. Open moorland, punctuated by lochans, rocky outcrops and the scars of peat hagging, dominates the foreground of the view to the south, backclothed by mixed agriculture, scattered settlement and coniferous forestry and moorland.

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for selection	Description of Existing Visual Amenity
8	Scrabster – Stromness Ferry	ND13206, 84983	15m	Ferry passengers	This viewpoint is location on the deck of the Scrabster to Stromness ferry and is representative of the view seen by crew members and ferry passengers travelling in each direction. The viewer's attention will generally be focussed on the nearest landmass. The view is one that is dominated by the Pentland Firth which occupies the fore and midground of the view. The sea cliffs to the west of the port rise steeply from the rocky shore and appear as a dark horizontal band with some contrast where the rocks catch the light. Above the cliffs, improved grassland forms a narrow swathe of contrasting colour. Looking to the south west, the existing turbines at Forss are visible in clear conditions and are seen against a backcloth of the distant hills to the west with tips breaching the skyline. The turbines at Baillie Hill are also visible. The view is obviously seen from an ever-changing location as the ferry plies its way between the two harbours.
Orkney					
9	Path to the Old Man of Hoy	ND19147, 98988	140m	Walkers Representative of Hoy and West Mainland NSA	This elevated location takes in a wide sweeping panorama over the low lying dispersed settlement of Rackwick. The eye is drawn along the rugged coastline cliffs of South Hoy. The Scrabster to Stromness Ferry passes close to this location as it heads towards and away from the Old Man of hoy. In conditions of clear visibility, the mainland can be seen with Dunnet Head being almost due south and Duncansby Head beyond Stroma to the south east.

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for selection	Description of Existing Visual Amenity
11	A836 east of Forss	ND05570, 69323	70xm	Local and regional road users on key coastal road A836	This viewpoint is adjacent to the A836 near the Hill of Forss, approximately 5km west of Thurso. The existing turbines at Forss Technology Park form the key focal point of the view, seen across a foreground of large enclosed fields of predominantly improved grassland. There are some scattered plantations of coniferous woodland, and the mixed woodland around Forss House is visible on the lower ground. The small Lochan Buidhe, with extensive adjoining areas of gorse scrub, also forms a prominent feature in the mid-ground. Further to the north, Brims Castle and the shoreline at Brims Ness are visible.
12	A897 near Craigtown, Strath Halladale	NC89311, 56797	45m	Local and regional road users on A897	This viewpoint is located just to the east of the A897 near the small township of Craigtown in Strath Halladale. The view is channelled northwards along the strath towards the coast, and encompasses grazing land on the valley floor enclosed by higher ground to the east and west, with a predominantly moorland landcover. Foreground features include frequent patches of gorse scrub, and scattered plantations of mixed and coniferous woodland. Wood pole power and telecommunications lines are also prominent, along with a larger scale pylon line following the eastern shoulder of higher ground. A domestic scale turbine is also partially visible, along with scattered agricultural buildings and residential dwellings.

Sequential visual amenity baseline

15.65 A total of 17 routes were identified for the assessment of sequential visual effects as shown on Figure 15.8. The visual amenity of each of these is described in below.

B9047 Hoy

15.66 This road follows the east coast of Hoy linking Moaness Pier in the north with Cantick Head in the south. High ground to the west of the road screens all views towards the Pentland Firth to the south and west, with the eye being drawn either to the hill slopes and summits, or eastwards over Scapa Flow. East of the causeway known as The Ayre, joining South Walls to Hoy proper, the road briefly climbs to an elevation which allows views across the Brims peninsula to the south west. A minor road linking the east coast with the settlement of Rackwick is also particularly important for tourist traffic, giving access to the main car park for Rack Wick bay itself and the walk to The Old Man.

A838 Eastbound (Loch Hope to Tongue)

15.67 The A838 enters the study area at the head of Loch Hope, ascending initially through steep switchbacks screened by dense deciduous woodland to reach higher open ground. Eastwards, the road continues through heather-dominated moorland with frequent craggy outcrops at the margin of the open plateau of A' Mhoine, where there are initially panoramic views south and west to Ben Hope, before these are enclosed by forestry plantations approaching Loch Maovally.

15.68 Beyond this forestry, the alignment then swings gently southwards, with views to Ben Loyal, to run almost due east for several kilometres across a particularly exposed stretch of moorland. Here views are very extensive to both north and south, taking in glimpses of the coastline and the Pentland Firth for the first time. Beyond the lochan of An Dubh-loch, the road swings south again to begin its descent to the Kyle of Tongue, with Ben Loyal's multiple summits very prominent, before views become focussed on the Kyle itself.

A838 Westbound

15.69 No view of the Project when travelling west.

A897 Northbound (Kinbrace to Melvich)

15.70 The road enters the study area approximately 4 km south of the small settlement of Kinbrace, where it joins the B871. Views are initially expansive, taking in the broad valley floor at the junction between Strath Beg and the Strath of Kildonan, with Kinbrace Farm backclothed by forestry plantations to the east.

15.71 The rail line which parallels the road to the west is generally visible but not prominent. Leaving Kinbrace, the road curves north eastwards, and wide views open out to the north and north west across the Blar Mor towards Ben Griam Mor and Ben Griam Beg. By contrast, views north eastwards are enclosed by forestry and the neighbouring slopes of Achentoul Hill. Beyond Achentoul Lodge, which sits within woodland on the eastern shore of Loch an Ruathair, the impressive form of Ben Griam Beg again dominates panoramic views west across open Flow Country. A communications mast is prominent above forested slopes on Mheall a Bhealaich to the east of the road.

15.72 Approximately 1 km south of Forsinard Station, Strathy North wind farm is visible for a short distance. The rail line crosses the road at Forsinard, where views are enclosed by forestry and scattered buildings within the settlement. Northwards, the road is enclosed by forestry blocks on both sides. A high voltage over-head line converges from the east to run parallel with the road immediately to the west, with the Halladale River now prominent to the east. Strath Halladale becomes narrower and more well-defined, enclosing views to both sides, with an increasing density of farming settlement. Hummocky glacial moraines are prominent landform features. Just south of Trantlebeg, a minor road bridges the river, running parallel to the A897 and serving a series of farms on the west side of the strath. At Achiemore the road curves eastwards, and the valley sides become steeper, with occasional craggy outcrops, again restricting more distant views. North of the farm of Calgarry Beg the over-head line leaves the Strath at a new substation, to run north eastwards towards Dounreay. A small single turbine is visible near Loch Earacha, where views become focused along a canalised section of river towards the coast, with the Melvich Bay dune system and Bighouse now prominent. High ground to the east of the Strath continues to restrict views eastwards until the junction with the A836 is reached.

A897 Southbound

15.73 No view of the Project when travelling south.

B871 Southbound

15.74 No view of the Project when travelling south east.

B871 Northbound

15.75 No view of the Project when travelling north west.

B873 Northbound

15.76 No view of the Project when travelling north.

B873 Southbound

15.77 No view of the Project when travelling south.

A9 Northbound (Latheron to Thurso)

15.78 Heading north to Thurso on the A9 from Latheron, views are initially constrained by buildings and associated vegetation. On leaving the settlement, views begin to open up over moorland with the occasional dwelling or stand of trees providing a focal point. A wood pole mounted line borders the road to the east. Boulfruich wind farm is visible within open moorland to the north west with Scaraben, Morven and Maiden Pap creating a striking skyline beyond. Just before the junction to Smerral, the road begins to descend, opening up elevated views over the sweeping moorland.

15.79 An overhead line feeds in from the southwest, crossing the A9, and continuing along the eastern edge to Spittal – a prominent vertical feature within a largely open and horizontal landscape. Views are concentrated in a north westerly direction across lower lying moorland to the distant horizon line. Causeymire wind farm becomes a prominent feature to the north west, with turbines and forestry becoming dominant as proximity increases. Views then open out to reveal panoramic views to the far west and north west over moorland, forestry and mixed agriculture towards Ben Dorrery, Beinn Freiceadain and Hill of Lieurary.

15.80 Occasional roadside houses obstruct the view. After passing Spittal and a number of forestry blocks, extensive views of rolling moorland and farmland continue to the north west. Halkirk becomes clearly visible on the approach to Georgemas Junction Station, with expansive views to Buckie Hill and along the River Thurso. Hedges and forestry continue to obscure views to the east on the approach to Thurso.

A9 Southbound

15.81 No view of the Project when travelling south.

A99 Northbound (Wick to John o Groats)

15.82 Leaving Wick the road initially heads north west through flat open farmland giving wider views to the west, with the coast not in view. At Reiss, the A99 branches right to head in a northerly direction, providing views directly ahead over Sinclair's Bay. The road then skirts the bay some 1 km inland, with fine views east over the large dune system and sandy beach, before passing through Keiss, where the coastline once more becomes rocky.

15.83 Beyond Keiss views west over neighbouring pastureland are confined by gently rising ground, but fine open views seaward continue. North of Nybster, the road gradually ascends over Hill of Harley with views opening out over moorland to the west, succeeded by further coastal views down to Freswick Bay. A further more significant ascent follows over Warth Hill, where moorland views dominate. Beyond the summit, an expansive panorama over the Pentland Firth opens out, with Stroma and the hills of Hoy prominent, although the northern coastline itself is initially obscured by the local landform.

A99 Southbound

15.84 No view of the Project when travelling south.

A836 Eastbound (Tongue-Reay)

15.85 The A836 in this section is also part of National Cycle Route 1.

15.86 Leaving the junction with the A838 at Tongue, the road first climbs through woodland on the western slopes of Ben Tongue, giving fine open views northward across the Kyle. Curving east, it descends to Coldbackie and Strathtongue, where views are enclosed on both sides by the steep valley sideslopes, before climbing again beyond Dallcharn to reach more open moorland with frequent craggy outcrops. The road reaches the highpoint of this open moorland stretch beyond Loch Crocach, giving expansive views to north and south, and begins to descend gently through forestry plantations towards the glen of the River Borgie. It then traverses a short enclosed stretch of valley floor, before climbing south eastwards, again through craggy gorse-covered outcrops, and then descending gently through peat moorland with more open views to join the B871 at Strath Naver. Here the road turns sharply northwards, following the edge of the floor of the strath through scattered woodland with steep slopes to the west, where views are predominantly enclosed, to emerge at the coast at the mouth of the Naver.

15.87 Climbing north towards Bettyhill, there are fine views west over Torrisdale Bay, the road then swings east again and descends through enclosed glen landscapes at the head of Farr Bay. A stretch of undulating moorland follows, again punctuated by craggy heather-covered outcrops, and a lay-by viewpoint gives fine views southwards which include the two wind turbines at Bettyhill Wind Farm. Approaching Armadale Bay the large 33-turbine Strathy North wind farm becomes prominent in views southwards, and views open northwards to the coastline. Climbing eastwards again, rocky outcrops punctuate areas of peat moorland and rough grazing, as views are continually limited by undulating landscapes with only pockets of habitation visible.

15.88 On approach to Strathy, the terrain becomes more rolling with forestry visible to the south, although still predominantly moorland. On the approach to Melvich the first panoramic views to the east render Dounreay, Baillie Hill wind farm, and beyond the Forss wind farm, briefly visible. Sparsely populated moorland continues after Melvich, while Dounreay and the Forss turbines direct travellers' views along the coast when entering Caithness. Baillie Hill wind farm also directs views along the coast before guiding the eye to the south east and south the closer to it one becomes. Views of the coast continue on the approach to Reay, where moorland starts to give way to areas of mixed farming. Dispersed woodland occasionally obstructs views of Dounreay. Both Dounreay and Forss Wind farm continue to be visually significant on the route between Reay and Borrowston Mains.

A836 Westbound John o' Groats to Melvich

15.89 Leaving John o' Groats the A836 passes through settled grazing and crofting land with open views north over the Pentland Firth. St John's Point gradually becomes more prominent, nearing Gills' Bay the terminal also becomes a focus of seaward views. The road then rises over Mey Hill; beyond the summit views are directed over mixed farmland and moorland towards the Dunnet Head cliffs and Orkney. Gently rolling terrain continues, with views of Dunnet Bay and its impressive sand dunes, the caravan park at Dunnet is also a prominent local feature. On the approach to Castletown, and within the village, woodland is prominent, and partially screens views of the surrounding landscape.

15.90 From Castletown to Thurso a long straight section of more than 5 km continues through gently undulating terrain. Again mixed farming dominates the landscape while housing continues to occasionally obstruct views to the west and north. After passing through the town of Thurso, where it joins the A9, the A836 climbs gently over Scrabster Hill. Around Thusater farm the turbines at Forss become visible. As the road descends to Bridge of Foss, dense woodland obscures views. The road rises again passing the Forss wind farm and Forss Technology Park, where the Dounreay nuclear complex begins to dominate the coastal landscape. Baillie Hill wind farm also forms a prominent visual feature on the skyline to the south and south west.

15.91 The route descends gently to the junction with the minor road to Shebster and Westfield at Isauld, with views seaward towards Sandside Head, and continues through Reay where views seaward are typically obscured by woodland until reaching more open terrain at the access to Reay Golf Club. Further roadside buildings and woodland again obscure views to the north for a section extending to just beyond Sandside House. West of here, high ground intervenes between the road and the coast, and the road begins to climb towards the bend and viewpoint at Drum Hollistan. Here oblique views eastward back along the coastline are possible, although these are partially obscured by a prominent knoll (spot height 101m). The route then traverses a section of more elevated open moorland, heading away from the development, before descending to Melvich Bay.

A836 Northbound (Loch Staing to Tongue)

15.92 The A836 in this section is also part of National Cycle Route 1.The road enters the study area just to the north of Loch Staing, and descends north eastwards towards Loch Loyal, with grand, extensive views over the loch, enclosed by Beinn Stumanadh and neighbouring high ground on its eastern shore. Crossing a burn at Inchkinloch, the road then turns northward to follow the west shore of Loch Loyal for around 6 km, passing Loch Loyal Lodge midway along this section, with views tightly enclosed to the west by steep slopes along much of its length. Views begin to open out at a narrow isthmus separating Loch Loyal from Loch Craggie, with

Cnoc Craggie prominent to the west. The road then gradually descends towards the coast, contouring above the village of Tongue before its junction with the A838.

Scrabster - Stromness Ferry Northbound

15.93 Although the ferry is heading away from the mainland and from the Project, the main passenger deck is at the rear of the vessel and passengers tend to look back towards the diminishing view of the mainland. In clear conditions, existing wind farm turbines are visible for some considerable distance once the vessel passes Holborn Head. Although theoretical visibility occurs for the majority of the crossing, at around the half-way point, passengers' attention changes from looking backwards to looking forwards to the Island of Hoy (unless the ferry takes the alternative route through Scapa Flow).

Stromness - Scrabster Ferry Southbound

15.94 Although the ferry is heading towards the mainland and towards the Project, the existing view is less clear due to the main outdoor passenger deck being located at the rear of the current vessel.

B855 Northbound A836 junction to Dunnet Head

15.95 Leaving Dunnet village the B855 first traverses crofting landscapes with views to St John's Loch. At Brough the road turns north westwards, with the high ground of the headland forming an increasing focus. Open sea views are obtained to the east for a short section close to a small skerry (Little Skett) before the road shortly begins to climb through open moorland towards the headland. The road levels briefly with Loch Long on the right, before the final climb to the car park. Here views are focussed northwards across the Pentland Firth to Hoy.

B855 Southbound Dunnet Head to A836 junction

15.96 The route descends from the car park at Dunnet Head and reverses the above sequence to the junction with the A836 at Dunnet village.

B874 Northbound

15.97 The road passes through agricultural land with views generally focussed south west away from the coast with Loch Watten a key feature. Frequent farm building groups, hedgerows, and woodland blocks restrict longer views.

B874 Southbound

15.98 No view of the Project when travelling south.

B876 Southbound

15.99 No view of the Project when travelling south.

B876 Northbound

15.100 From Keiss at the junction with the A99 the road traverses flat to gently undulating crofting and mixed agricultural landscapes, with generally open views. It climbs gently to the junction with the B870. Beyond, dense coniferous forestry blocks temporarily enclose views on both sides of the road. The route continues through agricultural land of similar character to join the A836 at Castletown.

B870 Westbound

15.101 Heading southwest, the B870 passes Loch Watten to the right where views are focused. Spittal Hill and Backlass are visible to the west with Flex Hill and Achairn wind farms visible to the south east. Hedgerows line both sides of this section of the route. The route heads north west before swinging southwest as it climbs through moorland and agricultural land across Spittal Hill and Backlass. Large blocks of dark forestry are visible on the skyline to the south.

15.102 As the route reaches the A9, Causeymire wind farm is visible to the southwest against a backdrop of distant hills. There are intermittent views of the upper sections of an overhead line running perpendicular to the direction of travel. After crossing the A9, the route descends past a block of immature forestry to the south with views of the existing overhead line to the north. Large blocks of forestry and open peatland are revealed once past the existing overhead line with views focused on the distant skyline to the south and south west.

15.103 The road crosses the River Thurso before passing through the small settlement at Westerdale and continuing through areas of immature forestry and open moorland. Views are largely contained within immature forestry. Ben Dorrery and Beinn Freiceadain form a visual feature to the north west on the approach to Olgrinmore. The road rises and falls en route to Olgrinmore with views to the east and west being screened and revealed in turn. Loch Olginey becomes visible to the north west as the route passes over moorland on the approach to the lower lying settled landscape at Calder. Hill of Lieurary and Loch Calder form key features of the view from this stretch of the route.

15.104 From Calder, the road climbs Buckies Hill with views constrained by the convex nature of some of the slopes. To the north of Buckies Hill, views open up to the north west and north east revealing, once again, the route of an existing overhead line, the prominent Thurso recycling centre building and Glengolly. The B870 passes under the existing overhead line before terminating at Glengolly.

B870 Eastbound

15.105 No view of the Project when travelling south east.

NCR 1 (Duncansby Head to Isauld/Sandside Bay) Westbound

15.106 The NCR initially follows a minor road linking Duncansby Head car park to John o' Groats, before joining the A836 for a section to Canisbay, where it again joins a minor road. West of here the route continues inland past Loch Heilen to rejoin the A836 briefly at Castletown. Over this initial section, views are dominated by the sea and Dunnet Head.

15.107 After passing Castletown, views west are obscured by rising terrain as the road rounds the Hill of Clindrag. Thurso and Scrabster eventually become visible as the road rounds the Hill of Olrig. The recycling centre becomes a focal point on the horizon as the road continues through farmland on the approach to Thurso. Past Thurso the recycling centre continues to draw attention, after which, an existing overhead line leading from Dounreay draws the eye west. Undulating farmland continues in the foreground after Westfield, while large scale forestry is visible in the distance to the south. On passing Shebster, Dounreay becomes visually significant, while the existing overhead line becomes more and more prominent as it draws nearer before heading back to Dounreay. The NCR continues to the west where the landscape changes to moorland and open peatland with rocky outcrops and seaward views, before joining the A836 at Isauld.

NCR 1 (Duncansby Head to Isauld/Sandside Bay) Eastbound

15.108 No views, travelling away from the development.

NCR 1 (Loch Staing to Tongue)

15.109 The road enters the Study Area just to the north of Loch Staing, and descends north eastwards towards Loch Loyal, with grand, extensive views over the loch, enclosed by Beinn Stumanadh and neighbouring high ground on its eastern shore. Crossing a burn at Inchkinloch, the road then turns northward to follow the west shore of Loch Loyal for around 6 km, passing Loch Loyal Lodge midway along this section, with views tightly enclosed to the west by steep slopes along much of its length. Views begin to open out at a narrow isthmus separating Loch Loyal from Loch Craggie, with Cnoc Craggie prominent to the west. The road then gradually descends towards the coast, contouring above the village of Tongue before its junction with the A838.

Railway – Kinbrace/Strath of Halladale to Georgemas Junction[36]

15.110 The views from the train looking to the north are generally characterised by peatland and commercial forestry plantations. The Project will not be visible from the section within the enclosed Strath of Halladale to the south of Kinbrace. North of Kinbrace, the line passes initially through more open moorland, and curves westward away from the line of the A897, before looping back east to cross the road at Forsinard. East of Forsinard, on passing Cnoc nan Gall, the route skirts the southern edge of a forestry block before entering a large plantation around Altnabreac Station. This vegetation effectively blocks long range views for a number of kilometres. On emerging from the forestry, views over peatland, interspersed with lochans, are obtained towards the local summits at Beinn nam Bad Mòr. South of Ben Dorrery, the line again skirts the southern edge of a forestry plantation which obscures views northwards for just over 1 km. Between this plantation and Georgemas, the view is of an open landscape dotted with isolated buildings and groups of buildings with views towards Halkirk.

Railway – Georgemas Junction to Kinbrace/Strath of Halladale[37]

15.111 On leaving Georgemas Junction, views in a northerly direction are towards the settlement of Halkirk with Buckies Hill beyond. Views are then directed over open ground interspersed with forestry blocks towards Ben Dorrery and the telecommunications masts on its summit. The route passes to the immediate south of a forestry plantation at Druim Chracairnie, screening any northward views, and continues south westwards to Altnabreac, passing through a further very extensive area of forestry. Curving westward, the line then passes through more open peatland north of Cnoc nan Gall, before skirting to the north of another major forestry area entering Forsinard. The line bends sharply south shortly after leaving Forsinard, with no further views northward.

Railway – Thurso to Wick

15.112 No view of the Project when travelling south.

[36] The description of the visual experience between the stations at Kinbrace and Forsinard was undertaken by desk study only.

[37] The description of the visual experience between the stations at Forsinard and Kinbrace was undertaken by desk study only.

Railway – Wick to Thurso

15.113 No view of the Project when travelling north.

Summary

15.114 The following receptors have not been taken forward to the assessment phase for the reasons set out in Table 15-9 below.

Table 15-85 Receptors scoped out of the assessment

Receptor	Reason not taken forward to the assessment phase
CCA 3: Stromness/Clestrian Sound	No theoretical visibility
CCA 4: Orphir	No theoretical visibility
CCA 5: North East Hoy	No theoretical visibility
CCA 6: Graemsay	No theoretical visibility
CCA 7: Central East Hoy	No theoretical visibility
CCA 8: Cava, Rysa Little and Fara	No theoretical visibility
CCA 9: South East Hoy	No theoretical visibility
CCA11: Switha	No theoretical visibility
LCCA 5:The pier to the jetty	No theoretical visibility
LCCA 6: The jetty to Tween the Wicks	No theoretical visibility
LCCA 7: Tween the Wicks to Quoy Ness	No theoretical visibility
LCCA 8: Quoy Ness to House Geo	No theoretical visibility
LCCA 9: House Geo to Innan Neb	No theoretical visibility
LCCA12: Longhope	No theoretical visibility
LCCA14: Point of Hackness to Crowtaing	No theoretical visibility
LCCA15: Crowtaing to Cantick Head	No theoretical visibility
LCCA25: Loch Eriboll	No theoretical visibility
LCCA 32 Creag Ruadh to Farr Point (High Cliffs)	No theoretical visibility
LCCA 34: Armadale Bay	No theoretical visibility
LCCA 48: St John's Point to Gills' Bay	No theoretical visibility
LCCA 43 Thurso Bay	No theoretical visibility
LCCA 47: Dunnet Head to St John's Point	No theoretical visibility
LCCA 49: Gills Bay to Duncansby Head	No theoretical visibility
LCCA 52: Freswick Bay	No theoretical visibility
LCCA 53: Ness Head to Sinclair's Bay	No theoretical visibility

Receptor	Reason not taken forward to the assessment phase
LCCA 55: Sinclair’s Bay to Noss Head	No theoretical visibility
LCCA 54: Sinclair’s Bay	No theoretical visibility
LCT 5. Coniferous Woodland	This is a land cover/land use rather than a LCT – although the bare ground ZTV indicates theoretical visibility, there would be no visibility from within the plantation.
LCT 9 Harbour	This is a land cover/land use rather than a LCT
LCT 13. Inland Loch	This is a land cover/land use rather than a LCT – no theoretical visibility.
LCT 14 Loch Island	This is a land cover/land use rather than a LCT
LCT 23 Rolling Hill Fringe	No theoretical visibility
LCT 28 Town	This is a land cover/land use rather than a LCT
LCT 29 Urban and Rural Development	This is a land cover/land use rather than a LCT
B9047 (Hoy) Southbound	No Theoretical Visibility/heading away from Project
A838 Westbound	No Theoretical Visibility/heading away from Project
A882 Eastbound	No Theoretical Visibility/heading away from Project
A897 Southbound	No Theoretical Visibility/heading away from Project
A9 Southbound	No Theoretical Visibility/heading away from Project
A99	No Theoretical Visibility/heading away from Project
B855 Northbound	No Theoretical Visibility/heading away from Project
B870 Southbound	No Theoretical Visibility/heading away from Project
B871	No Theoretical Visibility/heading away from Project
B873	No Theoretical Visibility/heading away from Project
B874 Southbound	No Theoretical Visibility/heading away from Project
B876 Southbound	No Theoretical Visibility/heading away from Project

Receptor	Reason not taken forward to the assessment phase
Railway Thurso – Wick	No Theoretical Visibility/heading away from Project

Summary of species/specifics taken forward to the assessment phase

15.115 Table 15-10 summarises those receptor types which have been taken forward to the assessment phase.

Table 15-86 Receptors taken forward to the assessment phase

Receptors taken forward for assessment	
LCCAs	**WLAs**
LCTs	**Wild Land Area 35 Ben Klibreck - Armine Forest**
1. Cliff Landscapes	Wild Land Area 36 Causeymire- Knockfin Flows
2. Coastal Granite Pastures	Wild Land Area 37 Foinaven - Ben Hee
3. Coastal Hills and Heath	Wild Land Area 38 Ben Hope - Ben Loyal
4. Coastal Island	Wild Land Area 39 East Halladale Flows
6. Enclosed Bay Landscapes	Wild Land Area 40 Cape Wrath
7. Flat Peatland	Wild Land Area 41 Hoy
8. Glaciated Valley	**GDLs**
10. High Cliffs and Sheltered Bays	Melsetter House Garden and Designed Landscape
11. Holms	**VPs**
12. Inclined Coastal Pastures	1: Ben Ratha
15. Lone Mountains	2. Strathy Point Car Park
16. Long Beaches, Dunes and Links	3. Portskerra/ Melvich
17. Low Island Pastures	4: Drum Holliston Car Park
18. Low Moorland	5: Sandside Harbour Car Park
19. Mixed Agriculture and Settlement	6: St Mary's Chapel, Forss
20. Moorland Hills	7. Dunnet Head
21. Moorland Slopes and Hills	8. Scrabster – Stromness Ferry
22. Open Intensive Farmland	9. Path to the Old Man of Hoy
24. Rugged Glaciated Hills	**Sequential Routes**
25. Small Farms and Crofts	A836
26. Strath	A838
27. Sweeping Moorland	A882

Receptors taken forward for assessment	
30. Whaleback Island Landscapes	A897
NSAs	A9
Hoy and West Mainland National Scenic Area	A99
North West Sutherland National Scenic Area	B855
Kyle of Tongue National Scenic Area	B870
SLAs	B871
Ben Klibreck and Loch Choire SLA	B873
Duncansby Head SLA	B874
Dunnet Head SLA	B876
Eriboll East and Whiten Head SLA	B9047 Hoy
Farr Bay, Strathy and Portskerra SLA	NCR 1
Loch Fleet, Loch Brora and Glen Loth SLA	Rail line: Kinbrace/Strath of Halladale – Georgemas Junction
Oldshoremore, Cape Wrath and Durness SLA	Rail line: Thurso – Wick
The Flow Country and Berriedale Coast SLA	Ferry: Scrabster - Stromness
Bens Griam and Loch nan Clar SLA	

15.8 Identification of Potential Impacts

15.116 This section sets out the key potential impacts of the offshore proposals on the seascape and landscape resources and on visual amenity.

Potential impacts in the construction phase

15.117 Construction effects will be indirect and temporary, lasting approximately 6 months. The primary effects will be due to visibility of vessel movements relating to towing of the floating platform into position, installation of mooring lines and anchors, and export cable installation.

Potential impacts in the operational phase

15.118 The focus of this part of the assessment is on the likely effects during the operational phase. The Project would introduce two very large vertical man-made features in views of the open sea beyond Sandside Bay, with the platform largely reading as a recessive horizontal element merging with the sea surface. The visual context of the great majority of views of the Project is dominated by the large, expansive scale of the open sea, occasionally also including distant coastal features and hills or mountains further inland.

15.119 It is stressed that opportunities to gauge the true scale of the turbines will therefore be very limited, given the relative lack of frequency of backclothing by land, and juxtaposition with associated scale comparators including landforms, buildings and trees.

15.120 Also significant in establishing the wider seascape, landscape and visual context of the Project is the presence of numerous existing large scale wind energy infrastructure Projects within the baseline resource. Together with the existing Dounreay industrial establishment, which is the dominant built development in the vicinity of the Project, these constitute major contextual elements.

Potential impacts in the decommissioning phase

15.121 Effects during decommissioning would be similar to those arising during the construction period with the seascape and landscape resources and visual amenity being returned to the baseline conditions.

15.9 Impact Assessment

Likely impacts on the seascape resource

15.122 Wireframe representations are presented in Appendix 15.5. The baseline seascape resource as defined above consists of receptors which include units at national, regional, and local level. Given that the offshore Site is not attributed physically to any of these units, all effects will be indirect only, resulting from visibility of the infrastructure, which will affect their characteristics and qualities to varying degrees as detailed in Residual Impacts below.

Likely impacts on the landscape resource

15.123 The baseline landscape resource as defined above consists of landscape character types, which occur in discrete geographical units across the Study Area, in addition to specific designated landscape areas. The effects on all these receptors will also be indirect only, as the Project does not physically affect any unit or area.

Likely impacts on visual amenity

15.124 Impacts on visual receptors (people) are due to visibility of the Project. The extent and pattern of the ZTV (Figure 15.2) indicates a number of key characteristics:

- Relatively continuous visibility along the coastline and immediate hinterland extending from Strathy Point in the west to Thurso Bay in the east;
- Beyond this central zone, the configuration of the coastline has a much stronger effect, with headlands and bays frequently restricting visibility. Areas of visibility include Dunnet Head and Duncansby Head, but there are also many substantial areas which are almost entirely screened, including Thurso Bay, Loch Eriboll, and Tongue Bay;
- Further inland, elevation/relief is the most significant influencing factor – with theoretical visibility primarily restricted to areas of higher ground;
- In many inland areas, actual visibility will be very significantly reduced by the extensive areas of forestry plantation; and
- On Mainland Orkney and Hoy, visibility is mainly restricted to western cliff tops and hill summits, with localised fragmented areas occurring further inland.

15.10 Mitigation Measures

15.125 The Project shall not occupy the whole of the offshore Site. The Applicant shall agree the final location of the platform, within the offshore Site, in consultation with Scottish Ministers and The Highland Council.

15.11 Residual Impacts

Impacts on seascape - impacts on local coastal character areas

15.126 The assessment identified that there would be significant effects on four of the Local Coastal Character Areas from a total of 55 within the core Study Area:

- LCCA 19: Tor Ness to Rack Wick;
- LCCA 21: Rack Wick to Rora Head;
- LCCA 22: Rora Head to Kame of Hoy; and
- LCCA 40: Sandside Bay.

15.127 Three of the four areas above are located in Orkney. In these instances, the primary reason for the assessment is that although the magnitude is relatively low, the exceptionally high sensitivity of the coastline, reflected in two separate national level designations, (NSA and Wild Land), is judged to be of paramount importance. For Sandside Bay, the primary reasons for the assessment include the very high proportion of the unit with Theoretical Visibility (>90 %) combined with a separation distance of around 7 km.

15.128 The effects are summarised in Table 15-11 below. Table 1 in Appendix 15.4 presents the full assessment of effects on Local Coastal Character Areas.

Table 15-87 Summary of Impact on LCCAs

Receptor	Sensitivity	Magnitude of Change	Environmental consequence
LCCA 1: Lyre Geo to Neblonga	High	Minor	Minor
LCCA 2: Neblonga to Breck Ness	Medium	Minor	Minor
LCCA 3: Breck Ness to Skerry of Ness	Medium	Minor	Minor
LCCA 4: Innan Neb to the pier	Medium	Minor	Minor
LCCA 10: West Swona	High	Moderate/Minor	Moderate/Minor
LCCA 11: East Swona	High	Minor/Negligible	Minor
LCCA 16: Cantick Head to Aith Head	High	Minor	Moderate/Minor
LCCA 17: Aith Head to Brims Ness	High	Minor	Minor
LCCA 18: Brims Ness to Tor Ness	High	Minor	Minor

Receptor	Sensitivity	Magnitude of Change	Environmental consequence
LCCA 19: Tor Ness to Rack Wick	Very High	Moderate/Minor	Moderate
LCCA 20: Rack Wick	High	Moderate/Minor	Moderate/Minor
LCCA 21: Rack Wick to Rora Head	Very High	Moderate/Minor	Moderate
LCCA 22: Rora Head to Kame of Hoy	Very High	Moderate/Minor	Moderate
LCCA 23: West Stroma	High	Minor	Moderate/Minor
LCCA 24: East Stroma	High	Minor/Negligible	Moderate/Minor
LCCA 26: Loch Eriboll to Achininver Bay	High	Minor	Moderate/Minor
LCCA 27 Achininver Bay	High	Minor	Moderate/Minor
LCCA 28 Achininver Bay to Ard Skinid	High	Minor	Moderate/Minor
LCCA 29: Kyle of Tongue	High	Negligible	Minor
LCCA 30: Kyle of Tongue to Aird Torrisdale	High	Minor	Moderate/Minor
LCCA 31 Torrisdale Bay	High	Minor	Moderate/Minor
LCCA 33: Farr Point to Armadale Bay	High	Minor	Moderate/Minor
LCCA 35: Strathy Point	High	Minor	Moderate/Minor
LCCA 36: Strathy Bay	High/Medium	Moderate/Minor	Moderate/Minor
LCCA 37: Strathy Bay to Melvich Bay	High/Medium	Moderate	Moderate/Minor
LCCA 38: Melvich Bay	Medium	Moderate	Moderate/Minor
LCCA 39 Melvich Bay to Sandside Bay	Medium	Moderate	Moderate/Minor
LCCA 40: Sandside Bay	Medium	Moderate	Moderate
LCCA 41: Sandside Bay to Ness of Litter	Low	Moderate	Minor
LCCA 42: Ness of Litter to Holburn Head	Medium	Moderate/Minor	Minor
LCCA 44: Thurso Bay to Dunnet Bay	Medium	Moderate/Minor	Minor
LCCA 45: Dunnet Bay	High/Medium	Moderate/Minor	Moderate/Minor

Receptor	Sensitivity	Magnitude of Change	Environmental consequence
LCCA 46: Dunnet Head	High	Moderate/Minor	Moderate/Minor
LCCA 50: Duncansby Head	Very High	Minor/Negligible	Minor
LCCA 51: Duncansby Head to Skirza Head	High/Medium	Minor/Negligible	Minor

Residual impacts on landscape - impacts on landscape character types

15.129 The assessment identified that there would be no significant effects on Landscape Character Types. In no instance was the magnitude of change judged to result in material change to the key characteristics of the landscape.

15.130 The effects are summarised in Table 15-12 below. Table 2 in Appendix 15.4 presents the full assessment of effects on Landscape Character Types.

Table 15-88 Summary of Impact on LCTs

Landscape Character Type	Sensitivity	Magnitude of Change	Environmental consequence
1 Cliff Landscapes	High/Very High	Minor	Minor
2. Coastal Granite Pastures	High/Very High	Minor/Negligible	Minor
3 Coastal Hills and Heath	High/Very High	Minor	Minor
4 Coastal Island	High/Very High	Minor	Minor
6 Enclosed Bay Landscapes	High/Very High	Minor	Minor
7 Flat Peatland	Medium	Minor	Minor
8. Glaciated Valley	High/Very High	Minor	Moderate/Minor
10. High Cliffs and Sheltered Bays	High	Minor	Minor
11 Holms	High	Minor	Minor
12 Inclined Coastal Pastures	High	Minor	Minor
15 Lone Mountains	High/Very High	Minor	Minor
16 Long Beaches Dunes and Links	High	Minor	Moderate/Minor
17 Low Island Pastures	Medium	Minor	Minor
18 Low Moorland	Medium	Moderate/Minor	Moderate/Minor
19 Mixed Agriculture and Settlement	Medium	Moderate/Minor	Moderate/Minor
20 Moorland Hills	High/Very High	Minor	Minor
21 Moorland Slopes and Hills	Medium	Moderate/Minor	Moderate/Minor

Landscape Character Type	Sensitivity	Magnitude of Change	Environmental consequence
22 Open Intensive Farmland	Medium	Moderate/Minor	Moderate/Minor
24 Rugged Glaciated Hills	High/Very High	Minor	Moderate/Minor
25 Small Farms and Crofts	Medium	Moderate/Minor	Moderate/Minor
26 Strath	Medium	Moderate/Minor	Moderate/Minor
27 Sweeping Moorland	Medium	Moderate/Minor	Moderate/Minor
30 Whaleback Island Landscapes	Medium	Minor	Minor

Residual impacts on landscape- landscape designations

15.131 The assessment identified that there would be significant effects on one Landscape Designation from a total of 13 included in the assessment. The Farr Bay, Strathy and Portskerra SLA would experience a significant effect primarily due to views from the coastline being explicitly protected in the citation, and the fact that a high proportion of the coastline would be affected by views of the Project. The effects are summarised in Table 15-13 below. Appendix 15.4 presents the full assessment of Landscape Designations.

Table 15-89 Impacts on Landscape Designations

Landscape Designation	Sensitivity	Magnitude of Change	Environmental consequence
Hoy and West Mainland National Scenic Area	Very High	Minor/Negligible	Minor/Negligible
North West Sutherland National Scenic Area	Very High	Minor/Negligible	Minor/Negligible
Kyle of Tongue National Scenic Area	Very High	Minor	Minor
Ben Klibreck and Loch Choire SLA	High	Minor	Moderate/Minor
Duncansby Head SLA	High/Very High	Minor/Negligible	Moderate/Minor
Dunnet Head SLA	High/Very High	Moderate/Minor	Moderate/Minor
Eriboll East and Whiten Head SLA	High	Minor	Moderate/Minor
Farr Bay, Strathy and Portskerra SLA	High/Very High	Moderate/Minor	Moderate
Loch Fleet, Loch Brora and Glen Loth SLA	High/Very High	Minor/Negligible	Minor
Oldshoremore, Cape Wrath and Durness SLA	High	Minor	Moderate/Minor
The Flow Country and	High	Minor	Moderate/Minor

Landscape Designation	Sensitivity	Magnitude of Change	Environmental consequence
Berriedale Coast SLA			
Bens Griam and Loch nan Clar SLA	High	Minor	Moderate/Minor
Melsetter House Garden and Designed Landscape	Very High	Minor	Moderate/Minor

Residual impacts on wild land areas (WLAs)

15.132 The assessment identified that there will be no significant effects on Wild Land Areas from a total of 7 included in the assessment. The effects would be indirect and would not result in change to the physical attributes of the WLAs. In no instance was the magnitude of change judged to result in material change to the perceptual attributes of the WLA.

15.133 The effects are summarised in Table 15-14 below. The assessments of Wild Land Areas are presented in full in Tables 16-22 in Appendix 15.4.

Table 15-90 Residual Impacts on Wild Land Areas

Wild Land Area	Sensitivity	Magnitude of Change	Environmental consequence
Wild Land Area 35 Ben Klibreck - Armine Forest	Very High	Minor/Negligible	Minor
Wild Land Area 36 Causeymire- Knockfin Flows	Very High	Minor/Negligible	Minor
Wild Land Area 37 Foinaven - Ben Hee	Very High	Negligible	Minor
Wild Land Area 38 Ben Hope - Ben Loyal	Very High	Negligible	Minor
Wild Land Area 39 East Halladale Flows	Very High	Minor/Negligible	Minor
Wild Land Area 40 Cape Wrath	Very High	Negligible	Minor
Wild Land Area 41 Hoy	Very High	Minor/Negligible	Minor

Residual impacts on viewpoints

15.134 The assessment identified that there would be no significant effects on Viewpoints from a total of 9 included in the assessment. The relatively low magnitude of change was the primary determinant in instances where the sensitivity of the viewpoints was High or Very High; the predominantly long or very long separation distances and small proportion of the view affected by the Project being judged particularly important in this regard.

15.135 As the turbines will be lit (at the nacelle) and the platforms with red flashing lights and white flashing lights respectively, the assessment takes into account the night time effects of lighting. It should be noted that high level lighting is more frequently obscured by cloud, mist and fog than lighting closer to the sea surface but, in this case, a worst case scenario of clear night time visibility has been considered.

15.136 The effects of lighting were considered during the daytime fieldwork surveys. It is considered that the photomontages produced for each viewpoint provide sufficient information to understand the location of the proposed lighting in the context of the baseline conditions and that night time wirelines or montages would not add anything further to the description of night time effects.

15.137 The lighting on the Proposed Development will, of course, be seen in the context of other sources of illumination such as street lighting of the settlements along the coast, at the Dounreay establishment, at Scrabster harbour and, illuminated vessels including passing shipping and the scrabster to Stromness Ferry.

15.138 The effects are summarised in Table 15-15 below. Table 23 in Appendix 15.4 presents the full assessment of impacts on Viewpoints.

Table 15-91 Impacts on Viewpoints

Viewpoint	Sensitivity	Magnitude of Change	Environmental consequence
1: Ben Ratha	High	Minor/Moderate	Minor/Moderate
2. Strathy Point Car Park	High	Minor/Moderate	Minor/Moderate
3. Portskerra/Melvich	High/Medium	Minor/Moderate	Minor/Moderate
4: Drum Holliston Car Park	High/Medium	Minor	Minor
5: Sandside Head	High/Medium	Minor/Moderate	Minor/Moderate
6: St Mary's Chapel, Forss	Medium/Low	Minor	Minor
7. Dunnet Head	High	Minor	Minor
8. Scrabster – Stromness Ferry	High/Medium	Minor	Minor/Moderate
9. Path to the Old Man of Hoy	Very High	Minor	Minor
11. A836 east of Forss	Medium/Low	Minor	Minor
12. A897 near Craigtown, Strath Halladale	Medium	Minor	Minor

Residual impacts on sequential routes

15.139 The assessment identified that there would be no significant effects on Sequential Routes from a total of 17 included in the assessment. The primary reasons for these judgements included predominantly low incidences of views and very low proportions of the journey times affected by theoretical visibility of the Project.

15.140 Table 24 in Appendix 15.4 presents the full assessment of effects on Sequential Routes.

15.12 Cumulative Impacts

Cumulative impacts on seascape, landscape and visual impacts

15.141 Cumulative impacts are the summation of effects which result from changes caused by the Project in conjunction with other reasonably foreseeable actions.

15.142 The list of projects to be included within the cumulative assessment is provided in Appendix 15.4 Tables 25-29.

15.143 Given the number of developments, the size of the Study Area, and the number of receptors involved, in order to further limit the extent of the assessment to a proportionate level in accordance with guidance in GLVIA 3 and SNH (2012b), the following "rules" have been applied in sequence:

- The cumulative assessment for seascape receptors (Local Coastal Character Areas) includes only the offshore developments;
- With the exception of Designated Landscapes (included within the Extended Study Area of 60 km), only receptors within 45 km of the Project have been considered;
- With the exception of Designated Landscapes and Viewpoints, only receptors which were assessed as experiencing effects greater than Minor due to the Project alone have been considered (i.e. Moderate/Minor or above); and
- For LCTs, where multiple instances of Theoretical Visibility occur, only the worst case incidence has been assessed (i.e. the instance at the closest distance from the Project).

15.144 For each of the categories of receptors, the lists of developments scoped out are also provided.

Cumulative impacts on local coastal character areas

15.145 The following LCCAs (Figure 15.5) which have been assessed for the Project have been scoped out due to the fact that there is no theoretical visibility of any of the offshore developments:

- LCCA 1: Lyre Geo to Neblonga;
- LCCA 2 Neblonga to Breck Ness;
- LCCA 3: Breck Ness to Ness;
- LCCA 20 Rackwick Bay;
- LCCA26: Loch Eriboll to Achininver Bay;
- LCCA 27 Achininver Bay;
- LCCA 28 Achininver Bay to Ard Skinid;
- LCCA 29: Kyle of Tongue;
- LCCA 30: Kyle of Tongue to Aird Torrisdale;
- LCCA 31 Torrisdale Bay;
- LCCA 33: Farr Point to Armadale Bay;
- LCCA 35: Strathy Point;
- LCCA 36. Strathy Bay;
- LCCA 37: Strathy Bay to Melvich Bay;
- LCCA 38: Melvich Bay;
- LCCA 39 Melvich Bay to Sandside Bay;
- LCCA 40: Sandside Bay;
- LCCA 41: Sandside Bay to Ness of Litter;
- LCCA 42: Ness of Litter Holburn Head ;
- LCCA 44: Thurso Bay to Dunnet Bay;
- LCCA 45: Dunnet Bay.

15.146 The following LCCAs which have been assessed for the Project have been scoped out due to the fact that developments from the above list which are theoretically visible are at separation distances of greater than 45 km, out with the core Study Area.

- LCCA 21 Rack Wick to Rora Head; and
- LCCA 22 Rora Head to Kame of Hoy.

15.147 The assessment found that there will be no significant cumulative effects on LCCAs. The full cumulative assessment of LCCAs is included in Table 25 in Appendix 15.4.

Cumulative effects on landscape character types

Approved wind turbine developments scoped out

15.148 The following have been scoped out due to the fact that the distances to each of the LCTs in the table above are greater than the recommended ZTV distances:

- Berriedale; and
- Caen Cottage

15.149 The following have been scoped out due to the fact that there is either no theoretical visibility or the distances to each of the LCTs in the table above are greater than the recommended ZTV distances:

- Ore Brae; and
- Work Farm.

Other developments scoped out

15.150 The following have been scoped out due to the fact that the distances to each of the LCTs in the table above are greater than the recommended ZTV distances:

- Brims Tidal Array.

15.151 The assessment found that there will be no significant cumulative effects on LCTs. The full cumulative assessment of LCTs is included in Table 26 in Appendix 15.4.

Cumulative effects on designated landscapes

National Scenic Areas

15.152 The following developments have been scoped out due to the fact that there is no theoretical visibility from any of the National Scenic Areas:

- Ackron;
- Ore Brae;
- West Clyth; and
- Work Farm.

15.153 The following developments have been scoped out due to the fact that there is either no theoretical visibility from the NSAs or the distances from locations which do have theoretical visibility exceed the recommended study areas radii for the developments:

- Achlachan;
- Bad a Cheo;
- Beatrice;
- Berriedale;
- Caen Cottage;
- Gaultiquoy;
- Halsary;
- Holburn Head;
- Lochend;
- Lybster Road;
- Stevenson;
- Telford;

- MacColl;
- Weydale Farm;
- Wathegar 2;
- Achlachan 2.

15.154 The following In Planning Wind Turbine Developments have been scoped out due to the fact that there is either no theoretical visibility from the NSAs or the distances from locations which do have theoretical visibility exceed the recommended study areas radii for the developments

- Blackpark;
- Lower Rumster;
- Lynchrobbie;
- Osclay Quarry;
- West Garty
- Holodyke;
- Lower Thura;
- Mid Kirk;
- Seater Farm; and
- Gordonbush

15.155 The following additional developments have been scoped out due to the fact that there is no theoretical visibility from any of the National Scenic Areas:

- MeyGen Tidal;
- Spittal HVDC;
- LT22 - Thurso substation;
- LT22 – Thurso to Gills bay 132 kV OHL;
- Dounreay Substation Extension;
- LT22 – Dounreay to Mybster 275 kV OHL;
- LT22 - Mybster Substation Extension;
- LT22 – Gills Bay Substation; and Dounreay Trì Substation.

15.156 The assessment found that there will be no significant cumulative effects on NSAs. The full cumulative assessment of the NSAs is included in Table 27 in Appendix 15.4.

Cumulative effects on special landscape areas

15.157 The following SLA was scoped out by reason of having no Theoretical Visibility of cumulative developments less than 60 km distant:

- Oldshoremore , Cape Wrath and Durness

15.158 The following approved wind turbine development has been scoped out due to the fact that there is no theoretical visibility from any of the remaining SLAs:

- Burgar Hill.

15.159 The following additional approved developments have been scoped out due to the fact that there is either no theoretical visibility from the SLAs or the distances from locations which do have theoretical visibility exceed the recommended study areas radii for the developments:

- Akla;
- Akron;
- Berriedale; and
- Work Farm.

15.160 The following In Planning developments have been scoped out due to the fact that there is no theoretical visibility from any of the remaining SLAs:

- Holodyke.

15.161 The following additional developments have been scoped out due to the fact that there is no theoretical visibility from any of the remaining SLAs:

- Dounreay Substation Extension;
- Spittal Hill HVDC; and
- LT 22 - Thurso substation.

15.162 The assessment found that there will be no significant cumulative effects on the SLAs with the exception of the **Farr Bay, Strathy and Portskerra SLA**. The full cumulative assessment of the SLAs is included in Table 28 in Appendix 15.4.

Cumulative effects on gardens and designed landscapes

15.163 Melsetter House is the only GDL affected by the Project and is therefore the only GDL subject of the cumulative assessment.

15.164 The following approved or At Appeal developments have been scoped out due to the fact that there is no theoretical visibility from Melsetter House;

- Akla;
- Beatrice;
- Caen Cottage;
- Telford;
- West Clyth;
- Work Farm.
- Ackron;
- Berriedale;
- Stevenson;
- MacColl;
- Weydale.

15.165 The following approved or At Appeal developments have been scoped out due to the fact that although there is theoretical visibility, the distances from Melsetter House G&DL locations exceed the recommended study areas radii for the developments:

- Achlachan;
- Burgar Hill;
- Halsary;
- Achlachan 2.
- Bad a Cheo;
- Gaultiquoy;
- Lybster Road.

15.166 The following In-Planning developments have been scoped out due to the fact that there is no theoretical visibility from Melsetter House G&DL:

- Gordonbush;
- Holodyke;
- Lynchrobbie;
- Creag Riabhach;
- Lower Rumster;
- Osclay Quarry.

- West Garty;

15.167 The following In-Planning developments have been scoped out due to the fact that although there is theoretical visibility from Melsetter House G&DL the distances exceed the radii for the Projects' ZTVs.

- Blackpark;
- Mid Kirk;
- Seater Farm;
- Strathy Forest; and
- Strathy South.
-

15.168 The following other developments have been scoped out due to the fact that there is no theoretical visibility from any of the National Scenic Areas:

- MeyGen Tidal;
- Dounreay Substation Extension;
- Spittal HVDC;
- LT22 – Dounreay to Mybster 275 kV OHL;
- LT22 - Thurso substation;
- LT22 - Mybster Substation Extension;
- LT22 – Thurso to Gills bay 132 kV OHL;
- LT22 – Gills Bay Substation.
- Dounreay Trì Substation;

15.169 The assessment found that there will be no significant cumulative effects on the Melsetter House Garden and Designed Landscape. The full cumulative assessment of the GDL is included in Table 29 in Appendix 15.4.

Cumulative effects on wild land areas

15.170 The following approved developments have been scoped out due to the fact that there is either no theoretical visibility from any of the WLAs or the distances from locations which do have theoretical visibility exceed the recommended study area radii for the developments:

- Holborne Head;
- West Clyth;
- MeyGen Tidal;
- LT22 Thurso Substation; and
- LT22 Thurso to Gills Bay 132 kV OHL.

15.171 None of the scoped-in developments have Theoretical Visibility from Wild Land Area 40 Cape Wrath, which accordingly has not been assessed further.

15.172 The assessment identified that there would be no significant cumulative effects on Wild Land Areas. Table 30 in Appendix 15.4 presents the full assessment of cumulative effects on Wild Land Areas.

Cumulative effects on viewpoints

Approved/at Appeal Wind Turbine Developments Scoped Out

15.173 The following have been scoped out due to the fact that there is no theoretical visibility from any of the nine viewpoints:

- Akla;

- Caen Cottage; and
- West Clyth Farm.

In planning wind turbine developments scoped out

15.174 The following have been scoped out due to the fact that there is no theoretical visibility from any of the nine viewpoints:

- Gordonbush Wind farm;
- Holodyke Wind Turbines;
- Lower Rumster wind turbine;
- Lochrobbie Wind Turbines; and
- Osclay Quarry Wind Turbine.

Other developments scoped out

15.175 The following developments have been scoped out due to the fact that there is no theoretical visibility from any of the nine viewpoints:

- MeyGen Tidal;
- Spittal HVDC;
- LT22 Thurso substation; and
- LT22 Mybster Substation.

15.176 The assessment identified that there would be no significant cumulative effects on Viewpoints. Table 31 in Appendix 15.4 presents the full assessment of cumulative effects on Viewpoints.

Cumulative effects on sequential routes

15.177 The A9 Northbound was the only route assessed as experiencing an effect greater than Minor (Moderate/Minor) due to the Project. The assessment identified that there would be no significant cumulative effects on the route. Table 32 in Appendix 15.4 presents the full assessment of the sequential cumulative effects on the A9 Northbound.

15.13 Summary and Conclusions

Impacts on the seascape resource

15.178 The Project will result in limited significant effects on the seascape resource as set out in Table 15-16. These are restricted to three remote stretches of the coastline in the vicinity of The Old Man of Hoy, and Sandside Bay, closer to the Project.

Impacts on the landscape resource

15.179 The Project will result in one significant effect on the landscape resource as set out in Table 15-16, to the Farr Bay, Strathy and Portskerra SLA.

Impacts on the visual amenity

15.180 The Project will not result in any significant impacts on people at static viewpoints or on roads or cycle routes (Table 15-16).

Table 15-92 Summary of Significant Impacts

Potential Effect	Sensitivity	Magnitude	Overall Significance
Effect on LCCA 19: Tor Ness to Rack Wick	Very High	Moderate/Minor	Moderate
Effect on LCCA 21: Rack Wick to Rora Head	Very High	Moderate/Minor	Moderate
Effect on LCCA 22: Rora Head to Kame of Hoy	Very High	Moderate/Minor	Moderate
Effect on LCCA 40: Sandside Bay	Medium	Moderate	Moderate
Effect on Farr Bay, Strathy and Portskerra SLA	High/Very High	Moderate/Minor	Moderate

16 Offshore Archaeology and Cultural Heritage

16.1 Introduction

16.1 This chapter describes the existing archaeological environment in the offshore Study Area and export cable corridor (see Section 16.2) and presents the assessment of the potential impacts arising from the development of the proposed Dounreay Trì Project – the 'Project' - during the construction, operation and maintenance and decommissioning phases. A full and detailed description of the baseline marine historic environment is presented in Appendix 16.1: Marine Historic Environment Technical Baseline Report.

16.2 Cumulative effects from interactions with other existing or planned projects are also considered. The mitigation measures which will be implemented to prevent, reduce or offset any potential adverse effects are also described.

16.2 Study Area

16.3 The Site comprises a 5 x 5 km offshore area located approximately 6 km from the north coast of Scotland in the Pentland Firth and an export cable corridor running from the offshore site to the coast immediately to the west of the Dounreay Restoration Site fenceline (Figure 16-1).

16.4 The Site for this assessment comprises of the Site and the export cable corridor (Figure 16-1) and the marine geophysical survey that extends beyond these limits. Data were also captured for the wider general area for wrecks with unverified and unknown locations that had the possibility of lying within the Site and export cable corridor.

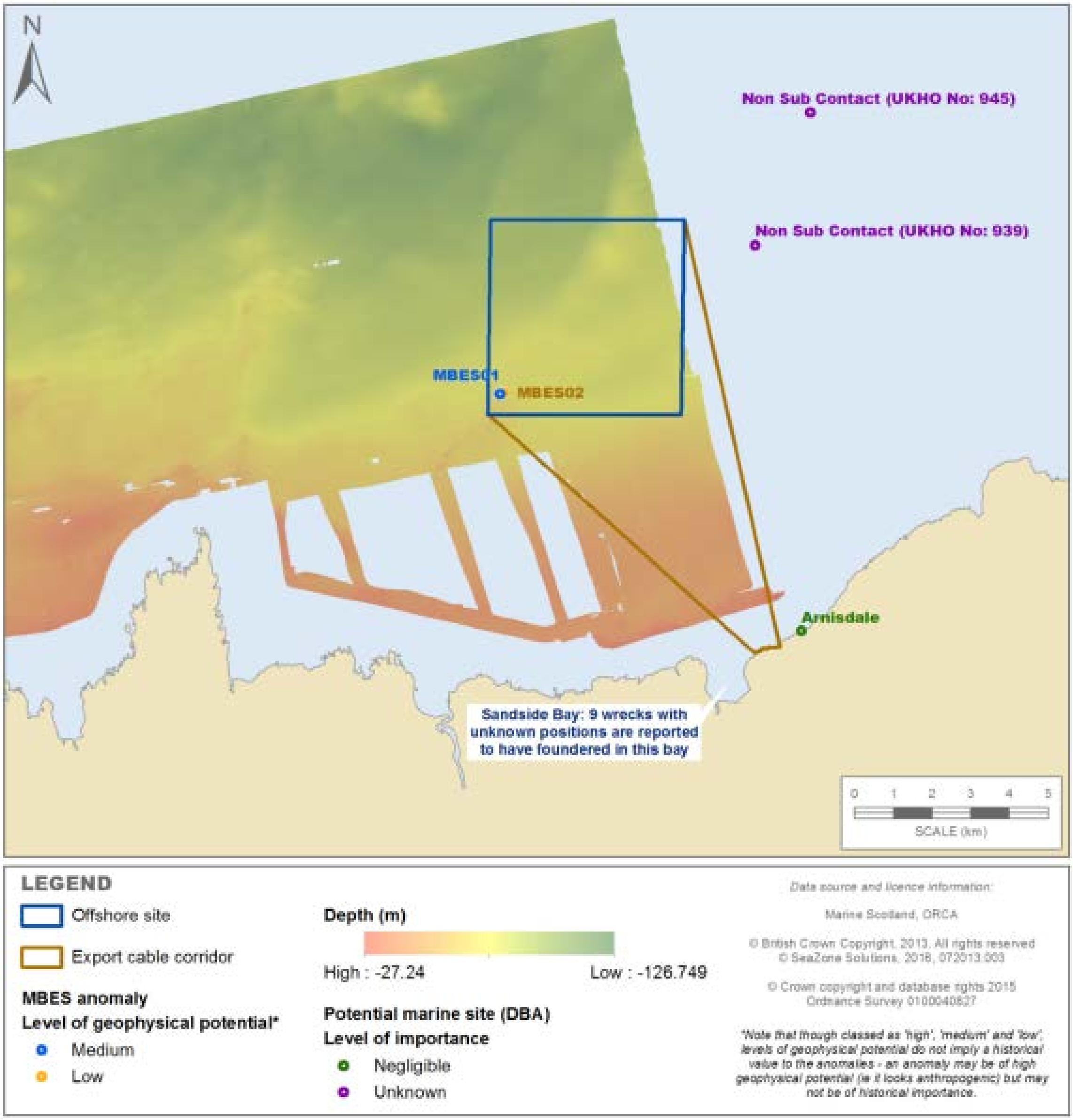


Figure 16-40 The Site and export cable corridor

16.3 Legislation and Guidance

16.5 There are internationally legally binding conventions, EU Directives, UK and Scottish legislation, policy frameworks and guidance to consider in relation to the historic environment. Various EU EIA directives have been incorporated in UK and Scottish legislation, all of which include the requirement to address impacts on the historic environment. The following relevant guidance and legislation relating to the Offshore Marine Environment was used in the preparation of this chapter:

International/EU legislation and policy

- The United Nations Convention of the Law of the Sea (UNCLOS);
- The European Convention on the Protection of the Archaeological Heritage (revised), known as the Valletta Convention; and

- Annex to the UNESCO Convention on the Protection of the Underwater Cultural Heritage 2001.

UK legislation and policy

- The Merchant Shipping Act 1995;
- The Protection of Wrecks Act 1973 (Section 1 of the Protection of Wrecks Act was repealed in Scotland on the 1 November 2013 and the 8 wrecks around the coast of Scotland designated under this section of the Act are now protected by Historic Marine Protected Areas (HMPAs) as defined in the Marine (Scotland) Act 2010);
- The Protection of Military Remains Act 1986; and
- The UK Marine Policy Statement (2011).

Scottish legislation and policy

- The Marine (Scotland) Act 2010;
- The Scottish Historic Environment Policy (SHEP) 2011;
- Scottish Planning Policy (SPP) 2014;
- The Scottish Government's Planning Advice Note (PAN 2/2011);
- Historic Environment Scotland's Operational Policy Paper HP6 1999; and
- The Scottish Government's Planning Scotland's Seas: Scotland's National Marine Plan (March 2015).

16.4 Sources of Information

16.6 A detailed review was undertaken of the existing literature and data relating to the marine historic environment of the Study area and this was used to give an overview of the existing environment of the Study Area. The principal reference sources used in the preparation of this chapter are listed in Table 16-1.

Table 16-93 Key data sources

Source	Content
National Monuments Records of Scotland	Database of sites, monuments and buildings in Scotland maintained by Historic Environment Scotland (Canmore)
UK Hydrographic Office (UKHO)	Wreck register and relevant nautical charts
Heath/Ferguson Private Wreck Database	This database contains material not published by Ferguson (see Ferguson 1991) and has been added to by Heath and Ferguson as new discoveries of wreck sites have been made
Larn, R & Larn, B 1998 The Ship Wreck Index of Great Britain & Ireland Vol. 4 Scotland (SIBI)	Index of ship wrecks within Scotland

Source	Content
Whittaker IG 1998 Off Scotland: a comprehensive record of maritime and aviation losses in Scottish waters	Comprehensive database of 18,500 records
Flemming, N., 2004 Strategic Environmental Assessment of the North Sea Area SEA5	Process of appraisal
Flemming, N., 2003 Strategic Environmental Assessment of Continental Shelf Area SEA4	Guidance
Faber Maunsell & Metoc PLC, 2007 Scottish Marine Renewables: Strategic Environmental Assessment	Guidance
Astill, M., Firth, A., Gribble, J., 2008 UKCS Offshore Oil and Gas and Wind Energy Strategic Environmental Assessment: Archaeological Baseline.	Guidance

16.5 Surveys and Studies Carried out to Date

Desktop surveys

16.7 The desk-based assessment (DBA) of potential submerged cultural heritage has been completed in accordance with the Chartered Institute for Archaeologists (CIfA) Standard and Guidance for historic environment desk-based assessment (revised December 2014) and reviewed key data sources of known submerged sites within the Site. Potential wrecks or archaeological artefacts located in the wider area as identified in 16.8 are included in this assessment as their exact locations are uncertain, therefore they could possibly be within the Site or cable corridor and so there is the potential for adverse impact. All readily available archaeological and historical reports, databases and publications were consulted for information about the Study Area and, where used, are cited in the report.

Field surveys

16.8 The following surveys were used to inform this assessment. The survey data was collected by the Marine Scotland Science vessel, the MRV Scotia in 2014, between the Kyle of Tongue and 8 miles west of Thurso. This surveyed area includes the Site and cable corridor.

- Marine Scotland (2014a) MBES data as post processed XYZ data in txt file format which gives coordinate and depth information, accessed from the Marine Scotland website (http://www.gov.scot/Topics/marine/science/MSInteractive/datatype/Bathymetry/data/farr-point);
- Marine Scotland (2014b) dropcam footage in kmz format files for reviewing in Google Earth accessed from the Marine Scotland website (http://www.gov.scot/Topics/marine/science/MSInteractive/datatype/TV).

16.9 The detailed reviewing methodology for the MBES data and dropcam footage can be found in Appendix 16.1: Marine Historic Environment Technical Baseline Report.

16.6 Consultation

Pre-application consultation

16.10 Pre-application advice was sought by the Applicant from The Highland Council, Historic Environment Scotland, Marine Scotland and Scottish Government Planning.

16.11 The key points raised by stakeholders regarding the marine historic environment are presented in Table 16-2 and have been used to guide the assessment and inform this chapter.

Scoping feedback

16.12 The following stakeholder responses have been received specifically relating to this chapter (Table 16-2).

Table 16-94 Summary of scoping responses

Consultee	Comment	Relevance/Cross Reference
Historic Environment Scotland	There is potential for impacts on the historic environment. ES to include a detailed assessment of direct and indirect impacts on the historic environment, including the cumulative impact	See Section 16.9
Historic Environment Scotland	There are no HMPAs in the vicinity of the site or wider area	Section 16.8 and Appendix 16.1: Marine Historic Environment Technical Baseline Report
Historic Environment Scotland	The assessment should consider direct and indirect impacts on known and potential for impacts on unknown historic assets relating to disturbance and changes to the physical environment and coastal sediment dynamics of the area	Section 16.9
Historic Environment Scotland	There are various non-designated wrecks within the vicinity of the proposed Site. It is recommend that the potential impact on these be assessed with appropriate involvement of archaeological expertise as these could be subject to potential direct impacts, depending on the specific location of works and the subsea cabling route	Section 16.9

Consultee	Comment	Relevance/Cross Reference
Historic Environment Scotland	The potential for indirect impacts to historic assets on the seabed or at the coast edge within the proposed Site, and possibly beyond may be caused by alteration to tidal currents and sedimentary regimes, and by changes to the chemical balance of the water and seabed sediments which should also be assessed	Section 16.9
Historic Environment Scotland	A review of existing geophysical and geotechnical data shall be undertaken in the Site, including Marine Scotland's Multi-beam EchoSounder (MBES) data. We also note that targeted geophysical surveys (Sidescan Sonar, Magnetometer, Sub-Bottom Profiler) may also be proposed for preferred anchor locations and the subsea cable corridor. We would highlight the need for the extent and nature of the survey work to be sufficient for archaeological analysis to identify whether any cultural heritage remains are likely to survive within the search area	Section 16.9
Historic Environment Scotland	The report indicates the potential for evidence of the historic environment and human activity in terms of submerged landscapes, peat and post-glacial deposits in Sandside Bay and beneath intertidal sands. As such, we would encourage archaeological analysis of any geotechnical surveys which are likely to be undertaken as part of the overall survey work	Section 16.9
Historic Environment Scotland	We welcome the references to mitigation strategies and monitoring requirements and that these are to be agreed with the client and statutory authorities. We would be happy to provide comment on draft assessment methodologies and mitigation strategies if that would prove helpful	Acknowledged
Highland Council Historic Environment Team	All archaeological work, including cultural heritage assessments for environmental statements will be undertaken by a professional and competent historic environment professional and will accord with Highland Council Standards for Archaeological Work	Acknowledged

Consultee	Comment	Relevance/Cross Reference
Highland Council Historic Environment Team	Appropriate mitigation strategies will be formulated where adverse impacts are predicted	Sections 16.9 and 16.10
Highland Council Historic Environment Team	It should be noted that the east side of Sandside Bay is rich in archaeological features, including a number of wrecks in the bay; the Council's Historic Environment Record provides details. http://her.highland.gov.uk	Section 16.8 and Appendix 16.1: Marine Historic Environment Technical Baseline Report
Marine Scotland	The ES chapter will need to follow Highland Council Standards for Archaeological Work, specifically Sections 3 and 4, the latter of which considers Environmental Statements	Acknowledged
Marine Scotland	The assessment will include marine surveys as outlined in 8.140 of the scoping report	Section 16.9
Marine Scotland	The assessment will consider any potential impacts to upstanding features and also on the potential for buried remains, features and deposits to be present within the landscape. Areas subject to survey must be clearly marked on a map	Section 16.9
Marine Scotland	The indirect impact assessment will need to include a study of cumulative impacts	Section 16.9
Marine Scotland	Where impacts are unavoidable, HET expect proposed methods to mitigate this impact to be discussed in detail, including both physical (i.e. re-design) and where appropriate, compensatory and off-setting. HET are currently in direct discussion with the applicant's Historic Environment consultants	Section 16.9

Consultee	Comment	Relevance/Cross Reference
Scottish Government Planning	The ES should explore the potential for impacts to archaeological features, particularly due to seabed operations such as the placement of infrastructure anchors, burial of cables, landfall excavations, onshore site works and the placement of vessel anchors during installation, operation and decommissioning stages. For example, the presence of numerous historic wrecks in and around Sandside Bay, and Listed Buildings and sites with historic environment records located in coastal and terrestrial areas in proximity to the proposed onshore and landfall sites, should be considerations in the EIA	Acknowledged

16.7 Assessment Methodology

16.13 The overarching approach to the environmental impact assessment is described in Chapter 5: Environmental Impact Assessment Methodology. In addition to the overarching approach to assessment and the government legislation and policy outlined in Section 16.3 and presented in Appendix 16.1, codes of practice, professional guidance and standards directly relevant to the assessments of impacts have informed the assessment criteria, and are presented in Appendix 16.1.

16.14 The vulnerability (sensitivity) of each heritage asset or feature is summarised in Table 16-5 incorporates the guidelines used by statutory authorities and agencies such as:

- Scottish Government and Historic Environment Scotland, outlined in the Scottish Historic Environment Policy (SHEP) 2011; Planning Advice Note (PAN2/2011) Planning and Archaeology;
- The Marine (Scotland) Act 2010;
- English Heritage Designation Selection Guide: Ships and Boats, Prehistory to Present (2012); and
- Wessex Archaeology's three-part Assessing Boats and Ships 1860 – 1950 (2011).

16.15 Anomalies recorded in the analysis of the multi-beam echosounder data (MBES) were initially assigned a 'level of geophysical potential' assessed on the potential for the anomaly identified to be anthropogenic. This methodology is summarised in Table 16-6. Note that although classed as 'high', 'medium' and 'low', levels of geophysical potential do not imply an historical value to the anomalies – an anomaly may be of high geophysical potential (i.e. it looks anthropogenic) but may not be of historical importance.

Design envelope

16.16 As described in Chapter 5: Environmental Impact Assessment Methodology the design envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

16.17 The project description is set out in Chapter 4: Project Description. Specific assumptions relevant to the assessment in this chapter are described in Table 16-3:

- Moorings, clump weight and gravity anchors;
- Export cable burial depth;
- Rock armour for cable route;
- Horizontal directional drilling;
- Change in seabed dynamics; and
- Dredging of materials.

16.18 To ensure the assessment adequately covers all potential variations in the design, the realistic worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy. Therefore, for this assessment it has been assumed that the Project may impact the marine historic environment. These potential impacts are addressed by appropriate mitigation strategies, with avoidance being incorporated into the final design that will be developed post-consent.

Table 16-95 Design envelope parameters specific to marine archaeology

Design Envelope Parameter	Value / Description
Parameters of drag anchors (including dredging)	The platform may require up to two anchors on each mooring line so up to 16 drag embedment anchors in total The 8 mooring lines are each approximately 800 m long and may be slack. For the purposes of the assessment it is assumed that up to 75 % of each mooring line could come into contact with the seabed The anchors would have a maximum radius of 800 m from the platform centre and occupy an area of approximately 2 km^2 on the seabed Anchor size: 9 m by 9 m
Burial or armouring of Marine export cable	The export cable would be between 6 to 13.8 km in length, depending on the final position of the platform within the Site The export cable will be buried within a trench up to maximum 8 m wide and up to 2 m deep As a worst case it is assumed that a maximum of (20 %) 2.8 km of cable may require protection Cable protection – rock 2 m high by 8 m wide by 2,800 m long
Dredging for installation of clump weight	The plinth for the clump weight may require dredging to level the seabed. The plinth would measure approximately 70 m by 70 m and may need to be dredged to a depth of 5 m
Constructional vessel activities	Vessels unlikely to drop anchor in such deep water

Methods of prediction

16.19 For the marine historic environment, the potential ***effects*** are identified and significance of ***impact*** is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions.

16.20 A matrix approach has been used as a tool to inform the impact assessment. The significance of impact is based on best practice and expert judgment. Any impacts of 'moderate' or above are considered significant, in accordance with EIA guidance (SNH, 2013; CIEEM, 2010). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor (see Chapter 5: Environmental Impact Assessment Methodology for full details).

Magnitude of effect

16.21 The magnitude of any potential adverse direct and indirect impacts on marine cultural heritage caused by the development proposals are determined using the criteria outlined in Table 16-4. It should be noted that these categories are guideline criteria only, since assessments of magnitude are matters of professional judgment.

Table 16-96 Magnitude of effect

Magnitude of Effect	Description of Direct Impact	Description of Indirect Impact
High	Works would result in the complete loss of the site, or the loss of an area, features or evidence fundamental to the historic character and integrity of the site, severance of which would result in the complete loss of physical integrity.	The removal of, or a fundamental and irreversible change to, the relationship between a marine heritage asset or environment and a historically relevant seabed context. Major change that removes or prevents appreciation of characteristics key to a heritage asset, or permanent change to or removal of surroundings of a less sensitive asset or seabed context. A noticeable change to a key relationship between a marine heritage asset or environment and a highly sensitive, valued or historically relevant seabed context over a wide area or an intensive change to a less sensitive or valued asset or seabed context over a limited area.
Medium	Works would result in the loss of an important part of the site or some important features and evidence, but not areas or features fundamental to its historic character and integrity. Severance would affect the integrity of the site, but key physical relationships would not be lost.	Noticeable change to a non-key relationship between a marine heritage asset or environment and a historically relevant seabed context. Relationship, asset, or context tolerant of moderate levels of change. Small changes to the relationship between a heritage asset and a historically relevant seabed context over a wide area or noticeable change over a limited area.

Magnitude of Effect	Description of Direct Impact	Description of Indirect Impact
Low	Works or the severance of the site would not affect the main features of the site. The historic integrity of the site would not be significantly affected.	Minor changes to the relationship between a heritage asset or environment and a historically relevant seabed context over a wide area or minor changes over a limited area. Relationship, asset, or context considered tolerant of change.
Negligible	A very slight change, which is barely distinguishable, and approximates to the ‘no change’ situation.	A very slight change, which is barely distinguishable, and approximates to the ‘no change’ situation.

Vulnerability of receptor

16.22 Vulnerability of receptor takes into account various aspects of the historic asset such as its rarity, the completeness of the feature, whether it is a good example of its type, the historical or cultural associations of the feature and the value given to the feature by the local community. It also assesses the potential value of the historic environment asset for education, as a research resource, tourism or place-making purposes. Features for which further information is unavailable are recorded as being of uncertain importance. A set of guideline criteria for determining vulnerability of the historic assets are set out in Table 16-5.

Table 16-97 Vulnerability of the marine historic environment asset

Vulnerability	Description
High	Archaeological and historical sites, submerged prehistoric landscapes and deposits, wrecks, wreck cargos, or areas of international or national importance, including world heritage sites, designated wrecks (designated under UK or Scottish legislation) or Historic Marine Protected Areas (HMPAs). Shipwrecks dating to the prehistoric, Norse and Medieval periods, which are very rare; wreck cargos which contain rare artefacts or artefacts representative of a particular area or time period; and vessels, including aircraft lost in international conflicts which may have involved large losses of life. Shipwrecks involved in national or international trade, which were lost before 1913, a period during which the shipping industry was a major element in Britain’s world influence, particularly if their cargo survives, or the remains provide evidence of changes in construction technology or vessel design would also be considered of high importance.
Medium	Archaeological and historical sites, wrecks, wreck cargos and areas of regional importance. This would involve shipwrecks, shipwreck cargos, anchorages and fishing areas from before 1913 that would have been involved in regional industry and trade. Wrecks and cargos considered representative of the changes in naval engineering or support the identification and preservation of the diversity of vessels from this period are considered of medium

Vulnerability	Description
	importance.
Low	Locally important sites, wrecks, wreck cargos or areas. Shipwrecks dating from after 1913 relating to fishing, ferrying or other coastwise trade. Wreck cargos of limited intrinsic, contextual or associative characteristics, or that are commonly recovered are considered of low importance.
Negligible	Features that have been recorded but assessed as having no archaeological or historical interest, such as recent wrecks, or those wrecks whose structure or cargos have been so damaged that they no longer have any historical merit.
Uncertain	Features that cannot be identified without detailed work, but potentially of some interest. Also, for example, if the date of construction or rarity of a vessel is not known, but is potentially of some interest. Findspots, which may represent an isolated find, or could represent the location of a hitherto unknown site. Unidentified geophysical anomalies are also of uncertain importance and have been divided up further in Table 16-6.

16.23 A set of guideline criteria for determining potential of geophysical anomalies is listed in Table 16-6.

Table 16-98 Definitions for level of geophysical potential

Level of Geophysical Potential	Criteria
High	Anomaly looks anthropogenic (atypical in its context); or there is identifiable cultural material; or it is in the area of a known archaeological site, or another anomaly identified to be of high potential.
Medium	Anomaly lies in an area of intensive human activity such as near ports or areas of peat and other features relating to submerged landscapes. It would also be considered for an anomaly that is possibly anthropogenic, but which has no definite identification.
Low	Anomaly is likely to be a natural formation such as a sand dune or bedrock formation. It could also be a processing error of the geophysical data.

Significance of impact

16.24 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact. The significance of impact is based on best practice and expert judgment. While there is no specific guidance for other marine users, any impacts of 'moderate' or above are considered significant, in accordance with EIA guidance (SNH, 2013). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor. The evaluation of impact significance is informed by the matrix presented in Chapter 5 and by the professional judgment of the assessment team.

Table 16-99 Significance matrix

Vulnerability of receptor	Magnitude of effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

Data gaps and uncertainties

16.25 The data sources consulted during the DBA and the geophysical survey data analysed are considered sufficient for an adequate baseline assessment on which to base an impact assessment, although there were limitations in regard to the geophysical survey:

- Limited geophysical data, only a MBES survey carried out by Marine Scotland (MS) was available for analysis (for example, there was no sidescan sonar or magnetometry data available for review);
- The MS MBES survey data was gridded and reviewed at 4 m rather than 2 m resolution due to file corruption issues. Although of a lower resolution than the actual survey data (supplied at 2 m resolution) the reviewer concluded that this was still acceptable for identifying and analysing any anomalies present within the surveyed data.
- There were unsurveyed areas in the actual MS MBES dataset, to the east and inshore of the Site;
- Uncertainties in the location of some of the shipwrecks – identified as UV (unverified) or PA (position approximate); and
- There was limited geotechnical data available for review.

16.26 However, in order to avoid significant impacts on the historic environment, an additional appropriately detailed geophysical survey should be conducted prior to construction, this would resolve the limitations to the geophysical datasets. The geophysical data should undergo archaeological analysis, along with any geotechnical data gathered. This is in-line with the scoping feedback received from Historic Environment Scotland.

16.27 The project description is set out in Chapter 4: Project Description.

16.8 Description of the Current Environment

The site: Shipwrecks

16.28 There are no Historic MPAs or designated wrecks and military remains in the Site. There are no charted ship or aircraft wreck sites (i.e. with known locations) in the area. The nearest charted wreck is the pre-dreadnought Battleship HMS King Edward VII which is 3.5 km to the north of the northern edge of the Site.

16.29 There may be one shipwreck of high importance (HMT *Orsino*) somewhere within the area. There could be unknown wrecks, aircraft and unexploded wartime ordnance in the area. However, none is known and none has been identified in the available survey data.

16.30 The HMT *Orsino* (Canmore 214438) is considered to be of high importance because there was a loss of life and there is the potential that some of the crew went down with the ship; a requisitioned steam trawler left Loch Eribol for Stromness to patrol the swept channel off the north coast of Scotland on the 28 Sept 1916 but failed to reach her destination. In October 1916, a section of the wheelhouse washed ashore in the Bay of Ireland with shell fragments embedded (ADM. 1/8468/232). Six men died in the attack by U55 and four were taken prisoner by the U Boat. Canmore has HMT *Orsino* listed as 'Between Loch Eriboll? (sic) and Stromness'; Between Loch Eriboll and the Islands'; Pentland Firth'' and its actual position remains unknown. U55's KTB (Kriegstagebücher) (War Day Book) shows that the attack took place in grid square 043 alpha (Figure 16-2). Although this is just to the east of the Site, it is possible that with the poor visibility, the U-boat was not 100 % sure of her position and HMT *Orsino* may have been sunk in the area of the offshore Site or cable route. Also in pencil on the inner margin of the KTB page it states 10 miles from Thurso. This again places HMT *Orsino* east of the proposed Site. If identified, this vessel is of high importance as none of the six men killed in the attack were recovered and the vessel would be considered a war grave.

16.31 Within the Marine Scotland (MS) MBES data there is an anomaly 4.6 km north east of the Site with dimensions that make it a possible target for HMT *Orsino*. However, without ground-truthing it is also possible that this could be another unnamed vessel, or a large glacial erratic. The lack of complete MBES survey coverage for the Site and export cable corridor means that HMT *Orsino* could lie within the unsurveyed part of the Site and export cable corridor.

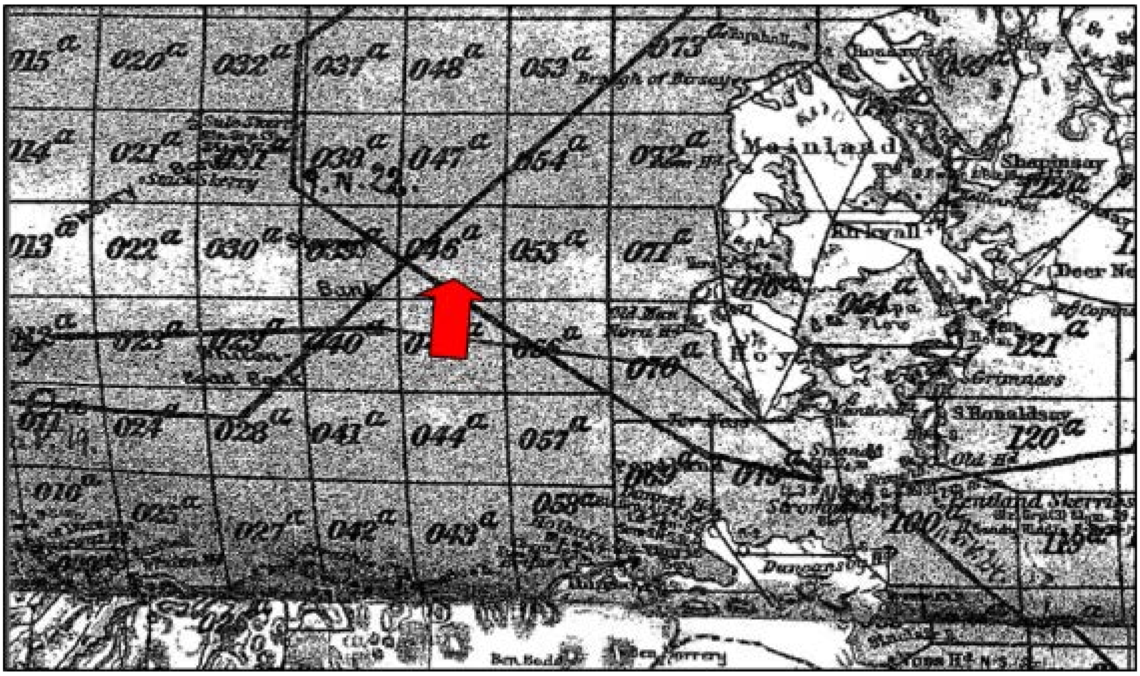


Figure 16-41 KTB Chart showing location of grid square 043 alpha where U55 reported attacking HMT Orsino (ML U55/11 /12)

16.32 Two MBES anomalies were observed in the geophysical assessment (MBES01 and MBES02) that fall within the Site. One anomaly, MBES01 was considered to be of medium geophysical potential (possibly anthropogenic) while MBES02 was considered to be of low geophysical potential.

16.33 As noted in paragraph 16.53 there is a low probability for the preservation of submerged landscapes, palaeoenvironmental evidence and prehistoric cultural remains in the Site due to the water depth in the area.

16.34 No data was available to be able to assess the extreme northeast corner of the Site, which is not covered by the MS MBES data. This data gap is in the configuration of an upside-down, right angle triangle measuring 0.6 km west to east at the northeast corner of the Site and then 2.8 km north to south.

Cable corridor - Shipwrecks

16.35 There are no Historic MPAs or designated wrecks and military remains in the cable corridor. There are no charted ship or aircraft wreck sites (i.e. with known locations) in the area.

16.36 There may be one shipwreck of high importance (HMT *Orsino*) somewhere within the area. There could be unknown wrecks, aircraft and unexploded wartime ordnance in the area. However, none is known and none has been identified in the available survey data.

16.37 There are nine wrecks dating from the late 18th to the 20th century that are recorded as located in or close to Sandside Bay, or towards Dounreay, at the south end of the cable corridor. However, none has a known location. There are no available survey data for Sandside Bay to be able to further assess the likelihood. If present, eight shipwrecks (the Unknown Sloop, *Anglia, Elizabeth Miller, Belvedere, Audrey, Lady Kyth, Pearl, Young Alexander* and an unknown vessel recorded in 1847 as parts of the masts of a vessel standing out of the water) are likely to be of low importance due to there being good historical records for their various methods of construction, low interest cargo, likely salvage and breaking up in the highly dynamic breaking wave regime along the shoreline. Two wrecks are considered of negligible importance as they are modern vessels of no historical interest. These are the Trawler BF 394 *Arnisdale* (Canmore 288543), a fishing vessel wrecked below Dounreay 13 April 1984; and the Fishing Vessel Audrey (Canmore 288544), stranded between Sandside Bay and Dounreay 30 July 1992.

16.38 No MBES anomalies were recorded in the cable corridor. However, the eastern edge of the cable corridor for a width of 0.5 km is not covered by the MS MBES data, and where the cable corridor approaches Sandside Bay there is no MBES data in waters shallower than 27 m, for a distance of 2 km to the coastline.

16.39 As noted in paragraph 16.54, it is possible that areas of preservation of submerged landscapes, palaeoenvironmental evidence and prehistoric cultural remains may lie in the cable corridor, which has depths shallower than 50 m. Items may be present in the gullies, and in sediments around the bedrock outcrops around the near-shore section.

16.40 If the sediments in Sandside Bay are stable, then there is a moderately high probability that there will be evidence of submerged landscapes, submerged peat and postglacial tsunami deposits beneath the sands in the bay, the intertidal zone and possibly the dunes. This is all potential evidence of the historic environment and for human activity in the area. Evidence of tsunami deposits dated approximately between 6507 – 6260 cal BC and 6228 – 6029 cal BC, have been found at the mouth of Strath Halladale only 8 km west of Sandside Bay (Dawson & Smith 2000; Smith *et al.*, 2004).

16.41 The locations of all potential archaeological sites and anomalies identified by the DBA and the geophysical data assessment are shown in Appendix 16.1: Marine Historic Environment Technical Baseline Report. These are discussed below.

Shipwrecks

16.42 Eleven shipwreck sites are listed on the Canmore database and Whittaker (1998) that may be in or close to the area, because the precise locations of their sinking are unknown and descriptions included within details of their circumstance of loss indicate the possibility; these are summarised in Appendix 16.1: Marine Historic Environment Technical Baseline Report. None has been identified from the MBES survey data, but there is a lack of complete coverage of MBES survey data for the Site and export cable corridor, on the east edge of the area and the southern 2 km into Sandside Bay. Thus it cannot be ruled out that these wrecks lie within the area.

16.43 As a maritime nation with a reliance on marine based trade and exchange, there have been countless shipwrecks around UK waters from all periods – many of which remain unreported. As such there is a high probability for unknown, unrecorded vessels to have sunk in the Site. Remains of such vessels and their associated artefacts may not be visible in geophysical data – constructed from materials that do not provide strong geophysical or magnetic returns or buried beneath the surface of the seabed.

Non-sub contacts

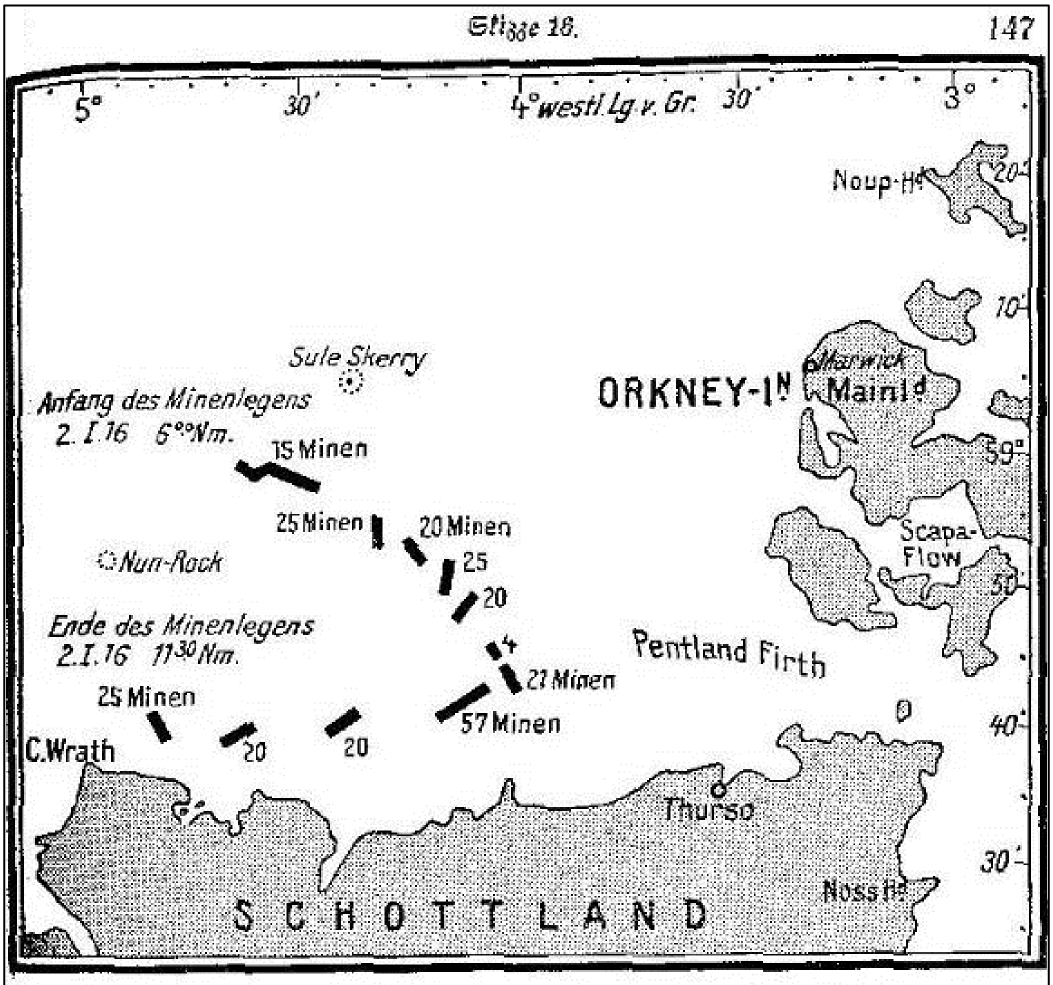
16.44 A Non-sub contact is a sonar contact detected during wartime submarine searches that are not submarines. The identity of these contacts is unclear – they have the potential to be shipwrecks or other anthropogenic features, or they can be natural. Two Non Sub Contacts had been reported outside the Site and export cable corridor. These were subsequently investigated and are now listed as dead by the UKHO. Non-sub contact (UKHO 939) is 1.9 km east of the Site while Non-sub contact (UKHO 945) is 4.3 km to the north east of the Site and, therefore, they are not discussed any further.

Aviation losses

16.45 There are no known aircraft losses in the proposed area but a number of aircraft have gone ‘’missing’’ off the north coast of Scotland so the possibility remains of finding one here. Any aircraft found is automatically protected under the Protection of Military Remains Act 1986 if lost on active service. These would be considered of high importance.

Unexploded ordnance

16.46 One of the largest German minefields was laid to the north of mainland Scotland by surface raider SMS *Möwe* in January 1916 (Figure 16-3). This was known to the British as the Whitten Head Field and had over 250 mines. By the end of April 1916 the Royal Navy had accounted for 70 of these mines and considered the field cleared. However, there is the possibility that live mines from the Whitten Head minefield could have drifted into the cable corridor either as a result of minesweeping operations or mines having broken free of their moorings; therefore, there is the potential for unexploded ordnance in the Site.



Minenunternehmung des Hilfskreuzers „Möwe" vor dem Pentland Firth am 2. Januar 1916.

Figure 16-42 The Whitten Head Field

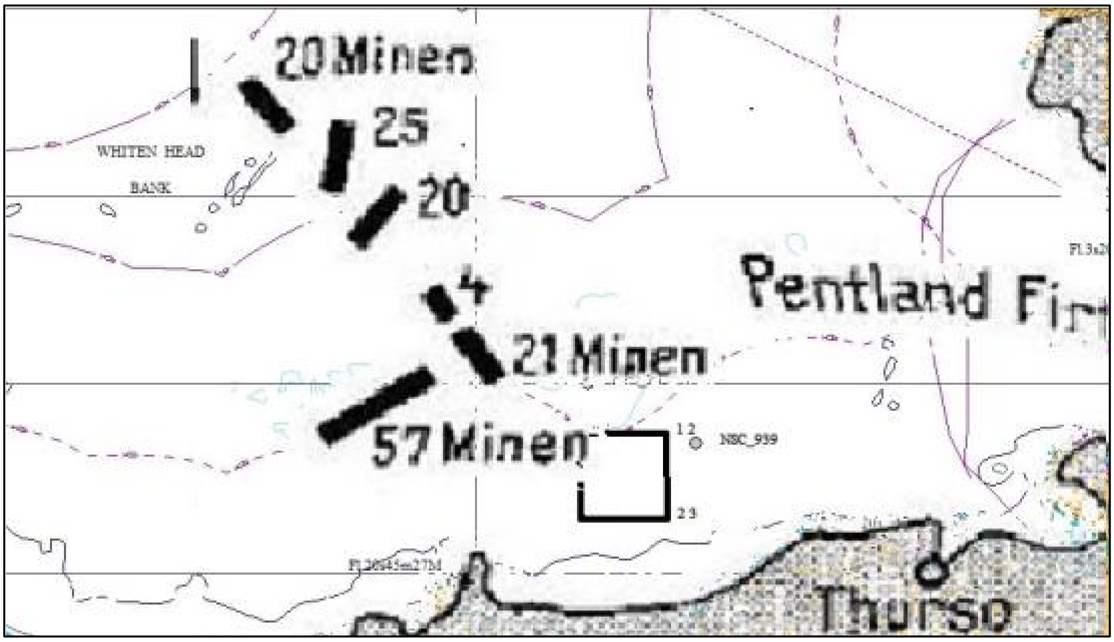


Figure 16-4 The Whitten Head Möwe minefield overlaid on the chart showing the proximity to the proposed area

Multi-beam echoSounder anomalies

16.47 The MBES data and dropcam images show the survey area to be flat seabed with some smaller bedforms concentrated along the cable corridor.

16.48 Two MBES anomalies were observed in the geophysical assessment (MBES01 and MBES02) that fall within the Site. No anomalies were identified within the cable corridor. One anomaly, MBES01, was considered to be of medium geophysical potential due to its distinctive linear nature and associated scour marks (possibly anthropogenic) while MBES02 was considered to be of low geophysical potential. Images, measurements and descriptions of each anomaly are provided in Appendix 16.1: Marine Historic Environment Technical Baseline Report.

Potential for submerged landscapes and cultural remains

16.49 Hominids and humans have occupied the UK Continental Shelf (UKCS) at various times for more than 700,000 years, but archaeological finds showing these are incredibly rare. Although in general terms, the potential for submerged prehistoric archaeology and landscapes across wide areas of the UKCS is high (Wessex Archaeology 2009, 9), the potential for site preservation in areas of the shelf deeper than 80 m is low (Flemming 2003: 16).

16.50 The Site is within Zone 4 of the Strategic Environmental Assessment (SEA) of the Continental Shelf (SEA4, Flemming 2003). The potential for the survival of submerged landscapes and prehistoric sites in the Site is influenced by various physical factors, processes and topography with sheltered areas with lower seabed water movements, deep sediment deposits in rocky gullies and depressions and sea caves often providing conditions suitable for good site preservation (Flemming 2003: 15 – 21).

16.51 The MS MBES survey data and dropcam images indicate that the Site and export cable corridor comprises flat seabed with bedrock covered by sediments, largely comprising silty fine sand with patches of mixed gravel, pebbles, cobbles, shells and occasional boulders. Without further marine geophysical (sub-bottom profile) data and/or coring, it is not possible to tell from the currently available data how thick the sediments are, and thus it is not possible to tell how the substrate might affect the preservation of any cultural heritage remains, or if there is potential for remains or palaeolandscape deposits to be buried below the seabed surface.

16.52 There is low potential for the preservation/identification of submerged landscapes and prehistoric sites in the area of the Site, which is located in waters deeper than 50 m, since Flemming (2003: 6; Figure 6) indicates that relative sea level in this area was only 40-50 m lower at the end of the last Ice Age. However, the cable corridor has depths shallower than 50 m and therefore has the potential for preservation of submerged prehistoric artefacts and palaeolandscape remains. This will be especially true closer to the shore in Sandside Bay.

16.53 If the sediments in Sandside Bay are stable, then there is a moderately high probability that there will be evidence of submerged landscapes, submerged peat and postglacial tsunami deposits beneath the sands in the bay, the intertidal zone and possibly the dunes. This is all potential evidence of the historic environment and for human activity in the area. Evidence of tsunami deposits dated approximately between 6507 – 6260 cal [38]BC and 6228 – 6029 cal BC, have been found at the mouth of Strath Halladale only 8 km west of Sandside Bay (Dawson & Smith 2000; Smith *et al.*, 2004).

16.9 Identification of Potential Impacts

16.54 The following potential impacts relevant to the marine historic environment were identified using project-specific parameters and Historic Environment Guidance for Wave and Tidal Energy (Firth 2013), produced for English Heritage, Historic Environment Scotland & CADW as potentially being associated with the Project.

16.55 Direct impacts predominantly occur during the construction and installation phase of the Project, but to a lesser extent occur during operation and maintenance phase or decommissioning (Firth 2013: 18). These impacts could include potential damage to or destruction of either known or unknown marine cultural heritage assets through:

- The deployment or removal of Floating Wind Turbine structures;
- The deployment or removal of the gravity base foundations for the Floating wind turbine structure, including dredging;
- The excavation of any trenches for the deployment of the export cable along the route and at landfall;
- The laying, anchoring or removal of mooring cables and export cables and any associated armour or cable protection and stabilisation methods; and
- The deployment/removal of maintenance vessel anchors.

16.56 Indirect impacts predominantly occur during the operational phase of the Project, but may to a lesser extent occur during construction and installation (Firth 2013: 18). Potential indirect impacts include potential damage to or destruction of either known or unknown marine cultural heritage assets through:

- The disturbance of sediment around and forming the context of the site (scouring) in response to potential changes in sediment dynamics; and
- The deposition of sediment around and forming the context of the site in response to potential changes in sediment dynamics.

[38] cal. –calibrated date: conversion of conventional radio carbon age date to standardised calendar years

16.57 The potential for indirect impacts as a result of scouring or sediment deposition is considered to be minor, but of unknown extent. Potential impacts of the development on the seabed are evaluated in Chapter 6: Physical and Coastal Processes and are found to be minor or negligible in all cases, and project wide mitigation measures will be implemented to further reduce all assessed impacts in Chapter 6.

Potential impacts in the construction phase

16.58 During construction and installation, direct impacts on cultural material on the seabed could be caused by the installation of the floating wind farm platform and gravity anchors for catenary cables. The deployment of gravity anchors is considered to have greater potential impact on marine cultural heritage as they penetrate the surface resulting in complete destruction of any cultural heritage beneath and in the immediate vicinity of the anchors, and by the dredging of seabed for installation of the clump weight.

16.59 Direct impacts on cultural material on the seabed could also be caused by the excavation of any trenches for the export cable along the cable route and at the landfall – which would result in the removal of marine cultural heritage or removal of material that forms the context of the site.

16.60 The laying and anchoring of surface-laid mooring and export cables and their associated armour or cable protection and stabilisation methods also have the potential to cause direct impacts to cultural material on the seabed. Installation of rock placement, concrete mattresses and armoured cabling (which is likely to be heavier) could cause direct damage to marine cultural heritage through compression.

16.61 Finally, direct impacts on cultural material by compression could be caused by the dropping of vessel anchors onto cultural heritage during construction and installation.

Potential impacts in the operations and maintenance phase

16.62 During operation and maintenance, it is possible that direct impacts to cultural material on the seabed could be caused by maintenance vessels dropping anchors on the seabed during routine inspections or preventative maintenance or by the removal of devices for general maintenance.

16.63 There is potential that movement of the mooring cable could expose areas of seabed which could affect sites of cultural heritage interest (if present). However, such movement is considered to be very unlikely due to the cables being anchored or buried.

16.64 Changes to local seabed dynamics could affect unknown historic site formation processes.

Potential impacts in the decommissioning phase

16.65 Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.

16.10 Impact Assessment – Construction Phase

Potential direct damage to or destruction of known marine historic environment assets

16.66 Using the Design Envelope approach (Table 16-3), it is assumed that there could be major direct impact on historic sites in the Site and, as the specific route of the floating wind farm platform and export cable route have not yet been determined. The significance of the impact takes into account the sensitivity of the receptor and the magnitude of the impact to determine the potential consequence.

16.67 The significance of direct impacts for geophysical anomalies of medium or low geophysical potential identified in Appendix 16.1) is summarised in Table 16-8 below. These anomalies are considered to be of uncertain importance and have the potential to be significant until proven otherwise.

16.68 In line with the Design Envelope approach that assumes all sites in the Site could be impacted, it is predicted that there could be significant impacts on two MBES anomalies within the Site. However, it may be possible to avoid them when designing the locations of the tidal turbine floating platform, cable connection hubs and routing of the mooring and export cables (see mitigation measures in Table 16-10).

Table 16-100 Potential direct impacts on marine historic environment assets – geophysical anomalies

Site	Proximity	Level of Geophysical Potential	Importance (Sensitivity) of receptor	Magnitude of Effect	Significance
MBES01	Site	Medium	Uncertain	High	Uncertain/ Major
MBES02	Site	Low	Uncertain	High	Uncertain/ Moderate

Potential direct damage to or destruction of unknown marine historic environment assets

16.69 There are 11 shipwreck sites that may be within or close to the Site listed on the Canmore, Highland Council HER databases and Whittaker (1998). Using the Design Envelope approach, it has been assumed that there could be a major direct impact on these sites.

16.70 However, the likelihood of direct impact on these possible shipwrecks is considered low since they have not been observed in the assessment of the MBES geophysical data so far obtained and if they are present, it is likely their remains will be identified as anomalies in further geophysical survey that should be undertaken to fill the data gaps as post consent mitigation (see Section 16.5 for areas that have not been surveyed at all, the types of geophysical survey that have not been undertaken, and mitigation measures to address this) and can therefore be avoided.

16.71 The significance of possible direct impacts on shipwreck sites within unverified locations is summarised in Table 16-9. Impacts on the non-sub contact identified during the DBA and anomaly MBES 02 are not considered as these features are not considered to be anthropogenic.

Table 16-101 Impact significance – shipwreck sites with unverified locations

Site	Proximity	Sensitivity of receptor	Magnitude of effect	Significance
Anglia	Unknown (possibly within cable corridor)	Low	High	Moderate

Site	Proximity	Sensitivity of receptor	Magnitude of effect	Significance
Arnisdale	Unknown (possibly within cable corridor)	Negligible	High	Minor
Audrey	Unknown (possibly within cable corridor)	Negligible	High	Minor
Belvedere	Unknown (possibly within cable corridor)	Low	High	Moderate
Elizabeth Miller	Unknown (possibly within cable corridor)	Low	High	Moderate
HMT Orsino	Unknown (possibly within cable corridor)	High	High	Major
Lady Kyth	Unknown (possibly within cable corridor)	Low	High	Moderate
Pearl	Unknown(possibly within cable corridor)	Low	High	Moderate
Unknown	Unknown (possibly within cable corridor)	Low	High	Moderate
Unknown Sloop	Unknown (possibly within cable corridor)	Low	High	Moderate
Young Alexander	Unknown (possibly within cable corridor)	Low	High	Moderate

16.72 A change in seabed dynamics resulting from the addition of the floating wind farm and cable export may affect site formation processes in any unknown wrecks located within or near by the Site.

16.11 Impact Assessment – Operation and maintenance phase

Potential direct damage to or destruction of known and unknown marine historic environment assets

16.73 During operation and maintenance, it is possible that direct impacts to cultural material on the seabed could be caused by maintenance vessels dropping anchors on the seabed during routine inspections or preventative maintenance or by the removal of devices for general maintenance.

16.74 However, it is anticipated that as the devices are likely to be located in deep water, maintenance vessels are more likely to moor up rather than anchor. It is also predicted that the removal of the device will have no damaging impact further to any that occurred in the construction and installation phase is predicted. No direct impacts on known or previous unrecorded marine cultural heritage are therefore predicted.

16.75 There is potential that movement of the mooring cable could expose areas of seabed which could affect sites of cultural heritage interest (if present). However, such movement is considered to be very unlikely due to the cables being anchored or buried, further geophysical survey will ensure that there are no adverse effects on cultural heritage sites from the export cable.

Potential indirect damage to or destruction of known and unknown marine historic environment assets

16.76 The potential for indirect impacts to cultural material on the seabed as a result of scouring or sediment deposition during operations and maintenance was evaluated but these were not considered significant. Potential impacts of the development on the seabed (including scouring and sediment deposition) are evaluated in Chapter 6: Physical and Coastal Processes and are not considered to be significant.

16.12 Impact Assessment – Decommissioning

Potential direct damage to or destruction of known and unknown marine historic environment assets

16.77 There is an insignificant risk of potential impacts on marine archaeology or cultural heritage during decommissioning. This is assessed as not significant as any wrecks or anomalies of archaeological importance will have either been avoided as part of Project design and therefore will not be directly impacted during decommissioning, or where avoidance was not possible will already have been impacted after being investigated and recorded prior to installation.

Potential indirect damage to or destruction of known and unknown marine historic environment assets

16.78 There are no indirect impacts on known and unrecorded marine cultural heritage predicted during decommissioning.

16.13 Mitigation Measures

16.79 The principal mitigation is to consider the presence of cultural heritage material in advance of cable installation and position cable anchors and trenches in locations which will avoid impacts. Project mitigation will eliminate or reduce impacts to an acceptable level that they are no longer significant.

16.80 This Project mitigation strategy will be informed by results from further geophysical and geotechnical surveys of the Site undertaken to fill the data gaps (in terms of techniques and in areas not surveyed). The surveys may include MBES, side-scan sonar, sub-bottom profiler, seabed sampling, magnetometer and ROV surveys. These will inform the detailed design.

16.81 Project commitments, described in Chapter 4: Project Description, which comprise general measures relevant to the mitigation of impacts on the marine historic environment, which will be agreed with relevant consultees prior to commencement of works, will include:

- GM32 A written scheme of investigation, to include cross-referencing with construction and environmental management plans, and inductions on any marine historic environment assets to avoid; and
- GM 33 An agreed reporting protocol for the accidental discovery of cultural remains in line with The Crown Estate (2014) Protocol for Archaeological Discoveries: Offshore

Renewables Projects, http://www.thecrownestate.co.uk/media/148964/ei-protocol-for-archaeological-discoveries-offshore-renewables-projects. pdf.

Specific mitigation

16.82 Measures listed below will be implemented to minimise impacts on the Historic Environment. Depending on the results from any geophysical surveys or detailed examination, appropriate management and mitigation strategies will be developed in consultation with Hexicon AB and the statutory authorities (Marine Scotland, Historic Environment Scotland, The Highland Council). This will include specific measures that are considered to be appropriate and practical for a site of this nature as listed in Table 16-10 describes mitigation measures specific to the historic environment.

Table 16-102 Mitigation measures specific to the Historic Environment

Ref	Title	Description
ACH1	Avoidance	All sites of high importance and, sites of potential archaeological or cultural heritage importance will be avoided through Project design e.g. placement of floating wind farm platform anchors and dredging for them, and location of export cables route. Geophysical anomalies identified from only a single type of response may be given an avoidance buffer of 20 m, while anomalies identified from further geophysical surveys may be given an avoidance buffer of 50 m. This is in order to take account of a potential debris scatter field around a wreck, or a multiple response representing the tip of a wreck that extends further than the core location of the anomaly. This may result in layout redesign to avoid highly sensitive remains.
ACH2	Archaeological Survey and Recording	Where layout redesign and avoidance are not possible, targeted archaeological survey (high resolution remote sensing survey/drop down camera/Remote Operated Vehicle (ROV) survey/geotechnical) is to be undertaken to identify the nature, extent and potential importance/sensitivity of any remains of potential archaeological or cultural heritage importance affected by the Project. Archaeologically significant remains necessitate full archaeological recording and reporting, conducted by experienced maritime archaeologists.

16.14 Residual Impacts

16.83 Significant potential impacts on the marine historic environment were only predicted during the construction and installation phase. None were predicted for the subsequent operations, maintenance and decommissioning phases.

16.84 Implementation of the above management and mitigation strategies for direct impact on known and unknown cultural heritage (even if the location is unverified) during construction and installation, will eliminate, reduce or manage any significant impacts to an acceptable level, resulting in no significant residual impacts (Table 16-11 and Table 16-12).

Table 16-103 Residual impacts for direct impacts on cultural heritage during construction and installation

Site	Importance (Sensitivity) of Receptor	Magnitude of Effect	Significance
Anglia	Low	Negligible	Negligible
Arnisdale	Negligible	Negligible	Negligible
Audrey	Negligible	Negligible	Negligible
Belvedere	Low	Negligible	Negligible
Elizabeth Miller	Low	Negligible	Negligible
HMT Orsino	High	Negligible	Minor
Lady Kyth	Low	Negligible	Negligible
Pearl	Low	Negligible	Negligible
Unknown	Low	Negligible	Negligible
Unknown Sloop	Low	Negligible	Negligible
Young Alexander	Low	Negligible	Negligible
MBES01	Medium	Negligible	Negligible
MBES02	Low	Negligible	Negligible

16.85 The implementation of the mitigation measures outlined in Section 16.12 above, with avoidance of potential sites where possible incorporated into the Project design as the primary strategy, will eliminate or minimise impacts on the marine historic environment to a level that is not significant. The instigation of a reporting protocol for the accidental discovery of cultural remains will minimise impact on unknown sites.

16.86 The gravity anchors, dredging for them, catenary cables securing the floating wind farm platform and the export cable on route or at landfall could have a direct destructive impact on marine cultural heritage as a result of the penetration or removal of marine cultural heritage. Cable armour and cable protection through rock placement and concrete mattresses could have a direct destructive impact on marine cultural heritage as a result of compression of any remains.

Accidental and unplanned events

16.87 Strategies for accidental or unplanned impacts on marine cultural heritage are addressed within the mitigation measures (Section 16.12) above. The highest risk would be disturbing an unknown wreck, or dragging through an avoided feature during an unplanned or accidental event. Overall the likelihood of such events will be minimised through general HSE management systems and the residual risk of an incident leading to damage is rather small. Consequently, the likelihood of impact is considered low to negligible.

16.15 Cumulative Impacts

16.88 Cumulative impacts are impacts on the marine historic environment caused by planned and consented wave, tidal or wind or cable constructions/developments in the marine area. In-combination impacts are impacts on the marine historic environment as a result of the Project combined with impacts from other marine activities or users of the sea.

16.89 There is potential for cumulative impacts to arise from the development of a number of other projects in the nearby area (see Chapter 5: Environmental Impact Assessment Methodology for map of developments in nearby area):

- The SHE-T Orkney-Caithness interconnector cable;
- HIE Dounreay Demonstration Centre (DDC);
- Brims Tidal Array, Brims Ness; and
- MeyGen, Inner Sound.

16.90 The consideration of projects that could result in potential cumulative impacts is assessed based on the results of the impact assessment, together with expert judgement of the specialist consultants.

The SHE-T Orkney-Caithness interconnector cable and HIE Dounreay Demonstration Centre

16.91 The proposed HIE Dounreay Floating Offshore Wind Deployment Centre development in the area adjacent to the Site would result in cumulative impacts on the marine historic environment as the proposed developments are in close proximity. These impacts would be assessed in the Environmental Statement for the HIE Dounreay Floating Offshore Wind Deployment Centre as this project design is currently unknown.

Brims Tidal Array, Brims Ness and MeyGen, Inner Sound

16.92 The proposed Orkney-Caithness interconnector cable, the Brims Tidal Array project and the MeyGen project will disturb comparatively small areas of seabed, often comprising bedrock rather than deposits, and are avoiding known marine historic environment assets through project design.

16.16 Summary and Conclusions

- No sites with statutory designations, no aircraft and no submerged landscape deposits have been identified that will be impacted.
- The likelihood of direct impact on shipwrecks with unverified locations is considered low since they have not been identified in the assessment of the geophysical data gathered so far, and should be identified as anthropogenic anomalies in future geophysical surveys conducted to fill the data gaps, and thus can be avoided.
- Two multi-beam echosounder (MBES) anomalies were identified, which can be avoided. Further geophysical survey is recommended to fill the data gaps, which would inform further on the marine historic environment of the Site, and allow for avoidance of impacts by project design.
- Significant potential impacts on the marine historic environment were only predicted during the construction and installation phase. None were predicted for the subsequent operations, maintenance and decommissioning phases.

- Avoidance of known sites incorporated into the Project Design is considered the primary strategy to eliminate or minimise impacts on the marine historic environment.
- The instigation of a reporting protocol for the accidental discovery of cultural remains is recommended to minimise impact on unknown sites.
- Implementation of the suggested management and mitigation strategies will eliminate, reduce or manage any significant impacts to an acceptable level, resulting in no significant residual impacts.

16.93 Table 16-12 summarises the residual impacts.

Table 16-104 Summary of residual impacts on marine historic environment

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through excavation (e.g. cable ploughing, jetting, vertical injection)	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through compression (e.g. rock armour, anchors, etc)	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through dredging	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through burial (e.g. drag embedded anchors)	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through mooring lines and cable coming into contact with the seabed	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through pre-laying grapnel run	Low	Negligible	Negligible
A change in seabed dynamics resulting from the addition of the floating wind farm and cable export may affect site formation processes in any unknown wrecks located within or near by the Site	Low	Negligible	Negligible
Operations and Maintenance			

Potential Impact	Magnitude	Vulnerability	Overall Significance
A change in seabed dynamics resulting from the addition of the floating wind farm and cable export may affect site formation processes in any unknown wrecks located within or near by the Site	Negligible	Negligible	Negligible
Movement of the mooring cable could expose areas of seabed which could affect sites of cultural heritage interest	Negligible	Negligible	Negligible
Decommissioning			
A change in seabed dynamics resulting from the addition of the floating wind farm and cable export may affect site formation processes in any unknown wrecks located within or near by the Site	Negligible	Negligible	Negligible

17 Other Users of the Marine Environment

17.1 Introduction

17.1 This chapter presents the assessment of the impacts on human activities other than the main users in the marine environment within the vicinity of the Project by considering diverse interests such as subsea cables and utilities (including electrical and telecommunications), military activity, oil and gas activities, marine renewables, waste disposal and aggregate extractions.

17.2 The main user groups in the marine environment including commercial fisheries, shipping and navigation and recreational interests are addressed in Chapters 12, 13 and 18 respectively. Socio-economic impacts are also discussed in Chapter 18.

17.3 Navigational impacts on all users of the marine environment are addressed in Chapter 13: Shipping and Navigation and the Navigational Risk Assessment (NRA) (Appendix 13.1) and these are referenced in this chapter, where relevant.

17.4 The following marine users and activities have been scoped out of the EIA due to their distance from the Project and lack of potential for connectivity:

- Spoil disposal sites (at least 1 km east of the Offshore Site);
- Aggregate extractions (at least 10 km east of the Offshore Site); and
- Oil and gas activity and carbon capture and storage (CCS) (the nearest pipeline, well or licence block is at least 50 km from the Offshore Site).

17.2 Study Area

17.5 For the purposes of this assessment the Study Area includes the Offshore Site and an approximate 40 km boundary which includes the north coast of the Scottish mainland, the south west Orkney Islands and west Orkney mainland (Figure 17-1). This Study Area covers an extended area to ensure that all relevant marine users, particularly marine renewable developments in the Pentland Firth and Orkney Waters Strategic Area (PFOWSA), are captured in the assessment.

17.6 The Study Area also ensures that the baseline sufficiently describes the existing telecommunications receptors (both onshore and offshore) that might be potentially affected by the offshore elements of the Offshore Site.

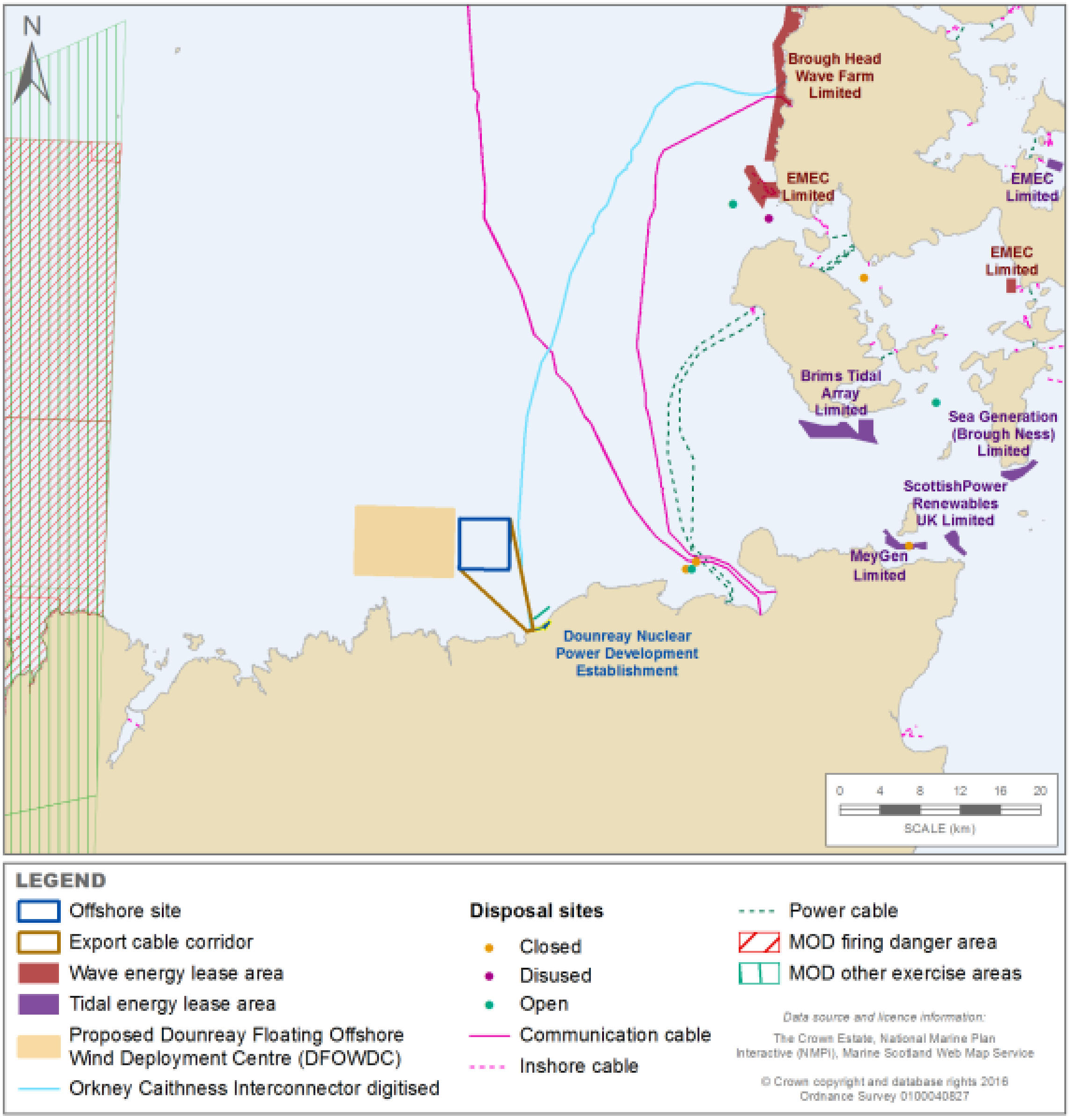


Figure 17-43 Study area and other marine users in the vicinity of the Project

17.3 Legislation and Guidance

17.7 The following relevant legislation and guidance relating to Other Users of the Marine Environment was used in the preparation of this chapter:

- The MoD can regulate and restrict the use of sea areas temporarily or in some cases permanently for the purposes of national defence using by-laws under the provisions of the following acts:
- Military Lands Act 1892 and 1900; and
- Land Powers Defence Act 1958;
- Potential telecommunication stakeholders were identified in accordance with the Ofcom guidance - Tall structures and their impact on broadcast and other wireless services (Ofcom, 2009), with the suggested anticipated extents of impact utilised as a minimum;

- Ofcom's Wind Farm Coordination Policy checks to determine whether any part of a windfarm is within range of telecommunication terminals or fixed link systems and notifies CSS and JRC and advises whether stakeholder engagement is required (Ofcom, 2016); and
- The Pentland Firth and Orkney Waters Marine Spatial Plan Framework and Regional Locational Guidance for Marine Energy (Marine Scotland *et al.*, 2012) helps to identify other important users of the marine environment and provides guidance on the most suitable locations for marine energy developments, with identification of potential opportunities and constraints.

17.4 Sources of Information

17.8 A review was undertaken of the existing literature relevant to this assessment and was used to provide an overview of the existing environment. Key data sources used in the preparation of this chapter are listed below in Table 17-1.

Table 17-105 Key data sources

Source	Content
National Marine Plan Interactive:http://www.scotland.gov.uk/Topics/marine/seamanagement/nmpihome	Current spatial data on the location of activity or infrastructure of other users of the marine environment.
Royal Navy operations information: http://www.royalnavy.mod.uk/news-and-latest-activity/operations/uk-home-waters/joint-warrior and http://www.royalnavy.mod.uk/qhm/clyde/jw	Information on the nature and location of Ministry of Defence Joint Warrior exercises. Details of forthcoming planned events are also advertised here.
Project Automatic Identification System (AIS) data	A vessel traffic analysis was undertaken as part of the Project Navigational Risk Assessment (NRA). AIS data was analysed to identify vessel activity of other marine users i.e. military during October 2014 - September 2015.

Surveys and studies carried out to date

17.9 No site specific surveys have been undertaken to inform the assessment of Other Users of the Marine Environment. The information available, including that in Table 17-1 and obtained through consultation has been deemed sufficient to provide a comprehensive baseline description of the environment.

17.5 Consultation

Dounreay Trì Drop-in Session

17.10 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date and included the following relevant information:

17.11 DSRL Senior Environmental Specialist:

- Confirmed that beach surveys are carried out approximately every two weeks per month, throughout the year with surface driven detectors but no ploughing is undertaken;
- Seabed monitoring has ceased; and
- The Dounreay foreshore and Sandside Bay are monitored with sediment sampling and water sampling carried out several times per month.

Engagement with HIE

17.12 Several meetings were held with Highlands and Islands Enterprise (HIE) in 2015 to discuss the prospect for a Memorandum of Understanding (MOU), grid capacity and sharing survey data, given that the Project is adjacent to HIE's proposed Dounreay Demonstration Centre (DDC) for offshore floating wind (see Chapter 3: Site Selection and Engagement to Date). While HIE are not pursuing Renewables Obligation accreditation in 2016, they are committed to continued investigation of the business case for the demonstration centre and have secured grid capacity. The timescales of the DDC indicate that there will be no construction overlap between the two Projects (see Chapter 3: Site Selection and Engagement to Date).

Engagement with DIO

17.13 Defence Infrastructure Organisation - Coordinates and turbine tip heights submitted to DIO Safeguarding team on the 25th of November 2015. On the 18th of March 2016, the DIO Safeguarding team stated that the offshore site does not appear to affect navigational routes or exercise areas.

Scoping feedback

17.14 The following stakeholder responses have been received specifically relating to this chapter.

Table 17-106 Summary of scoping feedback

Consultee	Comment	Relevance / Cross Reference
OpenHydro (Brims Tidal Array Ltd)	No comment on the proposal.	No specific concerns raised with regards to the Project.
Joint Radio Company (JRC)	This proposal cleared with respect to radio link infrastructure operated by the local electricity utility and Scotia Gas Networks.	Information provided informs the baseline in Section 17.8.4.
British Telecom: Radio Frequency Allocation & Network Protection	We have studied this Dounreay Trì Floating Wind Demonstration Project proposal with respect to Electro-magnetic Compatibility (EMC) and related problems to BT point-to-point microwave radio links. The conclusion is that the Project should not cause interference to BT's current and presently planned radio networks.	Information provided informs the baseline in Section 17.8.4.

Consultee	Comment	Relevance / Cross Reference
UK Hydrographic Office	Checked their largest scale chart of the Project Site and there is currently nothing charted that might impact on the Project (such as exercise areas).	Information provided informs the baseline in Section 17.8.4.

17.6 Assessment Methodology

17.15 The overarching approach to the Environmental Impact Assessment (EIA) is described in Chapter 5: Environmental Impact Assessment Methodology. This section sets out the specific criteria which have been used to evaluate the impacts of the proposals on Other Users of the Marine Environment (as defined in Section 17.1).

Design envelope considerations

17.16 The Project Description is set out in Chapter 4. Specific assumptions relevant to the assessment in this chapter are identified in Table 17-3 below.

17.17 In order that the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are considered by proxy.

Table 17-107 Design envelope parameters specific to other marine users

Design Envelope Parameter	Value/Description
Maximum Offshore Site construction footprint	Platform (0.09 km^2 including rotation and lateral movement), moorings, anchors (800 m radius) and construction safety zone (500 m) – 5 km^2
Maximum Offshore Site operational footprint	Platform (0.09 km^2 including rotation and lateral movement), moorings, anchors (800 m radius) and operational safety zone (50 m) – 2.3 km^2
Export cable footprint	13.8 km max length and 8 m max width (inc. cable plough footprint) – 0.1 km^2. Up to 20 % may require cable protection with rock placement - 2.8 km length or 0.02 km^2
Cable landfall installation method and location	Horizontal Direction Drilling (HDD) at East Sandside or pinned to existing water cooler channel at the Dounreay Nuclear Site. Trenching at Sandside Bay has been scoped out following consultation feedback.
Timing and duration of cable landfall installation activities (below MLWS)	Installed at the beginning of the construction phase, between Q4 of 2017 and Q2 of 2018 lasting 1-2 months (includes onshore activity, allowing for downtime/weather restrictions).

Design Envelope Parameter	Value/Description
Timing and duration of platform and associated infrastructure installation activities	2-3 months within Q2 and Q3 of 2018 (including commissioning). Vessels required include: up to 4 anchor handling tug supply vessels, up to 5 support vessels (crew transfer, dive support, guard vessels).
Timing and duration of export cable installation activities	1 week within Q2 of 2018. Vessels required include: 1 cable laying vessel, 1 dive support.
Frequency and duration of maintenance activities	Planned maintenance 19 visits per year for fault rectification and component replacement, 1 vessel required.

17.18 It is considered that impacts in the decommissioning phase will be comparable to those impacts assessed in the construction and operational phases. If the export cable is left *in situ* the potential impacts may be reduced further.

Methods of prediction

17.19 For Other Users of the Marine Environment potential ***effects*** are identified and the significance of each ***impact*** is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions.

17.20 A matrix approach has been used as a tool to inform the impact assessment, while professional judgement has also been used following best practice, best available understanding and relevant EIA guidance (SNH, 2013).

17.21 Significance is attributed using the following key attributes:

Magnitude of effect

17.22 Magnitude of effect is based on the consideration of the following four criteria to inform the determination of an overall impact magnitude as summarised in Table 17-4:

- Spatial extent;
- Duration;
- Frequency; and
- Severity.

Table 17-108 Assessment of magnitude of effect

Category	Description
High	Excludes or presents a barrier to activity of marine users, resulting in a permanent disruption for the duration of the Project lifetime.
Medium	Restricts activity of marine users, beyond that normally experienced in the area for the duration of the Project lifetime or for an extended period.
Low	Low limitation, consideration or nuisance to activity of/presents a navigable

	obstacle to marine users, typical to those normally experienced in the area, causing short-term or temporary disruption.
Negligible	Undetectable change, disruption or not likely to affect the activity of marine users.

Vulnerability of receptor

17.23 The vulnerability of the receptor to effects of the Project is also taken into account and is attributed according to the following characteristics to provide an overall impact vulnerability as summarised in Table 17-5:

- Adaptability;
- Tolerance;
- Recoverability; and
- Value.

Table 17-109 Assessment of vulnerability of receptor

Category	Description
High	Intensively used or localised charted sea use area. No capacity to adapt to or tolerate change in baseline conditions.
Medium	Extensive or charted sea use area lies adjacent to or partially overlaps with the Project footprint. Very little capacity to adapt to or tolerate change.
Low	Limited use area lies within or adjacent to the Project footprint. Some capacity to adapt to or tolerate change.
Negligible	The Project footprint is not charted or noted for use by sea users. Ample capacity to tolerate or absorb change or will not be affected.

Significance of impact

17.24 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact (Table 17-6). The significance of impact is based on best practice and professional judgement. While there is no specific guidance for other marine users, any impacts of 'moderate' or above are considered significant, in accordance with EIA guidance (SNH, 2013). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor. The evaluation of impact significance is informed by the matrix and by the professional judgement of the assessment team.

Table 17-110 Significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate

Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

17.7 Data Gaps and Uncertainties

17.25 The information sources used to establish the baseline environment for Other Users of the Marine Environment are deemed sufficient to inform a robust impact assessment. Where there is uncertainty about the location, timing or activity of particular receptors, a precautionary approach is taken either in their assessment of sensitivity or the potential magnitude of impact associated with the Project.

17.8 Description of the Current Environment

Other marine renewable energy Project developers

17.26 There are several marine renewable energy Projects either in development or undergoing the consenting process within the PFOWSA. The only Project to have been consented to date is Phase 1 (86 MW) of MeyGen Limited's Inner Sound 398 MW tidal energy Project, 20 nm (37 km) to the east of the Project site.

17.27 Other proposed marine renewable energy developments (for which Screening or Scoping Reports have been submitted) in the PFOWSA that could have potential connectivity with the Project proposals include HIE's Dounreay Demonstration Centre (DDC) for floating offshore wind, adjacent to the Project Site; Brims Tidal Array (Brims Tidal Array Limited, 200 MW) and Ness of Duncansby (ScottishPower Renewables UK Ltd, 95 MW), both of which are at least 16 nm (30 km) from the Project Site (Figure 17-1).

17.28 Farr Point Wave Farm was a proposal for up to ten Pelamis wave energy converters situated 18 km west of the Offshore Site. This Project underwent scoping but the technology developer has since gone into administration and there are currently no new proposals to continue development of this site.

MeyGen Tidal Array

17.29 The MeyGen Tidal Array has been consented for 86 MW (up to 61 turbines) with the first phase limited to a maximum of six turbines; Phase 1A will see the installation of four tidal turbines in 2016. This development is located at least 37 km east of the offshore Project Site. Offshore construction of the cable infrastructure was completed in 2015 which included HDD at the cable landfall site and installation of four export cables offshore. Fabrication and assembly of the tidal turbines and foundations are underway in preparation for deployment this year (2016) (MeyGen, 2016).

17.30 First tidal power generation to the grid is expected in 2016. Ports being utilised in the local area include Scrabster Harbour and Nigg Energy Park, the latter of which is the base for the tidal turbine assembly and testing facility and the fabrication of foundations (MeyGen, 2015, 2016).

Brims Tidal Array

17.31 A Scoping Opinion for the Brims Tidal Array was provided by MS-LOT in April 2014. Brims Tidal Array Limited (BTAL) planned to submit an application for Project consent of its proposed 200 MW tidal array during 2015 (OpenHydro, 2015), however this has not been made publically available as of March 2016. The Brims tidal site is located approximately 30 km north east of the offshore Project Site. Potential ports utilised for construction, operations and maintenance could include those located on Orkney and Scrabster Harbour on the north Scottish coast.

Ness of Duncansby Tidal Array

17.32 A Scoping Opinion was published for the Ness of Duncansby Tidal Array in February 2013, located approximately 43 km east of the Project Site. ScottishPower Renewables have not provided any further indication of developing this site to date and no planning applications have been submitted.

Dounreay Development Centre

17.33 The proposed DDC, located directly adjacent to the western boundary of the offshore area (Figure 17-1), received a Screening Opinion in February 2015 but a request for a Scoping Opinion has not yet been submitted to Marine Scotland[39]. At the time of screening the offshore area of search for the DDC was located within the same area as the Project boundary, however following consultation between HIE and Dounreay Trì, HIE has since moved their search area west of the Dounreay Trì Offshore Site.

17.34 The DDC is not progressing to the same timetable as the Dounreay Trì Project, consequently the Projects are very unlikely to be constructed simultaneously. At this time, no developer has publically stated an interest in deploying a floating technology at the DDC. Nevertheless, the development centre could consist of up to five turbines on a variety of floating sub-structures with one, two or an individual export cable per berth and an offshore hub or substation platform. The export cable(s) could be brought to landfall at a location within the vicinity of the Project landfall area of search (Aquatera, 2014), however no indication has been provided with regards to anticipated timescales or construction dates for the proposed development.

Summary

17.35 All proposed and consented wave and tidal energy Projects in the PFOWSA are a considerable distance from the proposed Project boundaries (at least 30 km), such that no impacts arising from the proposals on the location or activities to support these developments are likely to occur. Furthermore, scoping feedback from OpenHydro (BTAL), one of the tidal developers, confirmed that they had no comments to make in respect of the Project proposals (see Section 17.5 Consultation) and therefore no concerns were raised.

17.36 At the time of submission of the Dounreay Trì Project for planning consideration, the DDC for offshore floating wind has not been submitted for scoping, however due to its proximity, Dounreay Trì Limited will continue to engage with HIE throughout the application and development process so as to ensure that the siting and Project phases of the development do not conflict with or impede activity to develop either Project. The assessment will therefore scope in the DDC as a potential receptor.

17.37 Any impacts relating to the use of ports or harbours by other marine energy developers are addressed in Chapter 18: Socio-economics, Recreation and Tourism, while impacts in relation to navigation for construction or operational vessels associated with these Projects are considered in Chapter 13: Shipping and Navigation and the Navigational Risk Assessment (Appendix 13.1).

[39] As of March 2016 no scoping information has been made publicly available. Ordinarily Projects only need to be considered when in Scoping, however MSLOT have requested this Project be considered in the Cumulative Impact Assessment, therefore the Project has been considered as a receptor due to its proximity to the proposed Dounreay Tri Project.

Military activity

17.38 The Ministry of Defence (MoD) operates in Scotland's coastal areas and adjacent seas where they carry out maritime and aerial training activities and surveillance of potential threats to the country's offshore interests. Defence activities include the operation of naval vessel aircraft, navigational interests, underwater acoustic ranges, maritime exercise areas, amphibious exercises, coastal training ranges and coastal test and evaluation ranges.

17.39 The Offshore Site is approximately 19 nm (35 km) east of the Cape Wrath Firing Range military exercise area and its Firing Danger Area (Figure 17-1). There is also a practice and exercise area (PEXA) within Loch Eriboll, Sutherland (within the Cape Wrath Firing Range area).

17.40 The firing ranges are not always in use and access to these areas for certain activities is permitted where compatible with operational requirements. Temporal and spatial restrictions may be in place in these areas and where other military exercises are carried out.

17.41 Twice a year, Europe's largest military exercise, Joint Warrior is undertaken off the north, north east and north west coast of Scotland. Joint Warrior engages the three Armed Forces and aircraft, navy vessels, submarines and army personnel and occurs in March/April and October each year over a period of 10 - 15 days. The exercise includes UK, NATO and allied units and involves training in tactics and skills for use in a combined joint task force (Royal Navy, 2015).

17.42 There are no current or historical military munitions disposal sites within the vicinity of the Project boundaries. The potential for unknown unexploded ordnance (UXO) to be found within the Project Site is discussed in Chapter 16: Archaeology and Cultural Heritage. Aerial military activity is discussed in Chapter 14: Aviation and Radar.

17.43 An analysis of AIS data in Chapter 13: Shipping and Navigation identifies two military vessels transiting the Project Site, one vessel on three separate days (September 2015) and another on one day during the study period (April 2015) (Figure 17-2). These vessel tracks appear to deviate slightly from a main flow of military vessel transits eastward and westward, north of the offshore area and vessels appear to avoid the shallower inshore coastal waters.

17.44 Military vessels have some dispensations regarding switching off their AIS tracks and jamming GPS during exercises or defence activity therefore AIS tracking data will not necessarily record all military vessel movement in the area. Military exercises are however carefully planned and the process includes notification of local sea users.

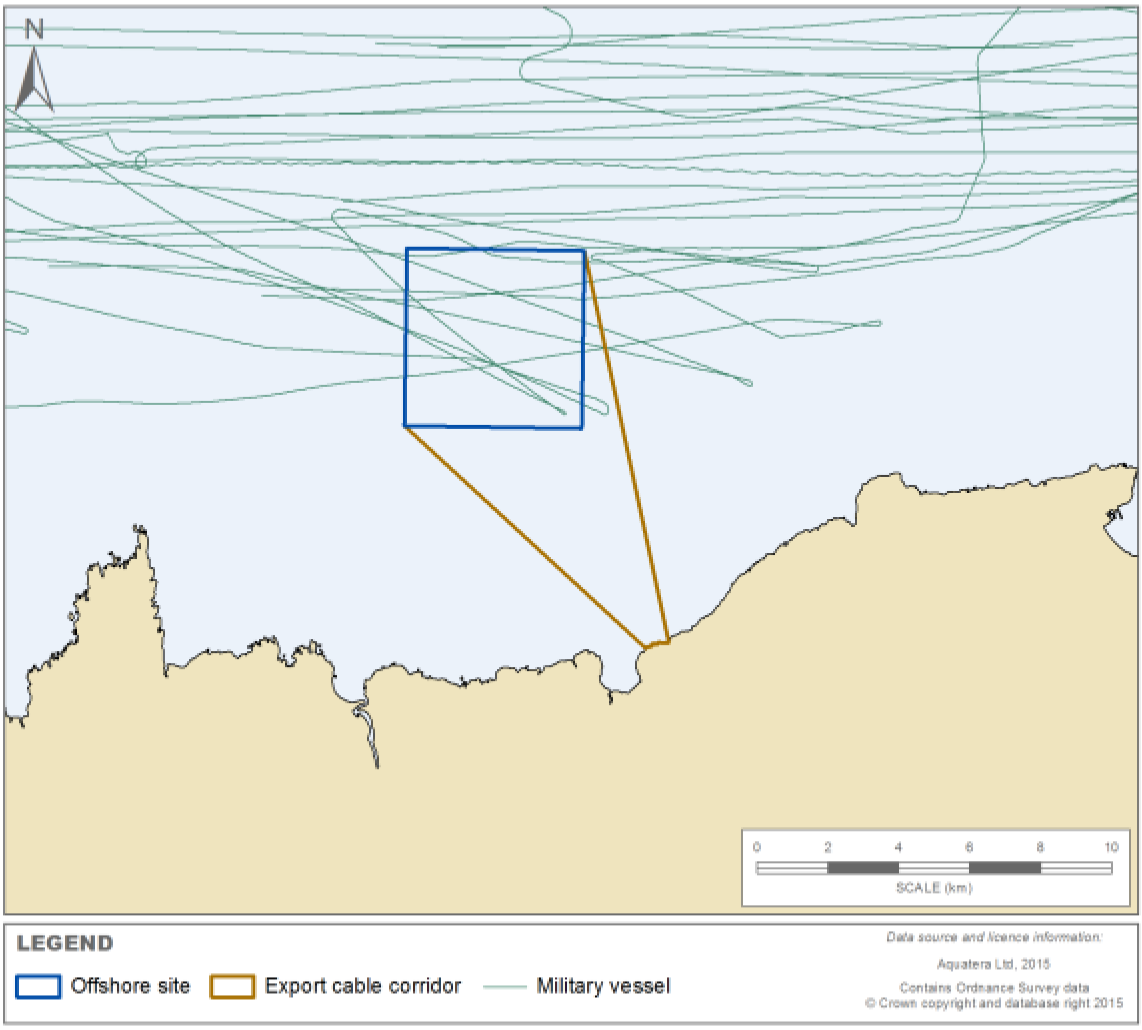


Figure 17-44 Military vessel AIS tracks (October 2014 – September 2015)

Subsea cables and utilities

17.45 There are no existing subsea cables or pipelines that intersect with the offshore Project Site or export cable corridor. The nearest existing cables are at least 6 nm (11 km) east of the Project Site.

17.46 New transmission infrastructure is required between Orkney and Caithness to enable the export of electricity from renewable energy generation in Orkney into the national grid. Scottish Hydro Electric-Transmission (SHE-T) is planning to develop a 70 km 220 kV subsea electricity transmission connection from Dounreay to the Bay of Skaill on the west coast of Orkney (SHE-T, 2013). Construction of this new network was expected in 2018/19 however this was subject to the progress of current wave and tidal energy generation sites in Orkney and dependent on the submission of a needs case and approval by OFGEM.

17.47 The current area of search for the landfall location for the Orkney to Caithness interconnector submitted in a Marine Environmental Appraisal (2013) to Marine Scotland is within the proposed area of search for the Project's landfall and export cable. It is likely that the proposed electricity cable could be directionally drilled at the point of landfall and the offshore cable trenched and buried or covered with additional protection in the form of rock placement, mattressing or other form of concrete protection (SHE-T, 2013).

17.48 An update on the SHE-T Project in 2015 (SHEPD and SHE-T, 2015) suggests that alternative routes may now be considered for the interconnector cable, dependent on generation deployment and what is deemed economic and efficient. Alternative landfalls on the Caithness coast could include Dunnet, Gills Bay, Freswick Bay and Noss Head, therefore likely to push back the proposed construction date[40].

Telecommunications

17.49 Telecommunications are identified in terms of wireless communications and television signals in the vicinity of the proposed Offshore Site. Due to the production of low levels of electromagnetic radiation, wind turbines can have an effect on communication systems that utilise electromagnetic waves as their means of transmission. The rotating blades of wind turbines can also cause interference through reflection and shadowing of electromagnetically propagated radio signals such as terrestrial fixed microwave links, terrestrial radio telemetry links and television broadcasts. Therefore, it is necessary to ensure a suitable separation distance between telecommunications links and wind turbines.

17.50 Telecommunication systems considered included the following:

- Microwave communications;
- Television reception;
- Radio reception; and
- Cellular telephone services.

17.51 Maritime communications devices within the scope of this assessment include cellular telephones, satellite communications, VHF radio, television and offshore microwave fixed links. Cellular telephone service providers are unlikely to provide coverage for users located in the vicinity of the Offshore Site, which means that interference to services is unlikely. Satellite communications users include surface vessels or rigs/platforms, the latter of which are not located within the Study Area.

17.52 The Ofcom Tall Structures guidance document indicates that the principal impact of new structures, such as wind turbines, upon satellite television is potentially blocking the signal between the receiver and the satellite (Ofcom, 2009). Satellite signals are generally received from a high elevation; this means that disruption to satellite reception is usually limited only to cases where a receiver is very close to a tall structure (for example a ship passing in close proximity to a turbine).

17.53 Consultation with oil and gas companies and using Ofcom data confirms that there are no offshore microwave links in the vicinity of the Offshore Site (Section 17.5.2 Scoping feedback):

- The Offshore Site is considered not to affect the radio link infrastructure operated by the local electricity utility and Scotia Gas Networks (JRC);
- The Project should not cause interference to BT's current and presently planned radio networks;
- Open Hydro: Environment & Consents have no comment on the proposal; therefore, no effects are expected; and

[40] It is understood from discussions with SHE-T that cable routing options are being considered for the Orkney-Caithness interconnector Project and information on previous options work has been accessed at www.ssepd.co.uk/OrkneyCaithness/ProjectDocuments/

- The Offshore Site is considered not to affect current charted infrastructure according to the UKHO.

Dounreay nuclear facility

17.54 Dounreay Nuclear Plant, owned by the Nuclear Decommissioning Authority, operated as a centre for fast reactor research and development between 1955 and 1994 and is currently undergoing decommissioning. Dounreay Site Restoration Limited (DSRL) is the contracted company responsible for the decommissioning of the nuclear facility (DSRL, 2015a).

17.55 DSRL is authorised by the Scottish Environmental Protection Agency (SEPA) to discharge low-level waste water effluent into the sea as part of the remediation programme being carried out by DSRL since site closure (DSRL, 2015b). Decommissioning is expected to be completed by 2030. The effluent is transported through a pipeline in a subsea tunnel and discharged through a diffuser approximately 600 m offshore (DSRL, 2015c).

17.56 As a result of operational standards in reprocessing during the 1960s and 1970s, some radioactive particles were released into the sea via the active discharge pipeline, which is now no longer in use. A number of historic radioactive particles have been discovered on the seabed close to the discharge point. An extensive programme of remediation activity was undertaken by DSRL to detect and retrieve hazardous particles from a 60 hectare area of seabed near the outfall using remotely operated vehicles (ROVs), clean-up vehicles and divers as part of an Environmental Monitoring Programme. Further details are presented in Chapter 6: Physical and Coastal Processes.

17.57 The outfall pipeline is located 1-2 km east of the cable route corridor area of search, while the main plume remediation area where monitoring and dredging was undertaken intersects with the export cable corridor (Figure 17-3). Consultation with DSRL in 2016 confirms that seabed monitoring work has now ceased (Section 17.5 Consultation).

17.58 Sandside Bay is also routinely monitored for particles and other contamination by surface driven detectors but no ploughing is currently undertaken. This remediation work is currently ongoing with the frequency of monitoring activities approximately every two weeks per month, throughout the year. The Dounreay foreshore is also monitored whereby sediment sampling and water sampling is carried out several times per month.

17.59 The potential for impacts as a result of disturbance of sediments and possible release of any radioactive material is discussed in Chapter 6: Physical and Coastal Processes.

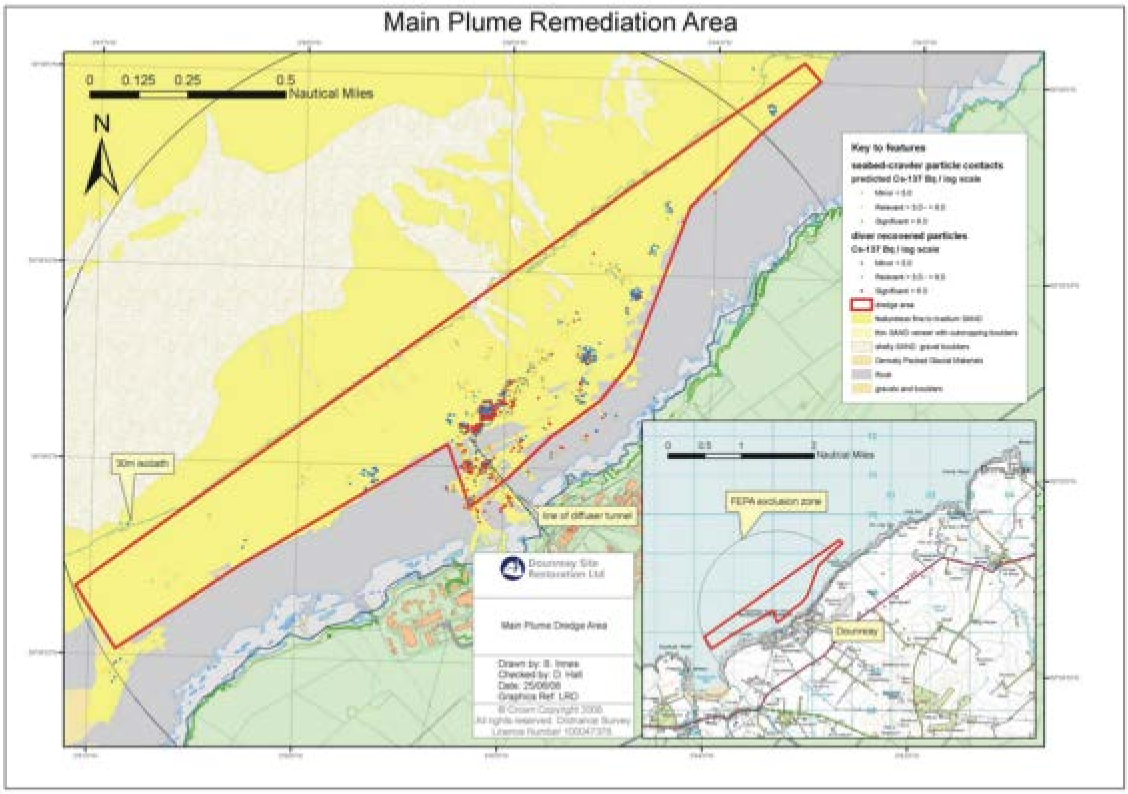


Figure 17-45 Dounreay nuclear facility plume remediation area (source: DSRL, 2015c)

Summary of baseline conditions

17.60 The DDC floating offshore wind Project, military interests and the proposed SHE-T Orkney-Caithness Interconnector are being taken forward to the assessment phase due to their potential connectivity with the proposed Project.

17.61 MeyGen, Brims Ness and Duncansby marine renewable energy Projects have not been taken forward to the assessment phase, principally due to their distance from the Project proposals and unlikely connectivity. The Offshore Site is also not considered to affect any telecommunication systems and infrastructure in the region; therefore, no systems are taken forward to an assessment phase.

17.62 DSRL activity is scoped out of the assessment as seabed monitoring activity has now ceased and Sandside Bay, where they undertake onshore monitoring, has been scoped out as a potential cable landfall location during consultation. It is therefore concluded that Project activities will not disrupt or restrict DSRL's monitoring and remediation activity.

17.9 Identification of Potential Impacts

17.63 The following impacts have been considered in the assessment. These have been informed through scoping and the consultation process.

Potential impacts in the construction phase

- Obstruction of marine renewable energy activities due to the presence of safety zones and construction vessels during installation activities;

- Obstruction of military activities due to the presence of safety zones and construction vessels during installation activities; and
- Obstruction of electricity cable installation (SHE-T) activities due to cable landfall construction activities, the presence of safety zones and construction vessels during installation activities.

Potential impacts in the operations and maintenance phase

- Obstruction of marine renewable energy activities due to the presence of the floating structure, associated moorings and export cable; and the presence of safety zones and vessels during maintenance activities;
- Obstruction of military activities due to the presence of the floating structure and associated moorings; and the presence of safety zones and vessels during maintenance activities; and
- Obstruction of electricity cable installation (SHE-T) activities due to the presence of the floating structure, associated moorings and export cable; and the presence of safety zones and vessels during maintenance activities.

Potential impacts in the decommissioning phase

- Impacts during the decommissioning phase would be similar to but not exceeding those discussed for the construction phase.

17.10 Impact Assessment – Construction Phase

Obstruction of marine renewable energy activities due to the presence of safety zones and construction vessels during installation activities

17.64 Installation activity and construction vessel presence will be temporary, lasting up to 3 months. Safety zones around the construction sites will limit the movements of all non-Project vessels to ensure operations are managed safely. The extent and duration of safety zones will be agreed with the Northern Lighthouse Board (NLB) and the Maritime Coastguard Agency (MCA). The area of restriction could be up to 5 km^2.

17.65 The current export cable route corridor and landfall area of search for the DDC overlaps with the proposed Project boundaries for the export cable and landfall, while the DDC offshore area of search is also adjacent to the Offshore Site. The construction and/or operational phase of the DDC could therefore potentially be sensitive to construction activity associated with the Project proposals, should timescales coincide.

17.66 There is potential for limited partial overlap of the sea use area but capacity to tolerate or absorb change given that the development area of search for both Projects is broad. Furthermore, the DDC Project has not been submitted for Scoping Opinion and a potential construction date has not been established as of March 2016, therefore it is unlikely that there will be any interaction during the DDC construction phase and thus operational phase of HIEs proposals. The DDC activities are therefore considered to be of low vulnerability to Project construction activities.

17.67 Construction activities associated with the Project are unlikely to overlap with DDC's own installation activities, nevertheless the potential footprint of restricted area is relatively small, navigable and will be for a temporary period. The magnitude of effect is therefore assessed as low and the impact considered minor.

Obstruction of military activities due to the presence of safety zones and construction vessels during installation activities

17.68 Installation activity and construction vessel presence, as described above in paragraph 17.66, will temporarily limit the movements of all non-Project vessels, including military vessels, to ensure operations are managed safely.

17.69 There are not expected to be any effects on the Cape Wrath Firing Range and Danger Areas which lie approximately 35 km west of the Offshore Site. Joint Warrior activity, conducted in March/April and October ever year, tends not to overlap with the proposed Offshore Site; however MoD and associated NATO member vessels may navigate through the Offshore Site during the exercise period.

17.70 Low military vessel numbers were recorded through the Offshore Site during the AIS study period. However there may be instances where AIS tracks are not recorded and frequency may be greater.

17.71 The MoD is accustomed to operating alongside day to day marine activities, with due regard for other sea users and the presence of structures at sea. The Offshore Site and surrounding area is currently of limited use by the MoD for military activities, is not within a charted sea use area, with key exercise areas located some distance west of the Offshore Site (35 km). The MoD is therefore likely to have capacity to adapt to any changes to this local marine area. Construction activity and associated safety zones will present a short-term, temporary disruption to military activities transiting through the Offshore Site, however vessels will still be able to navigate around the temporary exclusion area. Vulnerability is therefore considered low and the magnitude of effect low with a minor impact anticipated.

Obstruction of electricity cable installation (SHE-T) due to cable landfall construction activities, the presence of safety zones and construction vessels during installation activities

17.72 Installation activity and construction vessel presence, as described in paragraph 17.66, will limit the movements of all non-Project vessels, including those associated with any construction activity for the SHE-T electricity cable, to ensure operations are managed safely.

17.73 The cable landfall may be drilled (HDD) or pinned via an existing water cooling channel at the foreshore of the Dounreay Nuclear Site. The cable landfall will be installed at the beginning of the construction phase, lasting up to 3 months (allowing for downtime/weather restrictions).

17.74 The current proposed cable route for the Orkney-Caithness Interconnector overlaps with the Project boundaries for the export cable and cable landfall. The construction and/or operational phase of the electricity cable is therefore potentially sensitive to construction activity associated with the Project proposals.

17.75 There are currently no plans approved or indication of dates to commence construction of the electricity cable and the proposed routing is under review, with several locations now being considered. Due to the uncertainty about the proposals and potential for numerous locations to accommodate the cable, the vulnerability of SHE-T's cabling proposal is therefore considered low.

17.76 Construction activities associated with the Project may temporarily disrupt SHE-T's own installation activities if construction periods overlapped causing a medium magnitude of effect. The impact is therefore potentially minor.

17.11 Impact Assessment - Operations and Maintenance Phase

Obstruction of marine renewable energy activities due to the presence of the floating structure, associated moorings and export cable; and the presence of safety zones and vessels during maintenance activities

17.77 The presence of the floating structure, associated moorings and any operational safety zones applied will have the potential to disrupt the activity of vessels associated with the construction and operation of the DDC should it reach the development stage. The maximum operational footprint will be 2.3 km^2. The Project export cable corridor also overlaps with HIE's area of search for the export cable corridor for the DDC proposals.

17.78 The DDC is therefore potentially sensitive to the Project proposals. However, since the area of search is relatively large, there is capacity for the DDC to tolerate the addition of a marine renewable energy site adjacent to its own proposals and adapt alongside the Project. Furthermore, the DDC proposals have not been submitted for Scoping Opinion and a potential construction date has therefore not been established. The DDC is therefore assessed as low vulnerability to the development proposals and as a precaution the magnitude of effect is considered medium, whereby there is potential for restrictions to the DDC. The significance of impact is therefore assessed as minor.

Obstruction of military activities due to the presence of the floating structure and associated moorings; and the presence of safety zones and vessels during maintenance activities

17.79 The presence of the floating structure and associated moorings will constitute new obstacles in the sea area that would need to be considered and avoided during military operations and exercises. The Project footprint liable to cause obstruction covers an area of 2.3 km^2.

17.80 Planned and unplanned maintenance activities are likely to be undertaken by 1-2 vessels, up to 19 times per year for a period of up to two days for an individual activity on the maintenance programme.

17.81 There are not expected to be any effects on the Cape Wrath Firing Range and Danger Areas which lie approximately 35 km west of the Offshore Site. Joint Warrior activity, conducting in March/April and October ever year, tends not to overlap with the proposed Offshore Site; however MoD and associated NATO member vessels may navigate through the Offshore Site during the exercise period.

17.82 The MoD is accustomed to operating alongside day to day marine activities, with due regard for other sea users and the presence of structures at sea. The Offshore Site and surrounding area is currently of limited use by the MoD for military activities, is not within a charted sea use area, with key exercise areas located some distance west of the Offshore Site. The MoD is therefore likely to have capacity to adapt to any changes to this local marine area. Military vessels will be able to navigate around the Offshore Site. Vulnerability is therefore considered low and the magnitude of effect low with an overall minor impact anticipated.

Obstruction of electricity cable installation (SHE-T) activities due to the presence of the floating structure, associated moorings and export cable; and the presence of safety zones and vessels during maintenance activities

17.83 The presence of the floating structure and associated moorings and cables may reduce the available suitable seabed and route for the Orkney-Caithness interconnector cable. The development footprint liable to cause obstruction covers an area of 2.3 km^2.

17.84 There are currently no plans to commence construction of the cable, which is still at the pre-application stage, and the proposed routing and landfall location is currently under review. Due to the uncertainty about the proposals and potential for numerous locations to accommodate the cable, the vulnerability of SHE-T's cabling proposal is considered medium as a precaution, given that the current landfalls overlap.

17.85 The presence of Project infrastructure, the overall footprint and vessels operating in the area may limit location options and could disrupt or obstruct installation activities for the proposed SHE-T electricity cable. The magnitude of effect is assessed as medium and the resultant impact of moderate significance.

17.12 Mitigation Measures

17.86 Project commitments, described in Chapter 4: Project Description, which comprise general measures relevant to the mitigation of impacts on Other Users of the Marine Environment include:

- GM18 Cable Laying Strategy and Method Statement;
- GM2 Construction Environmental Management Document;
- GM3 Operational Environmental Management Document;
- GM22 Vessel Management Plan (VMP) in construction and operational phases;
- GM23 Construction Safety Zone;
- GM24 Operational Safety Zone; and
- GM31 Navigational aids such as site marking and lighting.

17.87 Receptor specific mitigation measures are summarised in Table 17-7 below.

Table 17-111 Receptor specific mitigation measures

Mitigation Measures Specific to Other Marine Users		
Ref	**Title**	**Description**
OM01	Liaison with other marine users during construction and maintenance	Management and notification of activities in consultation with HIE, MoD and SHE-T.
OM02	Installation of acoustic transponder	If necessary, the Applicant will investigate the feasibility of installing an acoustic transponder to alert military submarines to the presence of the floating platform.
OM03	Negotiations on location of export cable route and landfall	HIE for the DDC and SHE-T for interconnector electricity cable.

17.13 Residual Impacts

17.88 The majority of impacts were assessed as having minor significance, with one assessed as moderate. Dounreay Trì Limited is committed to reducing impacts wherever possible. Those impacts that were assessed as moderate will have mitigation measures applied thus reducing impact significance of all impacts to negligible or minor i.e. not significant. Impacts assessed as minor will be reduced further through the implementation of Project and receptor specific mitigation measures to ensure they remain not significant.

Impacts on marine renewable energy activity

Construction phase

17.89 Although the assessment did not identify significant impacts, as a precaution, the Applicant will continue to liaise with HIE regarding the Project programme (OM01).

17.90 Furthermore, Project commitment mitigation measures including: the implementation of a Construction Environmental Management Document (GM2) which will include a VMP (GM22); the use of navigational aids (GM31); and the application of safety zones (GM23) will ensure disturbance to Other Users of the Marine Environment is minimised while safety is prioritised. The residual effects are therefore anticipated to be minor or negligible and not significant.

Operational phase

17.91 The Applicant will liaise with HIE and look for opportunities to collaborate and coordinate activity so as not to conflict with or impede activity to develop either Project (OM01 and OM03).

17.92 Furthermore, Project commitment mitigation measures including: the implementation of an Operational Environmental Management Document (GM3) which will include a VMP (GM22); the use of navigational aids (GM31); and the application of safety zones (GM24) will ensure disturbance to Other Users of the Marine Environment is minimised while safety is prioritised. The magnitude of impact is therefore considered low with the introduction of these mitigation measures and residual effects anticipated to be minor and not significant.

Impacts on military activity

Construction phase

17.93 Although the assessment did not identify any significant impacts, the Applicant will subscribe to be a consultee on the standard notifications of Joint Warrior operations. Notifications include contact details should any particular activities be likely to conflict or impact with respective operations. The Applicant will notify all marine users, including military, of prospective construction activities, their timing and duration to minimise disruption and enable MoD to consider in their own planned operations (OM01).

17.94 Project Commitment mitigation measures including: the implementation of a Construction Environmental Management Document (GM2) which will include a VMP (GM22); the use of navigational aids (GM31); and the application of safety zones (GM23) will ensure disturbance to Other Users of the Marine Environment is minimised while safety is prioritised.

17.95 Safety zones will be marked/notified in accordance with the recommendations of the NLB and MCA and in compliance with IALA 0139 for the aid of navigation (refer to the NRA for further detail, Appendix 13.1: Navigational Risk Assessment). Consideration of construction activities and associated Project vessels as potential navigational hazards are discussed in detail in the NRA and Chapter 13: Shipping and Navigation.

17.96 These mitigation measures will ensure that the magnitude of impact remains low or negligible and residual effects are minor and therefore not significant.

Operational phase

17.97 The Applicant will continue to liaise with all other sea users, including the MoD and notify of any planned or unplanned maintenance activities during operations (OM01). Project Commitment mitigation measures including: the implementation of an Operational Environmental Management Document (GM3) which will include a VMP (GM22); the use of navigational aids (GM31); and the application of safety zones (GM24) will ensure disturbance to Other Users of the Marine Environment minimised while safety is prioritised.

17.98 Safety zones will be marked/notified in accordance with the recommendations of the NLB and MCA and in compliance with IALA 0139 for the aid of navigation (refer to the NRA for further detail, Appendix 13.1). Consideration of the presence of infrastructure and associated operational Project vessels as potential navigational hazards are discussed in detail in the NRA and Chapter 13: Shipping and Navigation.

17.99 If necessary, Dounreay Trì Limited will investigate the feasibility of installing an acoustic transponder to alert military submarines to the presence of the floating platform (OM02). These mitigation measures will ensure that the magnitude of impact remains low or negligible and residual effects are minor and therefore not significant.

Impacts on SHE-T activity

Construction phase

17.100 The Applicant will notify SHE-T of intended Project installation activities and ensure adequate notification is provided so as not to disrupt any planned works (OM01), and will include a range of measures to minimise disturbance to other users and ensure safety is prioritised. These will form part of the Project construction plans: Cable Laying Strategy and Method Statement (GM18) and Construction Environmental Management Document (GM2).

17.101 The magnitude of effect is therefore reduced to low and residual impact anticipated to be minor and therefore not significant.

Operational phase

17.102 The Applicant will liaise with SHE-T and negotiate suitable locations for the development so as not to conflict with or impede activity to develop either Project (OM03), given its medium vulnerability. The Applicant will ensure adequate notice and information is provided throughout the operation of the Project to minimise disruption or obstruction to SHE-T's activity through mitigation measures as outlined in the Operational Environmental Management Document (GM3). The magnitude of effect is therefore reduced to low and residual impact anticipated to be minor and therefore not significant.

17.14 Cumulative Impacts

17.103 There is potential for cumulative impacts to arise from the development of a number of other Projects in the nearby area:

- The SHE-T Orkney-Caithness interconnector cable;
- Brims Tidal Array, Brims Ness;
- MeyGen, Inner Sound;
- DP Energy, Westray South;

- Scotrenewables, Lashy Sound; and
- HIE, Dounreay Demonstration Centre (DDC).

17.104 The approach to the cumulative and in-combination impact assessment is described in Chapter 5: Environmental Impact Assessment Methodology.

Other marine renewable energy Project developers

17.105 The Project could have cumulative impacts on the HIE DDC alongside proposals for the SHE-T Orkney-Caithness interconnector cable Project. Wave and tidal marine renewable energy Projects in the PFOWSA are a considerable distance from the Project boundaries, such that no cumulative effects on their operations or on others in-combination with the Project are likely to occur.

17.106 The Applicant will liaise with HIE and SHE-T throughout the development process to negotiate suitable locations for the Offshore Site and export cable, collaborate and coordinate where possible so as not to conflict with or impede activity to develop either Project (OM01). As a result, it is not anticipated that any significant cumulative impacts will arise.

17.107 Potential indirect effects could include congestion at ports and harbours for Project-related vessels and shore-based operations. Any impacts relating to the use of ports or harbours are addressed in Chapter 18: Socio-economics, Recreation and Tourism, while impacts in relation to navigation for construction or operational vessels associated with these Projects is considered in Chapter 13: Shipping and Navigation and the Navigational Risk Assessment (Appendix 13.1).

17.108 No significant cumulative effects on other marine renewable energy Project developers are therefore anticipated.

Military activity

17.109 Construction activities and the presence of the Project, the DDC and Orkney-Caithness interconnector could have cumulative impacts on military activity in north coast waters. Proposed wave and tidal marine renewable energy Projects in the PFOWSA are of sufficient distance from the Project boundaries and known areas used by the military to not have connectivity.

17.110 During construction for the Project, DDC and interconnector, it is likely that safety zones will be administered which will exclude other sea users from the area and consequently obstruct or disrupt military activity. However, as neither of the latter Projects currently have confirmed timescales and are yet to be submitted for planning consideration, it is unlikely that construction activities will coincide. The Applicant will however liaise with other marine users and developers throughout the planning and construction phase and will provide notice of intended maintenance activities to minimise potential disruption (OM01, GM2 and GM3).

17.111 The presence of the Project alongside the DDC will present new obstacles in the sea area. The MoD is accustomed to operating alongside day to day marine activities, with due regard for other sea users and the presence of structures at sea. The Offshore Site and surrounding area is currently of limited use by the MoD for military activities, is not within a charted sea use area, with key exercise areas located some distance west of the Offshore Site and the DDC. The MoD will therefore have ample capacity to adapt to any changes to this local marine area and navigate around both Projects. It is therefore considered that there will be no significant cumulative effects arising from the proposals.

Subsea cables and utilities

17.112 No cumulative impacts are anticipated on existing subsea cables or utilities. The Project could have cumulative impacts alongside the proposed Brims Tidal Array on the Orkney-Caithness interconnector, should construction activities coincide. These are likely limited to navigational impacts and are considered in the NRA and Shipping and Navigation chapter. Project construction traffic will be managed as part of a detailed VMP, the Construction Environmental Management Document and consultation with other developers to ensure operations are conducted safely and without obstruction.

17.15 Summary and Conclusions

- No significant impacts to Other Users of the Marine Environment or their associated activities (marine renewable energy, military and electricity cable installation) have been identified as arising from any phase of the Dounreay Trì Project proposals;
- Where there is potential for overlap of Project infrastructure or construction activity with proposed developments in the area i.e. SHE-T Orkney-Caithness interconnector and HIE'S DDC for offshore floating wind, these will be mitigated through consultation and collaboration with developers to ensure there is no significant conflict or disruption to activities;
- Any temporary disruption to the activity of other marine users will be mitigated through liaison and adequate notification of intended activities to minimise disruption;
- All residual impacts have subsequently been assessed as minor;
- No significant cumulative impacts on Other Users of the Marine Environment have been identified; and
- A summary of residual impacts for Other Marine Users is presented in Table 17-8.

Table 17-112 Summary of residual impacts

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction Phase			
Obstruction of marine renewable energy activities due to the presence of safety zones and construction vessels during installation activities	Low	Low	Minor
Obstruction of military activities due to the presence of safety zones and construction vessels during installation activities.	Low	Low	Minor
Obstruction of electricity cable installation (SHE-T) activities due to cable landfall construction activities, the presence of safety zones and construction vessels during installation activities	Low	Low	Minor
Operation and Maintenance Phase			
Obstruction of marine renewable energy activities due to the presence of the floating structure, associated moorings and export cable; and the	Low	Low	Minor

Potential Impact	Magnitude	Vulnerability	Overall Significance
presence of safety zones and vessels during maintenance activities			
Obstruction of military activities due to the presence of the floating structure and associated moorings; and the presence of safety zones and vessels during maintenance activities	Low	Low	Minor
Obstruction of electricity cable installation (SHE-T) activities due to the presence of the floating structure, associated moorings and export cable; and the presence of safety zones and vessels during maintenance activities	Low	Medium	Minor

18 Socio-economics, Recreation and Tourism

18.1 Introduction

18.1 This chapter describes the socio-economic, recreation and tourism issues and benefits that are associated with the Project. The key considerations for this assessment are where the construction activity will be based, where the commissioning of the floating platform occurs and where the Operations and Maintenance (O&M) base is located. Locations for these activities will be identified during the detailed design phase of the Project. Therefore, for the purposes of this assessment the potential socio-economic impact is assessed strategically with a focus at a local (Caithness), regional (Highland) and national (Scotland) level.

18.2 The socio-economic aspects which may potentially be affected by the Project including creation of employment, Gross Value Added (GVA) (value of goods and services produced in an area or industry) impacts and other potential improvements to peoples quality of life, such as wage inflation, population increase and the attraction of younger people into the local area are discussed. The potential socio-economic impact of the Project on commercial fisheries (e.g. potential loss of earnings) is also discussed. The chapter then goes on to discuss the potential impact of the Project on recreation and tourism in the onshore and offshore area as well as on the infrastructure supporting these activities around Caithness. The chapter identifies and assesses the potential effects that the Project may have on socio-Economics, recreation and tourism in the Study Area and, if required, the mitigation measures to be implemented to avoid, reduce or offset any potential adverse effects, where necessary.

18.3 The construction and operation of any marine energy development has potential to provide a number of socio-economic benefits such as:

- Job opportunities;
- Improved infrastructure; and
- Business opportunities in the local supply chain.

18.4 This chapter has close links to a number of other chapters within the assessment:

- Chapter 12 Commercial Fisheries – financial impact on local fishing;
- Chapter 13 Shipping and Navigation – with regard to ports and vessel movements; and
- Chapter 15 Seascape, Landscape and Visual Amenity – tourism implications from visual impact.

18.2 Study Area

18.5 Socio-economic impacts have the potential to spread beyond the fixed boundaries of the Project site. The impact at a local (Caithness), regional (Highland) and national (Scotland) level has been assessed. The Study Area for recreation and tourism is assessed within the Caithness area (green box in Figure 18-1)

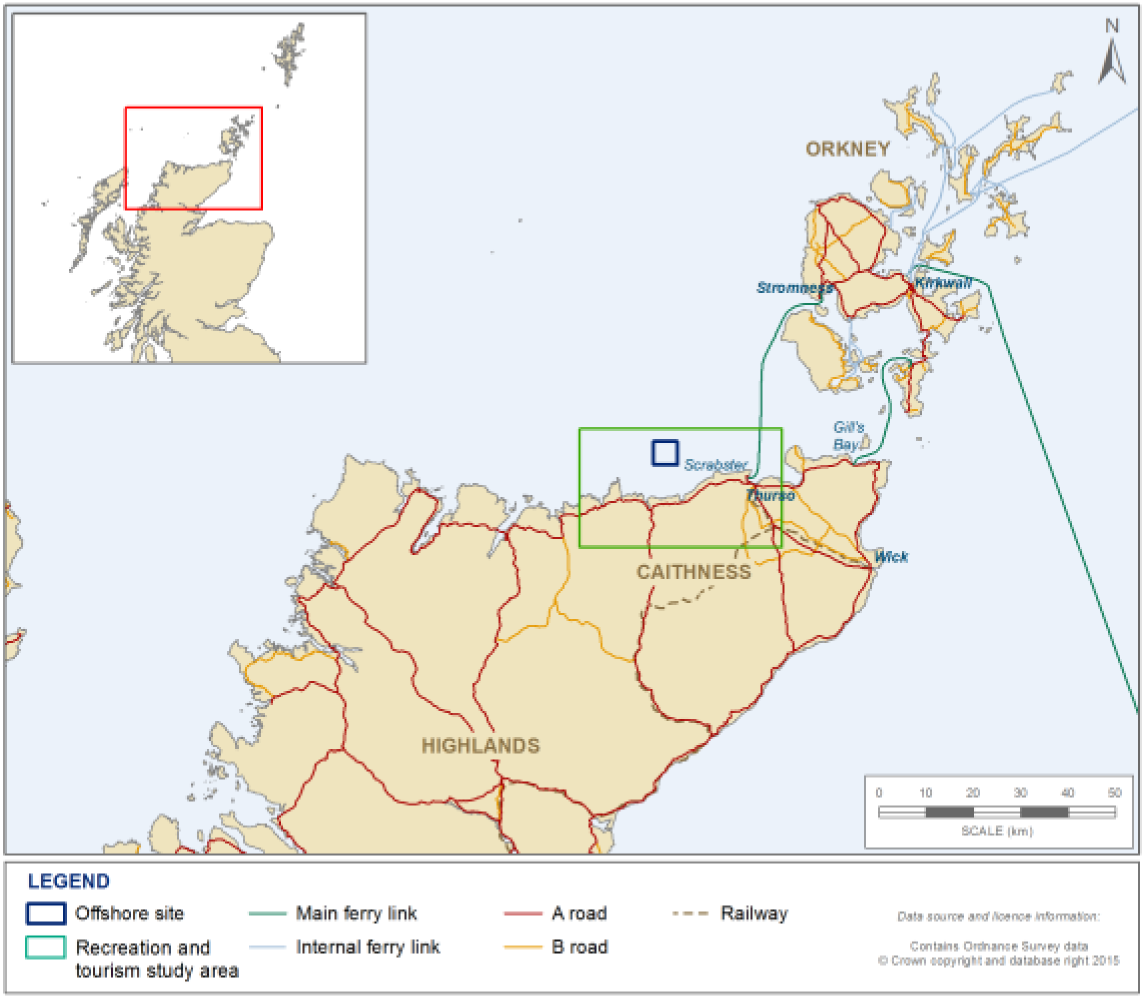


Figure 18-46 Study Area for socio-economics local (Caithness), regional (Highlands) and National (Scotland).

Boundary for the recreation and tourism assessment is displayed in the green box

18.3 Legislation and Guidance

- A report (ABPMer *et al.*, 2012) produced for The Crown Estate (TCE) outlines a common approach to and associated methodologies for socio-economic assessment of marine projects in the Pentland Firth and Orkney Waters (PFOW) strategic area, which is reflected in this assessment;
- Scottish Marine Recreation and Tourism Survey 2015 (Land Use Consultants (LUC), 2016)
- The Scottish Enterprise ‘Additionality & Economic Impact Assessment Guidance Note’ (2008);
- Caithness and Sutherland Local Development Plan (CaSPlan, 2014) sets out the local issues that affect development and the council’s plans for development and forms part of the overall Highland regional plan;
- Orkney Islands Council (OIC) Local Development Plan (adopted in April 2014) is a similar document to the Caithness and Sutherland plan that sets out the local issues that affect development and the council’s plans for development; and

- National Renewable Infrastructure Plan (Scottish Government, 2011a).

18.6 Other existing data sources and literature used to guide the assessment include:

- Economy and employment data from Highland Council Ward Statistics;
- National Census data (2011), scotlandcensus.gov.uk;
- Scottish Renewables Economic Impact Report (Scottish Renewables, 2007);
- Tourism Impact of Wind Farms, (2012). University of Edinburgh submitted to Renewables Inquiry Scottish Government; and
- ESRC (Economic and Social Research Centre Data archive), which is an organisation which funds research on economic and social issues.

18.4 Surveys and Studies Carried out to Date

18.7 Given the size of the demonstration project no bespoke studies were carried out to inform the socio-economics, recreation and tourism chapter; however the following desk-based studies and assessments were used, in addition to the specific guidance and strategic plans for the Pentland Firth, to inform this assessment:

- Pilot PFOW Marine Spatial Plan Consultation Draft: Socio-economic Baseline Review (Marine Scotland, 2015); and
- Shipping Study for Pentland Firth and Orkney Waters (Anatec and Halcrow, 2012).

18.5 Consultation

Table 18-113 Summary of scoping opinion received in reference to Socio-economics, Recreation and Tourism

Consultee	Comment relative to Socio-economics, Recreation and Tourism	Relevance/Cross Reference
Royal Yachting Association (RYA)	Highlighted that the Project is unlikely to pose any problem or act as a deterrence to recreational craft as there is plenty of room either side of the development. They noted that the Project should be well marked and lighted.	Recreational Sailing
Sport Scotland	Highlighted that SportScotland does not have detailed knowledge of the sport interests at or in the vicinity of the site so advised that consultation with local clubs and sport groups should be carried out.	Table 18-2

Consultee	Comment relative to Socio-economics, Recreation and Tourism	Relevance/Cross Reference
The Highland Council (THC)	Ensure that the core path south of the Burn of Is Auld which is used to gain access to Sandside Bay is kept open during construction	Since this scoping response was submitted the onshore Study Area has moved eastwards, and therefore further away from the core paths leading into Sandside Bay meaning they are unlikely to be impacted by project construction activities. However, mitigation is still considered, see Section 17.17

18.8 In February 2016 a consultation exercise was carried out with a variety of stakeholders relevant to Socio-economics, Recreation and Tourism issues and benefits. The organisations relevant to this assessment that were consulted included:

- Caithness Renewables;
- Caithness Chamber of Commerce;
- Forss Technology Park;
- Pentland Canoe Club; and
- Highland Council.

18.9 The key points raised by stakeholders during consultation are presented in Table 18-2.

Table 18-114 Summary of stakeholder responses from consultation event held in February 2016

Topic	Stakeholder	Comment	Response/Action Taken
Services	Caithness Renewables	Keen to know what ports will be used for servicing the Project and suggested base at Loch Eriboll Harbour, which Durness Development Group are looking to develop to increase capacity for larger vessels. Capital works would be required to bring Durness into use.	At present the location of the O&M base is not known. As soon as this information becomes available the consultee will be notified

Topic	Stakeholder	Comment	Response/Action Taken
Employment	Caithness Chamber of Commerce	Interested to find out any economic activity the Project could generate, highlighted Scrabster as a potential O&M port. Interested to know if construction could take place in Caithness. No decision has been made. Whilst the fabrication of the platform would occur in a large dry dock the fabrication of other components, such as anchors, could occur in Caithness, subject to agreeing commercial terms.	Generated economic activity is covered in the assessment (see Section 17.13).
Services	Representative Forss Technology Park	Interested to discuss options to supply office and storage space close to onshore site.	Positive effect: Local business opportunities are discussed in 17.13.1.
Recreation	Pentland Canoe Club	Project is too far offshore for any issues as kayakers tend to hug the coast. The main kayaking routes in the area tend to start at Sandside Bay and head west. It was suggested that the area immediately to the east of Sandside Bay was not a particularly interesting area for kayaking. Would like to ensure kept informed about cable laying activities so they can avoid area during construction. Confirmed that the canoe club are included on the circulation list for Notice to Mariners in Caithness.	Potential impacts to kayakers is covered in the assessment in Section 17.18.1.

Topic	Stakeholder	Comment	Response/Action Taken
Employment	The Highland Council	Thought the Project could be good for area, interested in planning issues and timescales, thought there could be some interest from Scrabster Harbour for the O&M base.	The location of the O&M base is currently unknown (see above). Benefits that the Project could potentially bring to the area are covered in Section 17.13.

18.6 Assessment Methodology

18.10 The overarching approach to the environmental impact assessment is described in detail in Chapter 5 Environmental Impact Assessment Methodology. There are no standard significance criteria for effects on Socio-economics, Recreation and Tourism. Therefore two separate approaches have been taken to assess, firstly the potential benefits and impacts to socio-economics and secondly the potential impacts to recreation and tourism.

18.11 The specific criteria which have been used to evaluate the impacts on socio-economics are described in Section 18.11.

18.12 The specific criteria which have been used to evaluate the impacts on recreation and tourism are described in Section 18.15.

18.13 A description of specific criteria relating to socio-economics and recreation and tourism has been defined through consultation with key stakeholders and professional judgement based on experience.

18.7 Design envelope considerations

18.14 The Project has taken a design envelope approach to consenting which is described in Chapter 4 Project Description. The approach differs from the normal assessment methodology to better reflect the implications of the Project on the socio-economic issues nationally, regionally and locally. The process requires that for each relevant (socio-economic, recreation and tourism) receptor the ‘worst case’ for negative and ‘best case’ for positive design envelope parameter is identified and assessed.

Table 18-115 Design envelope parameters specific to Socio-economics, Recreation and Tourism

Project Parameter Relevant to the Assessment	Definition of Project Parameter for Impact Assessment	Explanation of Project Parameters	Outcomes that Define the Full Design Envelope	
			Positive	Negative
Project capacity	Project is built with capacity of 8 MW Project is built with capacity of 12 MW	The capacity of turbines for the Project has not yet been specified. The Project will have a capacity of between 8 and 12 MW	Project is completed with capacity of 12 MW - most jobs and economic advantage	Project is built with capacity of 8 MW – less jobs and economic advantage
Project construction timescales	Project is built within 12-18 months	Maximum timescales, depending on the number, capacity and type of turbine	Project built within timescales – ensures jobs created within a short timescale	Project delay – jobs don't become available when expected which will reduce the positive impact
Project operation and maintenance timescales	Up to 25 years	As defined in the Project Description	If the Project is lengthened and/or repowered economic benefit will be increased	If shortened economic benefit will be reduced
Type and origin of vessels	The types of vessels that will be used within the Project are listed in Table 17-21	The type and number of vessels used as well as their origins are all variables that the technology selection, design process and contracting strategy will determine	Local and regional vessels used to deploy and maintain equipment and lay cables	Imported vessels from national or international areas bringing less economic benefit to local areas

Project Parameter Relevant to the Assessment	Definition of Project Parameter for Impact Assessment	Explanation of Project Parameters	Outcomes that Define the Full Design Envelope	
			Positive	Negative
Project decommissioning strategy	The approach to use of the site at the end of its planned operation lifespan	Possible repowering or reuse of the site or alternatively clearance of materials from the site to leave site as close as possible to pre-operations condition	Repowering or redevelopment of the site leading to ongoing capital and operations spend along with revenues, and associated economic benefit	Removal of equipment leaving a clear site, leading to a short-term task related increase in jobs but no long-term benefit
Employment numbers	Construction: 12 MW – 240 (72 locally) O&M: 11 (including indirect and induced)	Employment figures based on guidance from Scottish Government (see Sections 17.6.2 and 17.13.1)	Employment levels are realised with an appropriate level of localisation of opportunities and employment terms are comparable with or better than those in the existing employment market	Employment levels are lower than planned, localisation of employment is not, or is poorly achieved, terms are worse than existing local practices
Construction and installation base	Undefined at this stage therefore National, regional and local locations assessed.	The support base used by the Project will lead to major short and longer-term economic opportunities but also may lead to some disturbance impacts	The facility is located within Caithness and disturbance is minimised	The facility is located outwith Caithness and disturbance levels moderate

Project Parameter Relevant to the Assessment	Definition of Project Parameter for Impact Assessment	Explanation of Project Parameters	Outcomes that Define the Full Design Envelope	
			Positive	Negative
Operations and maintenance base	Undefined at this stage therefore National, regional and local locations assessed.	The support base use by the Project will lead to major long-term economic opportunities but also may lead to some disturbance impacts	The facility is located within Caithness	The facility is located outwith Caithness

Workforce estimates

18.15 Many of the benefits and impacts arising from the Project are closely related to the size of the workforce and where that workforce is distributed. The assumptions made to estimate the workforce are discussed below.

18.16 It is important to make assumptions of the workforce requirements to feed into the different aspects of the assessment for socio-economics, recreation and tourism. This section outlines the assumptions and calculations that have been used to make these estimates.

Construction and installation

18.17 This assessment has estimated the workforce based on the Marine Energy supply chain survey carried out by Sgurr Energy for the Scottish Government in 2009 (Sgurr Energy, 2009), which used a factor of 20 jobs per megawatt to estimate the workforce requirements for manufacturing, construction and installation. It has been further assumed that 50% of the CAPEX was allocated to manufacturing of the turbines and 30% for foundations and installation. The final 20% covers the cabling and onshore infrastructure. For this project, also it is assumed that 30% of these jobs would be applied locally during the construction and installation phase for the offshore infrastructure which is consistent with past offshore renewables projects in the region. Assigning the employment factor of 20 jobs per newly installed MW for the maximum project capacity of 12 MW, this would equate to approximately 240 jobs being potentially available, 72 of which could be available locally) (Table 18-4). These figures are broad estimates used to give a basis for assessment but may vary from the eventual outcome.

Table 18-116 Employment estimates for the Projects' construction

MW	Total Employees (20 per MW)	Local Construction and Installation (30%)
Maximum 12	240	72

Operations and maintenance

18.18 The O&M phase workforce is difficult to estimate at this stage. However, the MeyGen (2012) project estimated that around 0.58 jobs per MW would be created for the O&M procedures of the Project. Using this estimate approximately seven jobs would be created for 25 years, if the capacity of the two turbines is rated at 6 MW each.

Decommissioning

18.19 Potential impacts during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.

18.8 Data Gaps and Uncertainties

18.20 In order to evaluate the magnitude of the potential benefits and impacts, it was necessary to understand the extent of and approach to Project activities. Many of these decisions are still to be made and some are also related to the choice of installation technology (i.e. turbine capacity), these decisions will have an influence upon the required supply chain services and the estimated work force to be employed.

18.9 Description of the Current Environment

18.21 The socio-economic benefits of the Project have potential to stretch well beyond the boundaries of the Project. Therefore, the Study Area will take a strategic approach focussing at a local (Caithness), regional (Highland) and national (Scotland) level, however the catchment for employment statistics will also include Orkney, as the Orkney supply chain could be involved in the Project given Orkneys proximity to the site.

18.22 Impacts to recreation and tourism have the potential to stretch beyond the immediate Project site. For this reason the assessment boundary is for Caithness with a particular focus on the village of Reay.

18.10 Socio-economics – Baseline Description

18.23 The enhanced Renewable Obligation Certificates (ROCs) scheme provides support to the offshore renewables market and currently offers up to 3.5 ROCs per megawatt (MW) for floating wind projects in Scottish waters, provided they are licenced before the 31 March 2017 and operational no later than the 1 October 2018 (International Energy Agency, 2015). A new system to provide support for renewable energy developments, Contracts for Difference (CfD), has recently been adopted (first rounds allocated in 2014) and the system is being transferred from ROCs to CfD. The level of support for floating wind will subsequently drop by almost 60%.

18.24 Caithness and Orkney local authorities (THC and OIC respectively) are taking a proactive approach to the development of the industry and have invested in local infrastructure to support its growth. The Caithness port improvements (Scrabster and Wick) in 2012 were all geared towards attracting more renewable projects. Equally OIC has completed upgrades to three of their major ports (Hatston, Lyness and Stromness), again to attract marine renewable projects to the islands. The local supply chain and development agencies have also invested in improvements to support the industry (HI-Energy, 2015). To date in Orkney this has mostly been focussed around wave and tidal projects at the European Marine Energy Centre (EMEC) (and the developers coming to their facilities). In Caithness the onshore and offshore wind sector has also been targeted. The medium to longer-term objectives of both areas have always been towards commercialisation of the marine renewable industry and the community is expecting to benefit from this initial investment.

18.25 In order to gain an understanding of the current socio-economic environment at the local, regional and national level, to better inform the assessment of socio-economic benefits and impacts, a number of topics were assessed at the baseline level. The topics covered within the baseline description are:

- Economics;
- Demographics;
- Ports and harbours;
- Transport; and
- Tourism and recreation.

Economics

National

18.26 The recent national economic situation, within Scotland and in the wider UK, has seen steady growth. The Organisation for Economic Co-operation and Development (OECD) economic survey completed in 2014 (OECD, 2015) showed after a period of subdued growth after the 2008 downturn economic growth in the UK picked up to 2.6% in 2014, the strongest performance among the G7 countries that year. The Scottish economy has seen slower growth but the Scottish Government website (Scottish Government, 2015) states a stronger growth (0.6%) for the first quarter of 2015. On an annual basis, comparing the latest quarter (2015 Q1) with the same quarter in the previous year (2014 Q1), GDP grew 2.8 % (Scottish Government, 2015).

18.27 The continued downward pressure on oil prices is having a different effect on different areas of the economy. Lower oil prices boost consumption as well as production in energy-intensive sectors, but squeeze investment and profitability in the oil and gas sector and the wider supply chain.

18.28 The employment rate has also shown a steady recovery nationally with Scotland slightly ahead of the UK figures (Figure 18-2). This figure also highlights the greater level of employment within the Highlands and Orkney when compared against Scottish and UK averages.

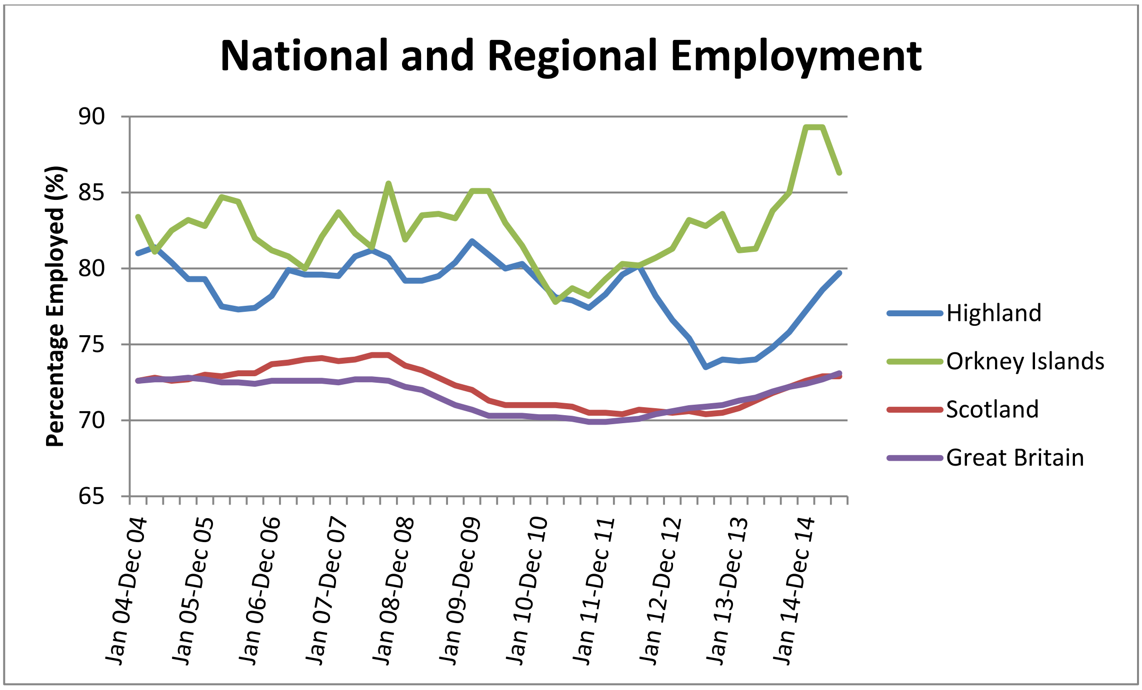


Figure 18-47 National and regional employment statistics[41]

18.29 Figure 18-3 below, highlights the continued growth, but consistent difference, in average hourly pay nationally and regionally.

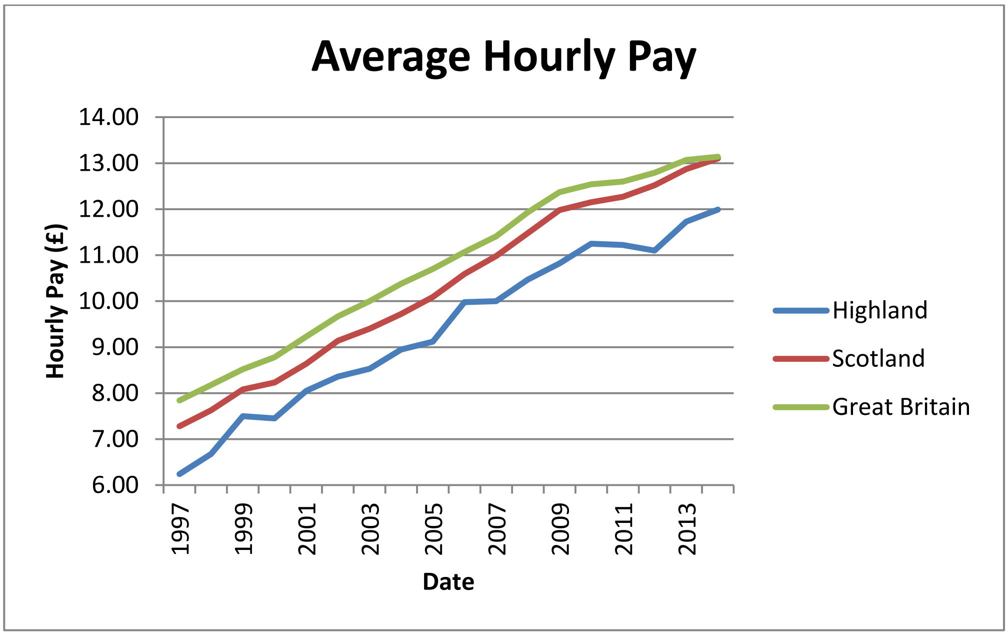


Figure 18-48 Average hourly pay comparison

[41] Office of National Statistics. (2015). NOMIS. Labour Market Profile [online] Available at: http://www.nomisweb.co.uk.

Regional

18.30 The total GVA (income approach), which measures the contribution to the economy of each industry or sector, and is used in the estimation of gross domestic product (GDP) (a key indicator of the state of the economy) within the region rose in 2014, which are the latest figures available (Table 18-5) but overall has remained relatively stable since 2009.

Table 18-117 Total regional GVA (Income approach) 2009 – 2014[42]

Region	GVA £million (workplace GVA allocated to region where it takes place)					
	2009	2010	2011	2012	2013	2014
Caithness & Sutherland and Ross & Cromarty	1,442	1,462	1,476	1,488	1,511	1,588
Orkney Islands	366	385	387	398	415	433

18.31 The regional statistics shown in Table 18-6 below shows the Highland region, which includes Caithness, has a lower level of GVA per head than the Scottish average and its near neighbour Orkney. The gross wages show a similar trend. The statistics indicate a relatively poor performing economy and taking into account that the Highland statistics include the City of Inverness the figures for Caithness could well be lower still.

Table 18-118 The GVA regional comparisons[43]

Economic Statistics	Totals	
	GVA £ per head (2012)	Gross wage and salaries per head (2012)
Scotland	49,359	21,102
Orkney	40,710	16,908
% difference v Scottish	17.5	19.9
Highland	38,666	16,375
% difference v Scottish	21.6	22.4

Demographics

18.32 The demographics of the more rural and remote areas are always a high priority for communities in the Highlands and Islands. These have less impact nationally compared to demographics in large cities but will normally feature highly on any councils list of key performance indicators. It is therefore important to discuss these factors within this

[42] Office of National Statistics. (2015). NOMIS. Labour Market Profile [online] Available at: http://www.nomisweb.co.uk.

[43] Office of National Statistics. (2015). NOMIS. Labour Market Profile [online] Available at: http://www.nomisweb.co.uk.

assessment which is located in a rural area of Caithness. The assessment includes Orkney as the proximity of Orkney could lead to the supply chain being involved in the Project (see Section 18.8).

18.33 The economic and demographic conditions nationally and in Caithness are outlined below.

National

18.34 The Scottish population as of 30 June 2014 was 5,347,600 (Office of National Statistics, 2015), an increase of 19,900 from the previous year. This rise in Scotland's population has been similar over the last ten years but should be seen in the context of the relative stability of the population over the last 50 years. The population last reached a peak of 5.24 million in 1974 before falling to 5.06 million in mid-2000 and then rising to a new high over the last 14 years. This stability is shown in the figures in Table 17-7, the economically active working population, which has also remained fairly constant and similar to UK figures.

Regional

Caithness

18.35 The population of Caithness has shown a smaller increase than the figures for the wider Highland region and Scottish figures in the period 2001-2011.

Table 18-119 Population comparisons from census information[44]

Total population	2001	2011	% change
Caithness & Sutherland	38,462	39,732	+3.3
Highlands & Islands	433,524	466,112	+7.5
Scotland	5,062,011	5,295,403	+4.6

18.36 The main population centres in Caithness are the ward of Thurso, with a population of approximately 9,074 (2011), and the ward of Wick with a population of approximately 8,200 (2011).

18.37 The annual average rate of unemployment in the Highlands (June 2015), was 3.5% (Office of National Statistics, 2015) compared to Scottish national figures of 5.9% and Orkney figures of 2.5% (Office of National Statistics, 2015).

18.38 Traditional industries such as farming, quarrying and fishing account for approximately 13% of employment (Foundation Scotland, 2013). The largest employment sector, however, is public administration, education and health, with employment of 30% of the total. The energy, water and manufacturing sector employs a relatively greater proportion of employees in Caithness and Sutherland than in the Highland region as a whole. Many of the jobs in this sector are directly or indirectly related to decommissioning activity at Dounreay. Dounreay was in the past the largest employer in Caithness but since it stopped generating in 1994 it has entered a decommissioning phase. This still requires a reasonably large workforce (approximately 800), and the value of the decommissioning work to the local economy is estimated at approximately £80 million a year (Nuclear Decommissioning Agency, 2009). Decommissioning is due to be completed by 2025. The economy is dominated by the Dounreay plant and its

[44] Scottish Government, (2011d). Scottish Census Results. [online] Available at: http://www.scotlandscensus.gov.uk/census-results

supply chain. According to the Dounreay site restoration webpage "One in five jobs in Caithness is located at Dounreay, and estimates suggest one in every three jobs in Caithness is associated indirectly with the facility" (Dounreay Site Restoration Limited, 2015).

18.39 THC, Highlands and Islands Enterprise (HIE) and the Nuclear Decommissioning Agency (NDA) are all aware of this dependence and are working to develop new businesses within the area such as renewables and this commitment has supported the recent upgrades to Scrabster Harbour, see quotes below:

18.40 "The structure of employment in Caithness and Sutherland will change in the longer-term as Dounreay is decommissioned. Emerging industries, such as wave and tidal energy developments in the Pentland Firth, tourism and financial and business services are expected to become increasingly important" (HIE, 2011).

18.41 "Scrabster Harbour has invested in upgrades to support the offshore oil industry and renewables and is actively seeking work within these offshore sectors" (pers. comm. Scrabster Harbour Trust 2015).

Orkney

18.42 The population of Orkney is 21,590 (in 2014), an increase of 0.1% since 2013. The main population centres are Kirkwall, with a population of approximately 9,200, and Stromness with a population of approximately 1,900 (OIC, 2011).

18.43 Orkney has developed an increasingly diverse economy over the past fifty years. Construction of the Flotta oil terminal and improved aviation and maritime links to and from mainland Orkney has enabled a thriving export market to grow. Although agriculture remains one of the most prolific industries on the islands, Orkney's economy has diversified from its agricultural roots and it now has a thriving tourism industry along with a successful craft industry. The success of the renewable energy sector has also diversified Orkney's economy and onshore wind and the marine renewables sector have provided income and employment for the islands.

18.44 Unemployment rates in Orkney fall consistently below the Scottish national average (see Section 17.9.2); however those claiming job seekers allowance continues to rise as the islands' population continues to swell. The largest increase in those claiming job seekers allowance has been seen in the 18-24 years age bracket. Despite this, the percentage of economically active people claiming job seekers allowance still remains half of that on mainland Scotland (Orkney Island Council, 2011).

Table 18-120 Economically active people aged 16 to 74 by Council area, Scotland, 2011 (%)[45]

Economically Active People aged 16 to 74 by Council Area	Employee: Full-time	Employee: Part-time	Self-employed	Un-employed	Full-time Student
Orkney	16.5	37.5	15.2	2.4	2.0
Highland	15.2	39.5	11.0	4.0	1.9
Scotland	13.3	39.6	7.5	4.8	3.7

[45] Scottish Government, (2011d). Scottish Census Results. [online] Available at: http://www.scotlandscensus.gov.uk/census-results

Ports and harbours

18.45 The detailed design stage of the Project is yet to be identified and so the location of the construction and O&M base(s) is unknown. Potential ports and harbours that could be used during Project activities are discussed below.

National facilities

18.46 On a national scale Scotland has a range of ports and construction facilities that could host the construction and O&M activity for the Project. The National Renewable Infrastructure Plan (Scottish Government, 2011a) completed in 2010-11 gives an assessment of the Scottish ports with regard to support of the marine renewable industry, (see Figure 18-4).

18.47 The National Renewables Infrastructure plan (NRIP) Phase 2 report (Scottish Enterprise and Highlands and Islands Enterprise, 2010) identified the need for more port infrastructure to support offshore renewables. Since then there have been a number of key investments to support the industry as it develops, such as improvements in Scrabster, Orkney, Invergordon, Lerwick, Nigg, Leith and Ardersier (see Figure 18-4). Scotland aims to attract offshore renewable projects and the Scottish Government has provided incentives in the form of ROCs (see Section 17.9.1), reduced business rates in some port areas and support for infrastructure investments to support this objective.

Figure 18-49 Port infrastructure around Scotland

Regional facilities

18.48 There are a number of harbours located within 70 km of the Project site. Figure 18-5 and Table 18-9 show their position and the distance in sea km from the site boundary, respectively.

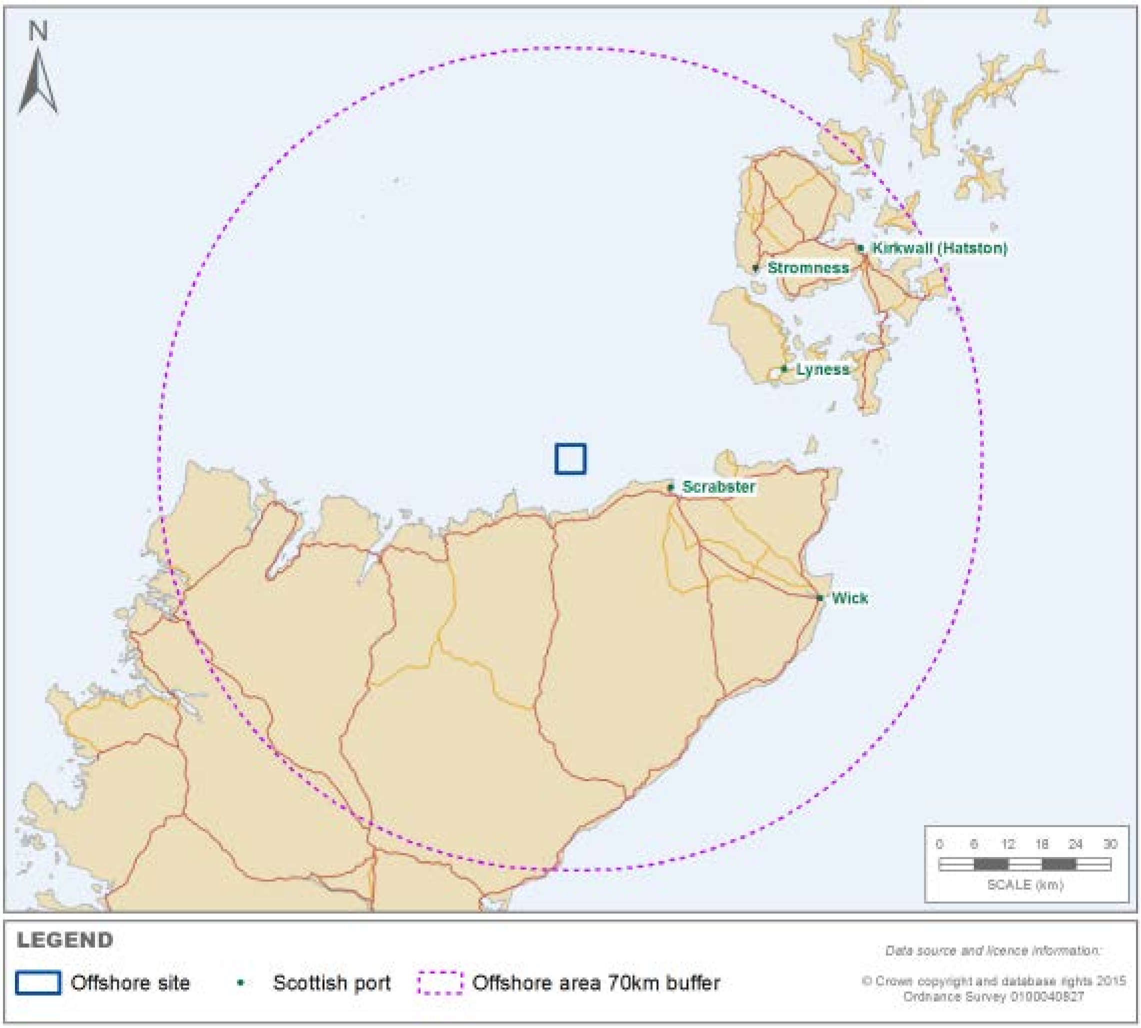


Figure 18-50 Main Scottish harbours located within a 70 km radius of the Project site

18.49 The characteristics of key ports within 70km of the Project are described in Table 18-9. Seventy km was chosen as the boundary as it was judged to be within an acceptable range to permit O&M activities.

Table 18-121 Characteristics of ports within 70 km of the Project

Ports Requirements	Distance from Site by Sea	Harbour Depth (Below chart Datum)	Maximum Available Length	Laydown Areas	Heavy Lift Facilities	Other Facilities	Road Access
Lyness	49km	4 - 8m	170m	14 hectares (35 acres) designated for marine renewables support. 4,000m^2 of hard standing on quayside plus additional 35,000m^2	Heavy lift areas constructed as part of refurbishment. May be limited by ferry capacity to take large crane	General storage areas and for development - 14.2 hectares and plans to provide steel-framed buildings, secure compounds and office and communication facilities as the site develops	Convention al/ Ro-Ro Linkspan. Sea access only
Scrabster	18km	7.5m	180m	Harbour area - 10.42 hectares Scrabster Farm development area an additional - 14ha	On-site mobile cranes from 35-350 T; Heavy lift pad up to 1,000 T	5,515 m^2 (50 kN/m^2 UDL). 45 units of HB loading. Tractor and Forklift "B" Axle load. Five high fully laden container stacks	Access to A9 trunk road
Stromness	45km	3-6m	135m	N/A	Not on-site available by arrangement with local contractors		Convention al/ Ro-Ro Linkspan. Sea access only
Wick	72km	4.2m	85m			Various buildings related to harbour activities including the former fish mart which is planned for conversion into a multi user facility	Access to A9 trunk road

Lyness Pier, Orkney

18.50 Lyness Pier on Hoy, a former naval base, has been recognised by OIC and development agencies as having the potential to attract industry and in the past has been considered as a decommissioning base, container port and fish processing hub. The OIC has invested £2.98 million in redeveloping the pier to upgrade the facilities for the renewable industry. Specifications of the site are given in Table 18-9. The area has already been involved in marine renewable activity with both the Pelamis devices and the Wello Oy Penguin device using the pier as a shore base over the last three years for the devices when not deployed at the EMEC site at Bilia Croo. The two Pelamis devices are still berthed at Lyness. The pier is also used by numerous dive boats and local fish farm boats and the Ro-Ro berth is used by the local ferry to/from Houghton and Lyness.

Scrabster Harbour, Caithness

18.51 Scrabster Harbour is an important port for the international fishing industry due to its proximity to various fishing grounds and an active fish market. Scrabster Harbour Trust (SHT) with support from the Scottish Government has undertaken a harbour redevelopment programme to facilitate marine renewable energy expansion and to provide logistical support to future oil and gas developments in the Atlantic frontier. Phase 1 of the development programme was completed in 2012. Associated facilities include additional harbour infrastructure with 190 m of new berthing face with a depth of up to 7.5 m at Chart Datum and a new Inner Basin 130 m long with a depth of 4.5 metres. The development provides 11,500 square metres of quayside area and a heavy lift pad with 1,000 tonnes capacity (Scrabster Harbour, 2015).

18.52 This redevelopment of the Old Fishmarket Pier was the first phase of the three-part Port Development Plan announced in 2007. The other two elements of the plan are still being finalised but include development of the land owned at Scrabster Farm (14 hectares) and the development of the deep-water basin (Phase 2).

18.53 Current use includes local and national fisheries, ferry services (including several daily lifeline services to Stromness in Orkney operated by Northlink Ferries), cruise boats, renewables and the oil and gas industry. The harbour is earmarked for potential use by MeyGen in support for their consented tidal development in the Inner Sound (MeyGen, 2015) and recent signing of a business agreement with NorSea Group of Norway to utilise the port as a base servicing the oil and gas industry (NorSea Group, 2015).

Copland's Dock and Stromness Harbour

18.54 Copland's Dock (100 m quayside edge) is situated within Stromness Harbour adjacent to Stromness Pier. This facility provides additional capacity for the marine renewable energy industry in Orkney with up to 3,200 m^2 of quayside hard standing. The site includes an adjacent 10 hectares of development land at Garson marked for potential storage and supply chain support, support for Orkney's local inshore fishing industry and public use. Current uses include docking of NLB vessels, as a landing pier for larger offshore creel vessels and for larger vessels during poor weather conditions.

Wick Harbour, Caithness

18.55 Wick Harbour is developing its harbour to support the marine renewable energy industry. Wick has diversified from traditional fishing activities, and in 2009 completed a marina facility and is seeking to attract new business from the development of wave, tidal, offshore wind, and oil exploration in the Pentland and Moray Firths. The harbour has a total quay length of 1,366 m with a maximum vessel length of 85 m and consists of three basins. The River Harbour is the main commercial quay (WHA, 2015).

Transport

18.56 The Project will rely on good transport links to support the construction phase and O&M phases of the Project.

National

18.57 Scotland has developed good support to its main ports and construction facilities. The majority of larger components for the offshore renewables industry travel by sea on larger vessels or barges of different types. This allows for relative ease of transport. There is a supply chain of smaller components that require road, rail or air transport routes either to the construction or assembly sites. Scotland, in general, is well served by these routes and has good links to Europe and beyond.

Local

18.58 Within the region (Caithness) the main airport is located in Wick. It has regular daily flights to Aberdeen, Edinburgh, Inverness and Glasgow. The flight times are between 40 minutes to 1 hour to these other Scottish airports.

18.59 The area is also connected by the A9 trunk road network which links through to the national road network. Work began in September 2015 to begin dualling sections of the road from Perth to Inverness, which will improve transport links, thus providing economic benefit to communities in the north of Scotland. Separately, there is also work under way to improve the road at the Berriedale Braes between Inverness and Thurso. However, that project is likely to go to a public inquiry before any construction work can begin (BBC, 2015).

Summary

18.60 The key factor influencing the socio-economic effects of this Project will be the location of the O&M and construction base. Within the Highland region marine renewables is seen by all the local authorities and stakeholder agencies as a growth industry and they are all trying to attract projects to be based within their area. The UK government has awarded the Pentland Firth and Orkney waters (PFOW) Marine Energy Park status which is a designation that has been developed to support the industry to locate within these areas. As a result of the described upgrades to harbours and the planned road improvements, Caithness is well placed to support the burgeoning marine renewables industry.

18.11 Tourism and Recreation – Baseline Description

18.61 Tourism is identified as one of Scotland's key growth sectors in the Government's Economic Strategy and is one of the most important industries for the Highlands (The Highland Council, 2013). The report by LUC (2016) indicates that annual expenditure on general marine recreation and tourism in Scotland is around £2.4 billion which represents the importance of the sector to the Scottish economy. More regionally, figures from 2011 indicate that overnight tourism in Caithness and Sutherland is worth £86.85 million (excluding day visits) and drives business generation in the area for construction, suppliers and supports local facilities such as shops, leisure facilities and transport routes which may otherwise not be sustainable based on local usage alone. Day visitors account for a further £5.67 million and it is estimated that tourism sustains 2,205 jobs across Caithness and Sutherland (The Highland Council, 2013).

18.62 The Ambitious for Tourism - Caithness and North Sutherland study (Highlands and Islands Enterprise, 2015) looked at income only from accommodation providers, estimating a total expenditure from overnight tourism section of £18.3 million.

18.63 With the decommissioning of Dounreay, government agencies (e.g. Highland and Islands Enterprise (HIE)) and local partners (Caithness Chamber of Commerce and Dounreay Stakeholder Group) have identified tourism as a potential growth sector for the area, and is considered to present further opportunities for development (Highland and Island Enterprise, 2015). The following sections summarise the key marine tourism and recreation sectors in the area of the Study Area.

Recreational angling

18.64 The north coast supports several rivers of importance of which several are designated for Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*) (see Chapter 9 Fish Ecology). The popular angling season runs from January to the end of September. The following rivers in the vicinity of the Project are considered important sea trout and salmon fishing rivers, with most of the rivers employing ghillies (seasonal and permanent) and offering lodge accommodation in association with fishing rights:

- The River Borgie runs from Loch Slain to Torrisdale Bay;
- The Naver (and its tributary, the Mallart Water) running from Loch Naver to Torrisdale Bay;
- River Strathy runs from Loch Strathy, entering the sea at Strathy Bay;
- The Halladale runs from the Knockfin Heights and enters the sea at Melvich Bay; and
- The Thurso River runs from Altnabreac and enters the sea at Thurso Bay.

Surfing

18.65 Surfing has a long history in the region. Surfers started visiting the north coast of Scotland over forty years ago and in 1973 the first Scottish Surfing Championships were held at Bettyhill near Thurso (Scottish Surfing Federation (SSF), 2013). Since then, there has been numerous surf competitions focused in the Thurso area at local, national and international levels. In 2006 Thurso hosted the inaugural O'Neill Highland Open World Qualifying Series surfing competition and from 2006-2011 O’Neill sponsored an international surf contest at this location. More recently the National Surfing Championships were held in Thurso in April 2015. These surfing competitions are a source of income to the local economy. The O’Neill Coldwater Classic was estimated to contribute £440,000 to the local economy in 2010 (ABPmer *et al.*, 2012).

18.66 The north coast of Scotland receives swell predominately from the north and west Atlantic fetches, and is considered one of the most important regions for Scottish surfing. Key breaks within 25 km of the Project include Torrisdale Beach, Farr Bay, Armadale Bay, Strathy Bay and Melvich. The Scottish Surf Federation estimates a total number of nine regular resident surfers from Melvich to Cape Wrath (SSF, 2013) and some 40 from Duncansby Head to Sandside Bay. Surf tourism is common throughout the year, with regional, national and international visitors visiting to enjoy less busy conditions outwith the tourist season in summer, and relatively consistent surf.

18.67 A number of local shops supply surfers with equipment, clothes and services including Thurso Surf (shop and surf school located in Thurso) and Surf Wrath (shop located at Scarfskerry). A local Caithness Board riders club forms a loose club affiliation for local surfers. The North Shore Surf Club also operates along the Caithness coast, mainly out of Thurso.

Recreational sailing

18.68 The tourism and recreation study by Marine Scotland, 2015, identifies areas of recreational vessel activity and the main routes to and from all major marinas and ports in the area as well as commonly used bays and anchorages. The main period of activity is summer, with little activity outside of April to September. Other minor routes that are used frequently by recreational users are illustrated in Chapter 13 Shipping and Navigation. Recreational anchorages include a cluster of five at the entrance to, and within, Loch Eriboll and a cluster of four at the entrance to and within the Kyle of Tongue. There is one known local sailing club (Pentland Firth Yacht Club) based in Scrabster Bay in Thurso, focused on small sailing dinghies. Recreational sailing on the north coast is increasing due to some improvements in infrastructure and development of sail tourism (Marine Scotland, 2015).

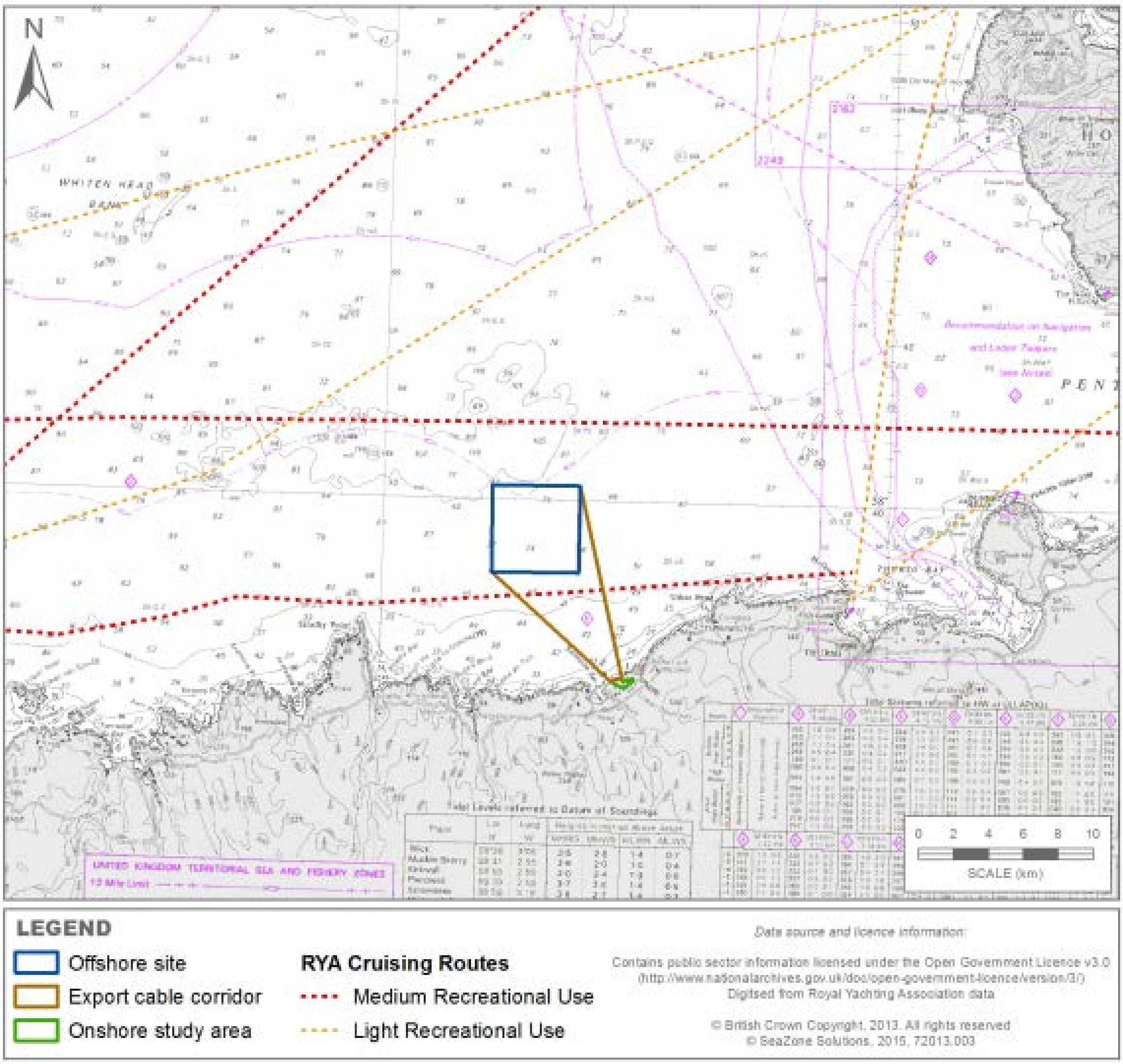


Figure 18-51 RYA sailing routes

Sea angling and wildlife trips

18.69 There are an estimated 7,894 resident sea anglers in northern Scotland with an annual expenditure of £11.2 million in the region (Scottish Executive *et al.*, 2011). Sea fishing in the area is primarily based from Scrabster. The Silver Line sea angling vessel is berthed in Scrabster and operates from Brough Bay and west of Thurso. The Hebridean Warrior is also based in Scrabster for sea fishing trips off the north coast, e.g. to Brough Bay, and advertises summer trips to Orkney. Wild Sea Charters and MV Stormdrift, also based from Scrabster, provides wildlife watching activities.

Canoeing and kayaking

18.70 Canoeing includes the activities of sea kayaking (sea touring) and surf kayaking (similar to surfing but with boats designed for use in the surf zone). There are a number of clubs in the region: The Caithness Kayak Club, East Sutherland Kayak Club and the Pentland Canoe Club. The Pentland Canoe Club coordinates multiple paddling activities including training and sea sessions. The Scottish Canoe Association (SCA) has held their National Canoe Surfing Championships in Caithness each year since the mid-1980s, along with intermittent international level championships. Caithness Kayak Club is based at Ackergill Harbour, which is based to the south east of the site slightly north of the ward of Wick. The coastline and sea lochs of Sutherland are considered some of the finest for sea touring in kayaks (Marine Scotland, 2015).

18.71 It is recognised that sea kayaking and canoeing are generally not limited to any particular locations throughout the region, beyond remaining generally closer to shore for safety reasons (see Section 18.18).

18.72 Slipways and piers may be used by canoeists and kayakers as well as other boat-based recreational activities.

SCUBA diving

18.73 Scuba diving is a popular activity in the Pentland Firth and Orkney Waters (PFOW) area with a number of sites along the north coast of Sutherland and Caithness that are popular with divers. There is a Caithness Diving Club which has around 30 members. There are no recreational dive sites in the immediate vicinity of any part of the Project, the closest being Portskerra Haven approximately 8 km east from the Project site. There are a number of recreational dive sites clustered on the east of Loch Eriboll at Ard Neckie (a shore dive) and Kempie (a wreck dive) (see Figure 18-7).

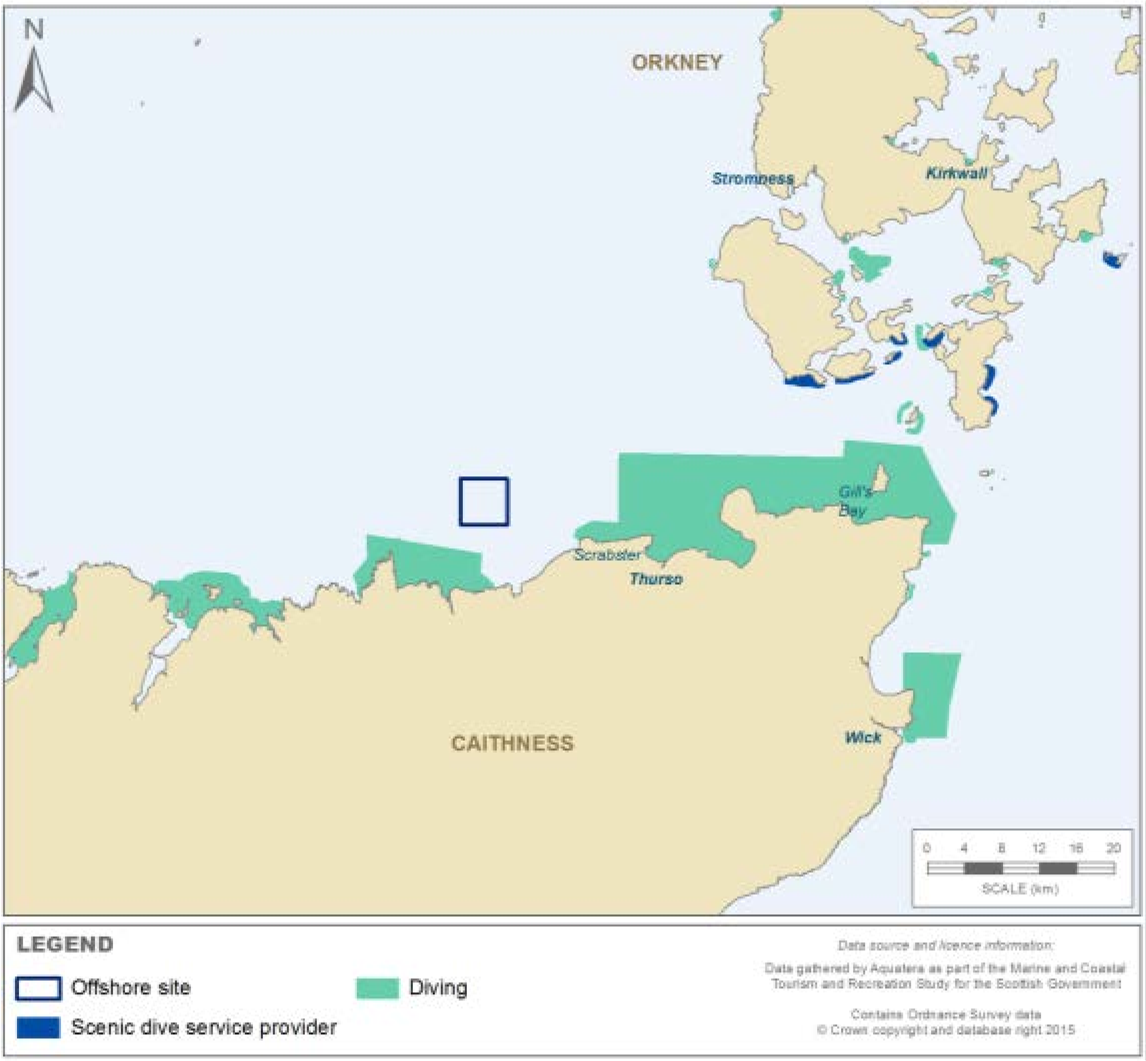


Figure 18-52 Dive sites and dive service providers locations in relation to the Project

Walking

18.74 Walking is practised throughout the north of Scotland by both locals and tourists. There are no core paths in the cable route Study Area. The closest designated core path is Path CA11.07 which provides a walking route from Reay village to the beach area in the south of Sandside Bay and which lies well to the west of the Study Area (see Figure 18-8 and Chapter 22 Land Use, Agriculture and Soils).

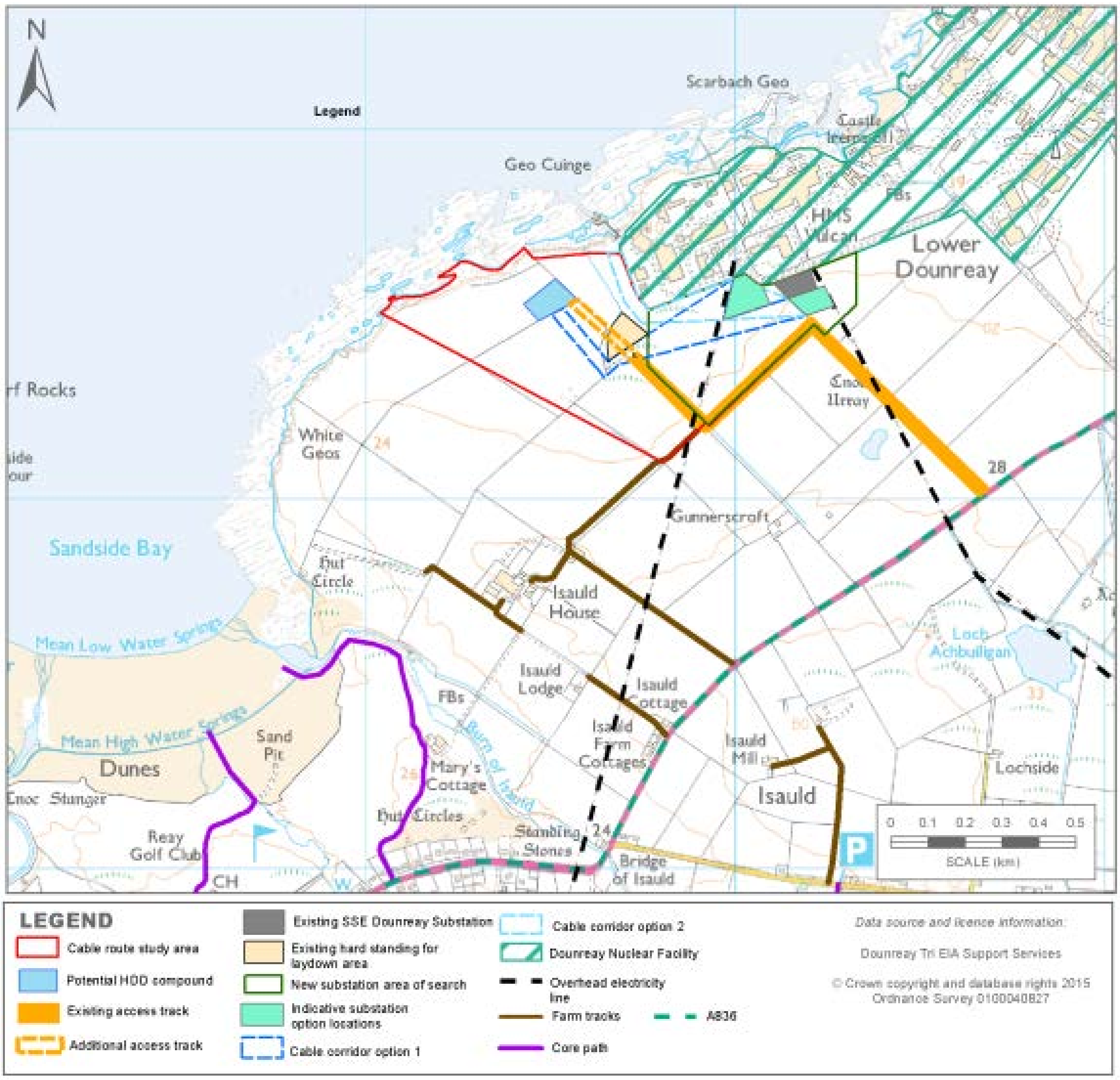


Figure 18-53 Land uses in the cable route Study Area, core paths in purple

18.12 Socio-economics – Potential Benefits and Impacts

18.75 Within this assessment benefits are defined as the advantages to a particular geographical area of having the Project located within it. The impacts are the issues that this location will have if the Project is based there.

18.76 The potential impacts and benefits have been identified initially through scoping, followed by further investigation during a stakeholder consultation exercise carried out to discuss the socio-economic impacts.

18.77 This impact assessment considers the Project in the medium to longer-term, however, the impact (negative and positive) could be significantly greater over the life of the Project and beyond. This is due to the greater opportunity presented to the Scottish supply chain through a potential full commercial scale offshore wind development utilising floating technology. Given the novel nature of the technology there is the potential for the Scottish supply chain to become a leader in the construction, installation, operation and maintenance and decommissioning. Although not arising immediately as a result of this Project it is a necessary stepping stone to achieving far greater potential economic benefits.

Table 18-122 Potential benefits and impacts

Benefits/Impacts
Potential benefits
Local employment and business opportunities
Gross value added (GVA)
Local employment and business opportunities generated through onshore works
Quality of life
Improvements to local infrastructure
Increased knowledge
Clustering effect
Energy security
Potential impacts
Pressure on local infrastructure and services
Commercial fisheries impacts
Direct impact on access to amenities

18.78 Each of these potential impacts (positive or negative) is assessed below.

Cost estimates/assumptions

18.79 There is considerable potential for cost differences between traditional fixed substructure wind farms and floating wind farms. For example, the higher capital expenditure (CapEX) of the floating wind platform, moorings and anchors could be negated by lower installation costs and lower operational expenditure (OpEX) driven by cheaper repair costs for major components (Carbon Trust, 2015). Demonstrating and validating the cost reduction potential is a critical next step for the industry.

18.80 A report by the Carbon Trust, 2015, indicates that the expected average cost for full scale prototype floating wind projects is £5.2 million per MW. Using this estimate a total CapEX assumption for the Project is £62.4 million (if the Project is completed with a capacity of 12 MW). Furthermore, a £100 million operational spend over a 20 year timescale, based on £5 million per annum average spend, has also been used for the impact assessment. This has been undertaken in accordance with Scottish Enterprise's economic impact assessment and additionality guidance[46], the HM Treasury Green Book guidance[47]and the Scottish Government Annual Statistics[48].

18.81 Included in the total capital spend is £12.48 million (20% CapEX) for cabling and onshore construction activity associated with civil engineering and the building of the onshore substation and cable termination. £18.72 million (30% CapEX) is for foundations and installation, with the remaining £31.2 million (50% CapEX) going towards the costs of the turbines and floating platform.

18.82 The assumptions and multipliers used to assess the economic impact from the Project on the local community have been carried out in accordance with Scottish Enterprise's guidelines and are shown in Table 18-18 below.

Specific criteria used to evaluate the potential benefits and impacts to socio-economics

18.83 The detailed design envelope of the Project is yet to be finalised and many of these factors (e.g. location of construction base, capacity of turbines) will have a bearing on the level of socio-economic impact (positive or negative) brought about by the Project. It was therefore decided to assess the potential impacts under two different scenarios. A positive scenario and a negative scenario. The following tables define the outcomes that should be expected in a positive (Table 18-12**)** and negative (Table 18-14) scenario. The impacts are categorised using the parameters in Table 18-11.

Table 18-123 Categories for impacts

Impact Magnitude	Description
Highly positive	Large improvements in economic conditions
Positive	Moderate improvements in economic conditions
Minimal	Slight improvements in economic conditions
None	No change in economic conditions
Negative	Slight decline in economic conditions
Highly negative	Large decline in economic conditions
N/A	Not appropriate

[46] Scottish Enterprise, 2008. Additionality & Economic Impact Assessment Guidance Note: A Summary Guide to Assessing the Additional Benefit, or Additionality, of an Economic Development Project or Programme

[47] http://www.hm-treasury.gov.uk/data_greenbook_supguidance.htm

[48] http://www.scotland.gov.uk/Topics/Statistics/Browse/Economy/Input-Output/IOAllFiles2007

Table 18-124 Positive scenario

Project Parameter Relevant to the Assessment	Outcomes that Define the Design Envelope
Construction, O&M and decommissioning location	All activity takes place in Scotland except for the manufacture of turbines
Project capacity	The Project is completed with a capacity of 12 MW
Project construction timescales	Project built within timescales
Project O&M timescales	If lengthened and/or repowered economic benefit will be increased
Type and origin of vessels	Local and regional vessels used to deploy and maintain equipment and lay cables
Project decommissioning Strategy	Repowering or redevelopment of the site leading to ongoing capital and operations spend along with revenues, and associated economic benefit
Employment numbers	Employment levels are realised with an appropriate level of localisation of opportunities and employment terms are compatible with or better than those in the existing employment market
Construction and installation base	The facility is located within the local region (Caithness)
Operations and maintenance base	The facility is located within the local region (Caithness)

Table 18-125 National, regional and local impacts under positive scenario

Impact Category	Local	Regional	National
Local employment and business opportunities	Positive	Positive	Positive
Improvements to local infrastructure	Positive	Positive	N/A
Quality of life	Positive	Positive	N/A
Increased Knowledge	Positive	Positive	Positive
Clustering effect	Positive	Positive	N/A
Energy security	Minimal	Minimal	Minimal
Pressure on local infrastructure and services	None	None	N/A
Commercial fisheries impacts	None	None	N/A
Direct impact on access to amenities	None	None	N/A

Table 18-126 Negative scenario

Project Parameter Relevant to the Assessment	Outcomes that Define the Design Envelope
Construction, O&M and decommissioning location	Large proportion of the construction work is completed outside Scotland, with O&M and decommissioning carried out locally within Scotland
Project capacity	The Project is completed with a capacity of 8 MW
Project construction timescales	Project delay
Project O&M timescales	If shortened economic benefit will be reduced
Type and origin of vessels	Imported vessels from national or international areas
Project decommissioning strategy	Removal of all equipment leaving a clear site, leading to a short-term task related increase in jobs but no long-term benefit
Employment numbers	Employment levels are lower than planned, localisation of employment is not, or is poorly achieved, terms are incompatible with or worse than existing local practices
Construction and installation base	The facility is located outwith the local region (Caithness)
Operations and maintenance base	The facility is located outwith the local region (Caithness)

Table 18-127 National, regional and local impacts under negative scenario

Impact Category	Local	Regional	National
Local employment and business opportunities	Minimal	Minimal	Minimal
Improvements to local infrastructure	None	None	N/A
Quality of life	None	None	N/A
Increased knowledge	Minimal	None	N/A
Clustering effect	Minimal	None	None
Energy security	Minimal	Minimal	Minimal
Pressure on local infrastructure and services	None	None	N/A
Commercial fisheries impacts	None	None	N/A
Direct impact on access to amenities	None	None	N/A

18.13 Mitigation and Optimisation Measures

18.84 There are only limited mitigation measures that have been agreed relevant to this assessment due to the largely positive nature this Project has on employment and other service benefits.

Project design mitigation

18.85 The Project design will have little effect on the socio-economic aspects of the areas being considered. The best form of mitigation is planning, i.e. planning ahead for the Project activities in order to avoid conflicts with other sectors that generate income for the economy. Once the construction and O&M bases have been chosen this will allow for detailed planning of Project activities, which will enable any potential conflicts to be identified and then mitigated. A number of the questions and concerns of consultees will be resolved through the internal and external planning processes which will be undertaken as the Project develops.

Receptor specific mitigation

18.86 The following mitigation measures will be implemented specifically to minimise the impacts on socio-economic receptors.

Table 18-128 Receptor specific mitigation measures

Title	Description
Infrastructure requirements	If construction of the floating platform is carried out in the Highland region Dounreay Trì Ltd. will liaise with the relevant planning authorities, to avoid congestion and pressure on existing housing and accommodation. Liaison will allow measures such as the supply of temporary accommodation for Project personnel during the construction phase.
Infrastructure requirements	Dounreay Trì Ltd. will work with relevant planning authorities to develop appropriate mitigation for any potential conflicts of Project vessels and other transport with existing uses of ports.
Infrastructure requirements	Dounreay Trì Ltd. will discuss with ports authorities the best way to ease congestion in the vicinity of the Project site, including consideration of infrastructure upgrades in the locality if required (although unlikely due to small scale of the Project).
Harbour congestion	Dounreay Trì Ltd. will work with the relevant harbour authorities when planning major operations to fit into general harbour management

18.14 Residual Impacts

18.87 The committed mitigation (see Section 18.12) is focussed around commitment to effective communication and stakeholder engagement that Dounreay Trì Ltd. will undertake to ensure that each of the areas within the negative scenario are resolved satisfactorily, prior to each phase of the Project. The Design Envelope is at this stage relatively broad (see Section 18.6) and there will need to be ongoing discussion with the stakeholders as the final design is identified. The Project has the potential to have a significant positive benefit to any community that is chosen as the construction base or the O&M base, and these benefits such as employment and upgraded infrastructure require to be managed and communicated clearly, which is the key mitigation that Dounreay Trì Ltd. will undertake.

Local employment and business opportunities

18.88 This is the key positive impact for the Project. There have already been some positive benefits with local firms delivering aspects of the EIA and completing the survey work required.

18.89 Work undertaken by Aquatera *et al.*, (2012) indicated that there has been upwards of £300 million (Table 18-17) of investment in projects and supporting infrastructure in Orkney and the north coast of Scotland. Since these figures were collated the MeyGen Tidal Energy project in Caithness has been consented and is now being built which would add substantially to these figures. This investment supports upwards of 200 jobs although 2015 saw a slight downturn in the Orkney figures.

Table 18-129 Investment in Orkney on marine renewables and renewable infrastructure projects (Aquatera, 2012)

Area	Gross investment to date in Orkney (2012)	Orkney investment to date (2012)	Orkney contribution (%)
Marine (wave)	£100 M	£5 M	5%
Marine (tidal)	£140 M	£10 M	7%
Ports	£20 M	£10 M	50%
Vessels	£15 M	£15 M	100%
New grid	£25 M	£5 M	25%
Total	**£300 M**	**£45 M**	**15%**

18.90 These investment levels have been achieved during the research and development and testing phase of marine renewables.

Construction and installation

18.91 Platform construction and installation will take place over 12-18 months (see Chapter 4 Project Description). This will require a construction workforce to be on site for this period. Fit out, turbine installation and commissioning of the platform will take place at a dry dock or quayside somewhere in Scotland and floated into position for installation on site, with the main construction of the wind turbine generator (WTG) units being carried out by the supply chain elsewhere.

18.92 The Project requires offshore construction work with the associated vessel requirements. This will increase the opportunities for local marine companies and their employees in each location depending on the types of vessels used. There could also be local benefit in supplying goods and services to the construction base, vessels and commissioning contractors. As previously mentioned it is assumed that 30% of the total construction jobs will be applied locally. It can therefore be estimated that 72 jobs will be created locally during construction and installation if the Project is completed with a capacity of 12 MW.

Operations and maintenance

18.93 To estimate net additional direct employment impacts for operation and maintenance procedures, a series of factors must be applied to the base direct employment figure. These are assessed for the regional bases and may need some adjustments if the base is designated outside the region.

18.94 The dead weight[49] effect is given to be 0% as without the Project there would be no equivalent employment created through any other means. Since permanent high value employment of this type is limited in Caithness, and few of these jobs would pass outside the local or wider labour market to elsewhere, the leakage[50] is taken to be at a low level and given a factor of 10%. It is also assumed that the displacement[51] effect would be limited given the nature of the supply chain and its development; it therefore is also given a value of 10%. These figures are similar to the assessment completed for the MeyGen (MeyGen, 2014) project which is relatively close to the Project and is assessing the same catchment area.

18.95 The Project needs also to assess the multiplier effect that estimates the indirect and induced jobs that would arise from the Project. Since there is no direct multiplier for these operations, the multiplier used is the Scottish Government established Type II for "machinery and equipment" of 1.8 (this is the same as for "fabricated metal" which would be another similar category).

18.96 Based on these assumptions, the total local direct jobs that will be created during construction and installation is estimated as six. Adding indirect and induced jobs[52], the total is 11 jobs (see Table 18-18).

18.97 The GVA estimated from Scottish Government statistics (SG, 2009) is estimated for construction/civil engineering as £52,876 per employee and applying this to the job estimates gives a GVA of £529,760 for the Project (Table 18-18).

Table 18-130 GVA and employment estimates for the Project during operation and maintenance

	Number of Jobs	Local Employment Factors			Total Local Direct Jobs	Total Direct, Indirect and Induced Jobs	Total GVA
Factor values	7	Dead weight (0)	Leakage (-10%)	Displace-ment (-10%)	6	Employment multiplier = 1.8	GVA per employment estimate = £52,976
		0	-0.7	-0.63		11	£529,760

[49] Benefits that would have occurred anyway without the intervention of the Project

[50] The proportion of outputs that benefit those outside of the intervention target area or group

[51] The proportion of intervention benefits accounted for by reduced benefits elsewhere in the target area

[52] www.gov.scot/Topics/Statistics/Browse/Economy/Input-Output/Mulitipliers (Scottish government , 2015) defines the direct, indirect and induced as "*an increase in final demand for a particular product, we can assume that there will be an increase in the output of that product, as producers react to meet the increased demand; this is the direct effect. As these producers increase their output, there will also be an increase in demand on their suppliers and so on down the supply chain; this is the indirect effect. As a result of the direct and indirect effects the level of household income throughout the economy will increase as a result of increased employment. A proportion of this increased income will be re-spent on final goods and services: this is the induced effect.*"

Gross value added (GVA)

18.98 To give an understanding of the value to the economy of the Project it is standard practice to estimate the increase in GVA that the Project will bring to the area. The GVA calculation for the Project is based on percentages used for the workforce estimates and is shown in Table 18-19.

Table 18-131 GVA estimates for expected CapEX investment (Carbon Trust, 2015)

CapEX Estimate per MW for Pre-commercial Floating Wind Projects	Dounreay Trì Ltd. – 12 MW Capacity
£5.2 million	£62.4 million

18.99 The above figure has been used to estimate the GVA figures for the Project within a local context.

Table 18-132 Local content estimates

GVA Estimates			
Project Capacity (MW)	GVA	Construction and Installation	Totals Locally
12	£62.4 million	30%	£18.7 million

National context

18.100 The national impact is highly dependent on the choice of O&M base and the location of the construction and installation works. Within the national context wherever the bases are located the benefits of increased employment and GVA will be similar. The numbers of jobs and levels of GVA are broad estimates at this stage and will only be refined when technology choices are confirmed.

18.101 The Scottish economy has grown more slowly than the UK as a whole according to Scottish Government statistics (Scottish Government, 2015 and see Section 17.9.2). When rounded to one decimal place, at 2014 Q3 annual GDP growth in Scotland was 0.2 percentage points lower than in the UK (see Section 17.9.2). At 2014 Q4, annual GDP growth in Scotland was 0.1 percentage points lower than in the UK therefore any investment of this kind would be welcomed.

18.102 Nationally this project is unlikely to be significant due to its relatively small size. However, the Project fits into the Scottish Governments plan to develop a high value marine renewable industry and the focus on the PFOW area as a preferred area for this investment. This demonstration project could help establish a supply chain and allow unique knowledge to be gained of the relatively new floating offshore wind industry.

Regional Context

18.103 The ports of Scrabster, Lyness and Stromness could potentially serve as the O&M base for the Project (see Table 18-9).

Scrabster

18.104 The area would benefit from the increased workforce and its associated base. Scrabster has better transport links for travelling workers than Stromness and Lyness so there would be less displacement of staff from other businesses or these would be more readily replaced therefore less issues for the businesses. Caithness and Sutherland has a higher unemployment rate (3.4% 2013) than Orkney and is just below the Scottish national average. This suggests more potential opportunities for local employees. It also has a relatively skilled engineering workforce due to the presence of the Dounreay nuclear facility and its decommissioning.

18.105 Regionally, the local job market within Caithness is limited with a high proportion of jobs reliant on the decommissioning of the Dounreay Nuclear Plant, therefore the creation of a construction base for the Project at Scrabster could have a significant positive impact on the local community.

Lyness

18.106 If the construction base is located at Lyness this would have a significant effect on the local employment even though the required workforce is relatively small. The population of Hoy is around 400 people therefore the requirement for approximately 72 jobs and the associated service base infrastructure will positively impact on the area by creating demand for services as well as employment opportunities. It should be noted that it is unlikely that all of these jobs would go to Hoy residents; nonetheless the Project would still have a positive benefit to the local community if Lyness was chosen as the construction base. Direct and indirect employment will lead to a range of employment opportunities. There is the possibility of leakage from other businesses and this will have an associated impact on those businesses. The employment opportunities on Hoy at the moment are relatively small and a number of islanders have had to leave the island seeking work (consultation by Aquatera with Community Council during impact assessment for Brims Tidal Array). There is a high likelihood that a number of workers would commute from the mainland similar to the situation at the Flotta Oil Terminal.

Stromness

18.107 Stromness is a busier port than Lyness but has recently had a new pier (Copland's Dock) constructed to support the marine renewables industry. There are already a number of regular users such as aquaculture support vessels and inshore fishing vessels, which have traditionally used the pier. With the development of the marine renewables industry a larger amount of renewable work boat activity has taken place in the area.

18.108 There are around 10 hectares of laydown area available for development. The impact of an O&M base would have a positive effect on the community and would benefit the local businesses that service the base. There could be some workforce leakage to the Project putting some pressure on other local businesses. Orkney in general has a very low unemployment rate (1.3% compared to Scottish national average of 3.8% (2012) see Section 18.9) therefore the predominant source for the local workforce would be from displacement from other employment or there would be greater reliance on workers from further afield.

Operations and maintenance

18.109 Maintenance will involve a dedicated vessel servicing the site with more vessels used on a planned basis for larger maintenance operations. The O&M base is likely to be based locally and therefore the Project could involve locally based vessels working from Scrabster, Lyness or Stromness. This would support local employment.

18.110 The planned maintenance will include one visit to the site per week, in order to carry out routine servicing of turbine components and platform equipment.

18.111 Whichever port is selected the planned maintenance will require vessels and onshore staff to work on the floating platform. Table 18-21 gives details of the types of vessels that will be used on site. There could also be the need for extended hours of work during a period of good weather and favourable tidal conditions so the numbers might increase to cover shift working.

Table 18-133 Vessels to be used during maintenance

Vessel Type	No. of Vessels	Operations	Phase
Cable laying vessel (medium sized)	1	Cable installation	Construction
Anchor handling tug supply (AHTS) vessel	4	Used for mooring layout (1 vessel), for platform tow (3 vessels) and for platform installation (4 vessels)	Construction / installation
Flat deck barge	1	Mooring layout	Construction
Tug	1	Mooring layout	Construction
Dive support vessel	1	Cable installation	Construction
Work boat	1	Platform installation	Installation
Crew boat	1	Commissioning and planned maintenance	Installation and O&M

18.112 The onshore operations will, over time, become streamlined and timescales reduced but there will be a planned series of events. The maintenance period is suggested as once a week. Regular inspections and cable surveys will also be undertaken. These regular maintenance activities will provide a direct socio-economic benefit, to the area in which they are based, through providing regular work to the vessel operators.

18.113 There will also be a service supply chain that could provide opportunities for local companies and service industries to expand their operations.

Decommissioning

18.114 This process would take place over a similar time period and create a number of the same opportunities as the construction phase. Therefore, a similar level of impact as from the construction and installation phase is likely to occur at each port.

Summary of GVA impacts

18.115 Nationally, although small, this project could bring moderate benefits through its ability to stimulate development in a nascent industry. It fits into the Scottish and UK Governments plans to develop a high value marine renewable industry within the UK and the focus on the PFOW area as a preferred area for this investment. Within the region marine renewables is seen by all the local authorities and stakeholder agencies as a growth industry and they are all trying to attract projects to be based within their area. The UK Government has awarded the PFOW area Marine Energy Park status which is a designation that has been developed to support the industry to locate within these areas.

18.116 Scrabster has a relatively small resident population but is within 3 km of Thurso which has a population of over 7,000. The jobs that could potentially be created would however be relatively skilled and support a reasonable income level which would impact on the areas involved.

18.117 The local job market within Hoy, which includes the port of Lyness, is limited and therefore either designation could have a very significant positive impact for the local community. The improvements already carried out at Lyness and the renewable companies already using the port have increased the work activity around the port and have already had a positive impact. Pelamis Ltd (before their liquidation) employed six people in Hoy and three in Stromness.

18.118 Stromness is a town of approximately 2,000 people (see Section 17.9.3) so the benefit or impact of any associated jobs would be proportionately less, but still significant.

18.119 The impact on local economies of each area will be largely positive whichever port is used as a base. The local region in general has relatively low levels of unemployment (see Section 18.13) but can be vulnerable to emigration of workforce if jobs are not available and finding workers for new jobs can be challenging (OIC, 2011). Therefore, the vulnerability to changes in employment opportunities is high. There is a need for new employment opportunities and for backfilling jobs lost in other sectors e.g. Flotta Oil Terminal and Dounreay. The opportunities the Project takes to the area for increasing business will likely be welcomed by the majority of stakeholders and therefore the vulnerability is low. The numbers of the workforce required is relatively low (see Section 18.6), but will nonetheless have a beneficial effect whichever port is finally selected, as will the downstream business that will service the Project. As with the majority of socio-economic effects it will have a positive effect.

Local employment and business opportunities generated through onshore works

18.120 The Project will require construction activity associated with bringing the export cable ashore. The design freeze highlights three potential approaches to cable landfall. These are trenching, horizontal direct drilling (HDD) or pinning to an existing outfall. Whichever method is chosen the anticipated installation time, including weather downtime and tidal restrictions, is 3 months (see Chapter 4 Project Description).

18.121 The Project will also require construction of an onshore substation or switchgear building to transmit the energy produced by the wind farm to the national grid, as well as a road track in order to access it. The design freeze states that the construction period for the onshore substation will be around 12-18 months. The overall programme of works would likely remain 12-18 months as the construction of the cable landfall, underground cable system and substation can be undertaken in parallel.

18.122 These construction activities will likely be carried out by contractors from within the local Caithness area or wider highland region which will provide socio-economic benefits in the form of increased employment, business opportunities and increased demand on local services. Although at this stage of the Project it is not possible to estimate the proportion of the workforce recruited locally for the onshore construction works, the relatively long period over which they will take place, demonstrates the capability of this phase of the Project to provide significant socio-economic benefits to the local community.

18.123 The operations and maintenance of the onshore substation will not result in the creation of any new local employment as the onshore infrastructure for the Project will not be permanently staffed. Operational expenditure on plant materials and services for maintenance purposes could potentially be attained from Caithness or the wider Highland region which would bring further benefits to these areas.

Quality of life

18.124 Some of the benefits resulting from bringing new high value jobs to an area include:

- Wage inflation;
- Population increase which could benefit the local economy; and
- Attracting younger people into the area.

18.125 At this stage of the Project it is not easy to define wage rates and the potential for increases and/or leakage but using the statistics from the Scottish Government's National Statistics Office from 2012 (ONS, 2012) it can be estimated that when compared with Scotland's gross wage and salaries per head, Caithness wages are 22% lower. The closest comparative category within the statistics (specialist construction activities) shows a much lower difference but the key fact is that nationally these wages are 30% higher than the average Highland salary (£23,313 compared to £16,375 for Highland) (see Table 18-22).

Table 18-134 GVA and wage estimates for national and regional areas

Economic Statistics	Totals		Specialised Construction Activities	
	GVA £ per head (2012)	Gross wage & salaries per head (2012)	GVA per head (2012)	Gross wage & salaries per head (2012)
Scotland	49,359	21,102	47,200	23,313
Orkney	40,710	16,908	46,275	20,698
% difference v Scottish	17.5	19.9	2	11.2
Highland	38,666	16,375	52,701	22,898
% difference v Scottish	21.6	22.4	+11	1.8

Population increase

18.126 The relatively short timescale of the Project and the relatively small local workforce that is required to undertake the Project O&M activities means any population increase is likely to be minor. However, any increase in population, even if small in scale and short-term would still have a positive impact due to the present low populations and the resulting economic stimulus that any population increase could give. The benefits to any increase in population in the longer-term would likely outweigh any issues such as increased pressure on accommodation that might occur with a short-term increase in the population.

Attracting younger people into the area

18.127 Rural areas typically have problems attracting young people to stay or come to the area mostly due to the lack of good employment opportunities. This Project has the opportunity to offer some long-term jobs which should encourage young people to the area.

Summary of quality of life impacts

18.128 Preliminary consultation has indicated a generally positive response to the Project with the option to attract people to the area supporting local services and businesses. This would be echoed within any area that was offered this opportunity particularly any rural or remote areas. Overall the Project is assessed as having a positive effect on the quality of life for the community at whichever port or construction site is chosen as the construction or O&M base.

Improvements to local infrastructure

18.129 The small scale of the Project and the fact that the floating platform will be towed to the installation site from the chosen construction port means that there is unlikely to be a requirement for any infrastructure improvements in order to accommodate the Project. The ability to tow means construction of the floating platform can take place far away from site, therefore any infrastructure improvements to dry docks etc. in the local region are likely not required. Furthermore, the surrounding ports such as Scrabster, Stromness and Lyness are already well equipped to act as an operations and maintenance base for the Project, as they have been upgraded in order to accommodate the already large proportion of marine renewable energy activity in the region.

Increased knowledge

18.130 The knowledge gained from having a novel floating wind demonstration plant of this kind will increase the knowledge bank and attract interest from elsewhere to come and learn from the Project. The knowledge gained from this demonstration Project could help inform other floating wind demonstration projects, particularly those similar to the type of floating technology used in this Project, which could attract other developers to the region.

Clustering

18.131 Clustering of direct supply chain, educational institutes and wider associated suppliers and business is a positive benefit for host communities and has been seen to have a significant effect in Orkney and the wider Pentland Firth area. Clustering has certainly enhanced the work at EMEC and the development of a novel wind energy project close to operations will again have a positive impact on the area and industry. This positive effect would be amplified if the construction base for the floating platform was to be located in the Caithness area, therefore relatively close to EMEC's operations in Orkney, permitting utilisation of the local supply chain and other businesses.

Energy security

18.132 Any improvements to energy security are likely to be minor due to the relatively small scale of the Project (max. 12 MW). However, the development of the floating offshore wind industry in Scotland could prove invaluable to Scotland's long-term energy security due to a large proportion of the country's offshore environment being sufficiently deep to limit the economic feasibility of traditional fixed sub-structure offshore wind farms. Successful development of the floating offshore wind industry and an associated supply chain could permit growth of the industry and allow a large uptake of floating wind farms in the country, thus contributing to an increase in energy security. The continued development and expansion of renewable energy increases energy security and also provides security to local businesses and creates jobs bringing more opportunities to rural areas.

Pressure on infrastructure and services

National

18.133 Nationally the Project is likely to be based in or around a port facility. These are serviced deliberately for this type of operation. With the growth in marine renewables any area that is considered for the Project is likely to develop the infrastructure and services to suit the Project. There may be some initial impact on services which will depend on the base chosen, but they will be minor (not significant) because of the relatively short time period of the Project construction activities and the ability of Scotland's large infrastructure base to absorb the Project activities.

Local

18.134 Depending on where the base for construction of the floating platform is chosen, there could be pressure on accommodation and other related services in the Caithness region, particularly during the summer months when a lot of tourists visit the local area. However, the fact that the floating platform can be fabricated far away from the Project site and then towed to site points indicates that this stage of the process may be undertaken outside the Caithness region. Nonetheless, the large amounts of available accommodation provided for tourists in the region and proper planning of the workforce requirements and thus, the required accommodation, will limit stresses to available accommodation (see Section 18.18).

Commercial fisheries impacts

Loss of income due to restrictions to fishing grounds resulting from any restrictions/exclusion zones

Construction

18.135 Impacts on fisheries are discussed in Chapter 12 Commercial Fisheries. The temporary safety zone of 500 m during construction could have an effect on fishermen in the area. Although small, the Project could result in a loss of area available for fishing and therefore potential income.

18.136 As a result of the safety zone, construction traffic may undertake slower speeds than normal vessel traffic in the area, which could temporarily disrupt fishing activity to allow safe transit of these vessels; however this should not halt or impede fishing activity to a degree which is over and above normal variation of navigational obstacles experienced.

18.137 Fishing vessels are accustomed to the consideration of other sea users and given the nature and frequency of vessel transits in and around the Pentland Firth shipping lane and general inshore waters, vessel traffic associated with construction of the Project is unlikely to constitute an additional significant disruption to fishing activity. Therefore, any disruption to fishing activity and associated loss of income from reduction in fishing effort is considered minor (not significant).

Operations and maintenance

18.138 For the purposes of this assessment a worst case scenario is assumed. It is possible that the area will have restrictions on fishing for the whole duration of the Project. However, the footprint of the floating platform and associated moorings is relatively small in proportion to the extensive fishing grounds available within the Study Area and other grounds in Scottish waters (see Chapter 12 Commercial Fisheries), such that any change to commercial fishing activity is likely to be highly localised, thus is likely to have very little effect if any on the income of fishermen in the area.

18.139 It should be noted that there is potential for the Project to act as an aggregation device for fish species from the wider area (see Chapter 9 Fish Ecology), thus potentially increasing the available catch in the vicinity of the Project. However, once again the small footprint of the floating platform means any effect is likely to be highly localised and of low enough levels so as to not result in a significant socio-economic impact.

Direct impact on access to amenities

Construction

18.140 There is potential for a direct impact on access to amenities during the construction phase of the Project. The floating platform is likely to be constructed in a large industrial port area such as Nigg Harbour. A number of the components for the Project will likely be delivered by road which could impact on access to amenities in the area surrounding the harbour. These areas are regularly exposed to large movements of cargo and personnel which means any amenities in the area will be used to compensating for this and so any impact would not be significant.

18.141 The Project may require some smaller components and workers to be transported to a suitable port in the vicinity of the site. This may impact on access to certain local amenities in whichever area is chosen as a port (e.g. Scrabster, Stromness and Lyness). For the people living in these relatively remote areas access to amenities which may be few and far between is essential. The majority of the Project components required during construction will be transported to a large industrial port with only small components and crew transferred to ports in the local and regional areas. As a result any impact on access to amenities during construction would be small in scale and not significant.

Operations and maintenance

18.142 During operation of the Project there is potential for a direct impact on access to amenities. It is anticipated that much of the maintenance requirements for the Project will be carried out on site which will require crew to be transferred to a suitable port and then on to the site. This could result in a direct impact on access to amenities. Ports such as Scrabster, Stromness and Lyness may act as a service base for the Project. Major maintenance activities may require the floating platform to be towed back to a large port area, such as Nigg which would not result in any significant effects on access to amenities due to the industrialised nature of such ports. The numbers of crew required for O&M activities is small. Therefore, the impact on access to amenities around the Scrabster, Stromness and Lyness areas would be small in scale and not significant.

Decommissioning

18.143 After decommissioning the Site is likely to return to the conditions that it exhibited prior to development and any potential impacts arising during this phase are expected to be similar to, but not exceeding, those arising during the construction phase.

18.15 Recreation and Tourism – Potential Impacts

Specific criteria ssed to evaluate the impacts on recreation and tourism

18.144 There are no specific criteria to assess the impact of renewable energy developments on recreation and tourism interests. The criteria used to assess the impacts to recreation and tourism is provided in Table 18-23 and Table 18-24. Due to the small scale of the Project it was decided to assess the potential impacts to recreation and tourism qualitatively using expert judgement.

Significance of impact

18.145 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact. The significance of impact is based on best practice and expert judgement. While there is no specific guidance for other marine users, any impacts of 'moderate' or above are considered significant, in accordance with EIA guidance (SNH, 2013). Where impacts are identified as potentially significant, mitigation measures are proposed to reduce their effects on the receptor.

Table 18-23: Definitions for magnitude of effect for recreation and tourism

Magnitude of Effect	Criteria
High	Long-term or permanent obstruction of recreational use Long-term or permanent obstruction of a tourist site Results in a large change in tourist visits or recreational uses
Medium	An obstacle that creates a nuisance to recreational users that must be avoided Results in a moderate change in tourist visits or recreational uses
Low	Short-term, temporary obstacle to recreational use that can easily be avoided There is a change in tourism visits or recreational users, but it is barely noticeable
Negligible	A noticeable activity that does not create any obstacle or obstruction to recreational users No noticeable change in tourist visits or recreational uses
Positive	Results in an increase in tourist visits or recreational uses

Table 18-1354: Definitions for vulnerability of receptor

Vulnerability	Criteria
High	Area or harbour with high levels of recreational use Harbour with limited capacity for recreational vessels or where the safety of recreational vessels is a concern Onshore recreational site with high use Tourist site of national or international status or high visitor numbers/users

Vulnerability	Criteria
Medium	Area or harbour with moderate levels of recreational use Harbour with some capacity for recreational vessels Onshore recreational site with moderate use Tourist site of regional status or moderate visitor numbers
Low	Area or harbour with low levels of recreational use Harbour with sufficient capacity for recreational vessels Onshore recreational site with low use Tourist site of local status or medium visitor numbers/users
Negligible	Area or harbour with little or no recreational use Onshore recreational site with little or no use Tourist site with few visitor numbers/users

18.146 Magnitude of effect is considered against the receptor's vulnerability to determine an overall significance of impact. The significance of impact is based on best practice and expert judgement. In this ES all impacts of moderate and above are considered to be significant. Impacts can be positive or negative.

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

18.16 Recreation and Tourism – Identification of Potential Impacts

18.147 There is potential for impacts on tourism and recreation activities within the vicinity of the Project and the wider Caithness area. The tourism and recreation impacts are considered within the region of Caithness (see Figure 18-1) with a particular focus on the village of Reay.

18.148 The potential impacts identified for each phase of the Project are:

Construction

- Congestion and disruption at piers, slipways and anchorages as a result of project vessels affecting recreational and tourism activities in the Study Area.

Recreation

- Direct impact on offshore recreational activities in the Study Area; and
- Direct impact on onshore recreational activities during the construction period.

Tourism

- Potential for impacts on tourism where visitors are deterred from visiting due to disruption throughout the construction phase; and
- Industrialisation of the local seascape reducing tourists' visual amenity during construction works.

Operations and maintenance

Recreation

- Disruption or severance to offshore recreation during operation and maintenance activities; and
- Disruption or severance to offshore recreation due to the Projects physical presence.

Tourism

- Direct impact to tourism whereby tourists are deterred from visiting due to the physical presence of the Project; and
- Additional topic of interest creating a new draw for tourists providing socio-economic benefit to the local area.

Decommissioning

- Impacts arising during decommissiong are expected to be similar to, but not exceeding those occurring during the construction and installation phase.

18.17 Impact Assessment - Construction

Congestion and disruption at piers slipways and anchorages in the vicinity of the Project as a result of construction activities

18.149 During Project construction activities there is potential, through the increased use of piers by project vessels, for disruption to recreational boaters in the Study Area. The location of the construction base has not yet been identified, but if it was to be situated in the Study Area it could increase congestion and the potential for incidents to occur between sailing boats and Project work boats (see Chapter 13 Shipping and Navigation). PFOW is defined by the RYA as an area of medium use and so is assigned a vulnerability of medium.

18.150 The relatively small scale of the Project and the short timescales associated with its installation (floating wind plants can be swiftly connected to export cable and mooring infrastructure) mean any impact is likely to be small in scale and temporary in nature resulting in a magnitude of effect of low and an overall significance of minor. Further information on the potential impact at specific ports (Scrabster, Stromness and Lyness) is provided in Section 18.18

Direct impact on offshore recreational activities in the Study Area (e.g. disruption to recreational sailing)

18.151 During Project construction activities such as the laying of the export cable and mooring lines and the installation of the floating platform there is potential for impacts on a number of recreational activities in the Study Area, these are as follows:

Recreational sailing

18.152 Recreational sailing is a common activity in the Pentland Firth, particularly during summer months, with vessels from around the UK and Europe travelling in the vicinity of the Study Area along the north coast or to Orkney (Figure 18-6 and see Section 18.10). There is one local sailing club in the Study Area. It is considered be of high vulnerability.

18.153 The main impact during construction is for potential disruption to recreational sailing in the area during the laying of export cables and mooring lines and the installation of the floating platform, as this will require a number of vessels (max. of 6 vessels at any one time) to be on site. This could cause vessels to avoid the north coast of Scotland or for local sailing vessels to avoid going on excursions which could have a negative effect on the local community through a reduction in potential economic activity.

18.154 The small scale of the Project and its location out with the major shipping lane to the north of the Study Area will provide lots of sea room either side of the Project to allow passing vessels plenty of room to manoeuvre around the Project site and vessels. Furthermore, the relatively short timescales over which it will take place will mean any disruption will be temporary in nature and is therefore assessed as having a magnitude of effect of low, giving an overall significance of moderate.

Surfing

18.155 Surfing is an important recreational activity along the north coast of Scotland with a number of Championships (national and international) being held in Thurso over the years (see Section 18.10). It attracts both local and travelling surfers and can therefore provide a source of income for the local community. The area around Sandside Bay is not a particularly frequently surfed area along the north coast and any surfing activity within it is restricted to the west side and therefore far away from the proposed cable landfall area. Surfing is therefore assessed as being of medium vulnerability.

18.156 The small scale of the Project, the relatively short timescale of construction activities and the long distance of the Project from shore means any impact to surfers is likely to be limited and only temporary. The north coast has a large number of surf sites of which Sandside Bay is not frequently used, moreover the fact that the cable will be pinned to an existing outfall at Dounreay or installed using HDD means there will be no long-term changes to beach morphology. A magnitude of effect of low is therefore assigned to surfing resulting in an overall significance of minor.

Canoeing and kayaking

18.157 Kayaking and canoeing is a popular activity within the PFOW and there are a number of clubs in the region: The Orkney Sea Kayaking Association, Caithness Kayak Club, East Sutherland Kayak Club and the Pentland Canoe Club (see Section 18.10). It is therefore assigned a vulnerability of medium.

18.158 Kayakers tend to remain relatively close to shore for safety reasons and so construction activities such as the installation of the floating platform and its associated moorings and anchors is sufficiently far offshore so as to not cause any disruption to these activities. However, laying of the export cable could potentially disturb kayakers in the vicinity of Sandside Bay. The laying of the export cable is expected to take around one week and so any potential disruption is likely to be only temporary in nature, resulting in a magnitude of effect of low and an overall significance of minor.

SCUBA diving

18.159 SCUBA diving is a popular activity along the north coast of Scotland with widespread areas for diving (Figure 18-7) and a local dive club (Caithness Diving Club). Diving provides an import source of revenue for the area attracting visitors from around the country and is therefore assigned a vulnerability of medium.

18.160 The small scale of the Project, its location relatively far offshore and the short period of construction activities mean any disruption to diving activities is likely to be of small and of a temporary nature. The Study Area lies out with any diving areas (Figure 18-7) and is therefore assessed as having a magnitude of effect of low resulting in an overall significance of minor.

Recreational angling

18.161 Recreational angling, particularly for Atlantic Salmon and Sea Trout is a popular activity in the north coast of Scotland amongst locals and tourists and provides an important source of income for the local area. However, the Study Area lies within a no fishing zone because of the

Dounreay Nuclear Plant. There is still potential for the Project construction activities to effect the behaviour and thus potential availability of fish in the wider area (see Chapter 9 Fish Ecology) for capture by recreational anglers. Recreational angling is therefore assigned a vulnerability of medium.

18.162 The fact that no fishing currently takes place within the Study Area and that recreational angling is a highly localised activity coupled with the small scale of the Project, temporary nature of construction activities and its long distance from any major rivers for recreational angling result in a magnitude of effect of low giving an overall significance of minor.

Direct impact on onshore recreational activities during the construction phase

18.163 During project construction activities there may be a reduction in onshore recreation activities in the Study Area such as walking.

Deterrence of walkers in the Study Area

18.164 The north of Scotland has several walking routes which attract locals and tourists. The onshore Study Area doesn't represent an area of intense walking activity and there are no core paths within the onshore Study Area (see Figure 18-8). There are two core paths to the east of the onshore Study Area, which provide routes into Sandside Bay, however these are condiered to be far enough outwith the onshore Study Area so as to not be impacted by the Project's construction activities. It is therefore assigned a vulnerability of low.

18.165 Onshore construction works i.e. building of the onshore substation and road access tracks could lead to an increase in traffic levels and disturbance which could deter walkers from visiting the area. It is stated in the Project description that the construction of the onshore infrastructure, may take up to 18 months. A magnitude of effect of medium is therefore assigned, which results in an overall significance of minor.

Potential for impacts on tourism where visitors are deterred from visiting due to disruption throughout the construction phase

18.166 Tourism is an important source of income for businesses in the Study Area and the Highlands in general. The construction of the Project has the potential to deter tourists from visiting the area, resulting in a reduction of business opportunities. The influx of workers required to construct the Project could also put pressures on available accommodation in the Study Area, once again potentially limiting the business opportunities brought about by tourism (see Section 18.13). The increased construction traffic caused by the Project may also deter tourists from visiting the area. It is considered to be of high vulnerability.

18.167 The small scale of the Project and the likelihood that the main construction activity (fabrication of the floating platform) will be carried out in a dry dock away from the host community means that any pressure on accommodation is likely to be small scale and temporary in nature. The small scale of the Project also means that any disruption to tourists is likely to be very small scale. The presence of the Dounreay Nuclear Plant also means the area is already industrialised with the additional small scale industrialisation brought about by the Project resulting in a magnitude of effect of low. This results in an overall significance of moderate.

Industrialisation of the local seascape potentially deterring tourists from visiting the area

18.168 Impacts related to visual amenity are discussed in Chapter 15 Seascape, Landscape and Visual Amenity. Due to the importance of tourism to the area it is given a vulnerability of high.

18.169 There is potential, during construction activities, for tourists to be deterred from visiting due to reductions in visual amenity brought about by the Project. The Project is small in scale and will be situated approximately 6 km from shore so is unlikely to deter tourist visits. Furthermore, the area has already undergone a relative degree of industrialisation with the building and now decommissioning of the Dounreay Nuclear Plant. The Project construction activities are therefore considered to have a magnitude of effect of negligible resulting in an overall significance of minor.

18.18 Impact Assessment – Operations

Disruption or severance to offshore recreation

18.170 There is potential for operation and maintenance activities associated with the Project to impact on offshore recreation activities, such as:

- Recreational sailing;
- Surfing;
- Canoeing and kayaking;
- SCUBA diving; and
- Recreational angling.

18.171 As was described in Section 18.17 all of these activities are assessed as being of medium vulnerability. Due to the fact the Project is of a small scale and requires minimal intervention for O&M activities (one visit to site per week) it was decided to combine the impact assessment for the above recreational activities.

18.172 Planned O&M activities are due to consist of one visit per week to site, by one workboat. This is unlikely to cause any disturbance to the above recreational activities. It is therefore assessed as having a magnitude of effect of low giving an overall significance of minor.

Disruption or severance to offshore recreation due to the Project's physical presence

18.173 The physical presence of the Project has the potential to effect recreational activities in the area, e.g. through changes to wave climate, effecting surfing conditions and through the requirement of sailing boats to avoid the area. The relatively high prevalence of offshore recreational activity in the area results in it being of medium vulnerability.

18.174 The small scale of the Project, means it can be easily avoided by sailing vessels and is highly unlikely to affect wave climate that could potentially be detrimental to surfing conditions in the area. Furthermore, its long distance from shore means it is highly unlikely to affect canoers and kayakers in the area. Finally, its location outwith any sites of importance for diving and angling means that overall the magnitude of effect for the aforementioned recreational activities is low. This results in an overall significance of minor.

Direct impact to tourism whereby tourists are deterred From visiting due to the presence of the wind farm

18.175 There is potential for the physical presence of the Project to deter tourists from visiting the site. Tourism provides an important source of income for the Study Area so is assigned a vulnerability of high.

18.176 The Project is of small scale and sufficiently far offshore so as to not act as a deterrent to tourists. Furthermore, the area is already quite industrialised due to the presence of the

Dounreay Nuclear Plant. It is therefore given a magnitude of effect of negligible resulting in an overall significance of minor.

Additional topic of interest creating a new draw for tourists providing socio-economic benefit to the local area

18.177 It has been shown that work at EMEC has on occasion attracted people to the area. The novel nature of the floating wind technology being used in this Project may attract tourists and media personnel creating business opportunities for the local area. This is unlikely to be significant, but any impact will be positive.

18.19 Mitigation measures

- GM13: The contractor will adopt Best Practicable Means, as defined in Section 72 of the Control of Pollution Act 1974 as a means of controlling noise from construction sites;
- GM2: Follow the guidelines of the Constrruction Environmental Management Document including; carry out vessel management strategies and communication and harbour management and planning to limit disruption to offshore recreational activities during construction and O&M activities; and
- GM21: The location and nature of Project activities and potential obstructions to mariners will be provided in Notices to Mariners in order to avoid disruption to other harbour users. These will be issued prior to the start of construction and where necessary during work at the site.

18.178 These mitigation measures are discussed in greater detail in the NRA (supporting document) and Chapter 13 Shipping and Navigation.

Specific mitigation measures

Mitigation Measures specific to Socio-economics		
Ref	**Title**	**Description**
SE01	Continued Consultation	Continued consultation with local diving, sailing, surfing, angling and canoeing clubs to inform them of the timescales of Project activities so they can avoid the Study Area during construction periods, if necessary;
SE02	Temporary Accommodation	Additional dedicated temporary accommodation will be provided for project workers if, at any stage of the Project it appears there may be pressure to existing accommodation. This will reduce pressure on local residential and tourism accommodation; and
SE03	Core Path Network	In order to minimise impacts on any walking routes, including the core path network, during construction, access to and along the core paths will be maintained along the construction corridor using diversions where required; Consultation with key stakeholders will be continued during the detailed design phase to ensure that all are up to date on any diversion that may be put in place in relation to existing paths.

18.20 Residual Effects

18.179 Although the majority of impacts were not assessed as significant it is considered good practice to further assess potential impacts with general and specific mitigation measures applied.

Construction

Disruption on offshore recreation during construction activities

18.180 It is expected that the subsea export cable, anchors and mooring lines would be installed at the site over a period of 2-3 months, subject to weather. The export cable will be routed from the Project site to a landfall location east of Sandside Bay. Potential bases for construction vessels include Scrabster, Lyness, Stromness and Wick.

18.181 Offshore recreational users that could potentially be impacted by these construction works, through disruption to activities and restricted access to piers, include local and visiting sailing boats, local dive boat operators, local recreational angling vessels, local and visiting surfers and local or visiting canoers and kayakers. Although none of the potential impacts were assessed as significant it is considered good practice to further assess the potential residual effect after standard and specific mitigation measures have been put in place.

Congestion and disruption at piers slipways and anchorages in the vicinity of the Project as a result of construction activities

18.182 Currently it is unclear which location(s) will be used as the construction, installation and O&M bases, but for the purposes of this assessment Scrabster, Stromness and Lyness have been considered.

18.183 There is little recreational activity based at Scrabster, as this port has high use as a commercial harbour and there is no dedicated recreational marina. Additional commercial use of Scrabster Harbour would not have a significant effect on recreational users as this is already a highly commercial harbour with this infrastructure required to maintain this commercial activity. There are also plans for potential expansion at this port to support marine energy development. Scrabster Harbour is therefore considered to be of low vulnerability, with the already heavy commercial use at the pier resulting in a magnitude of effect of medium and an overall significance of minor.

18.184 Planned upgrades at Scrabster Harbour include the development of marina facilities which could improve access for sailors in the future. Any potential conflicts however can easily be managed by the port authority’s control of the harbour.

18.185 There is little recreational activity based out of Lyness Harbour. The Scapa Flow Museum is a destination visited by yachts, and dive boats berth at Lyness. However, berthing at Lyness is only done for short periods. The harbour is infrequently used by recreational boats, given that there is limited space and safety issues, it is therefore considered to be of low vulnerability. There is potential for construction activities to result in less use of Lyness Harbour by recreational boats, and possible avoidance for the duration of construction. However, any disturbance will only be temporary and therefore the magnitude of effect is considered to be medium resulting in an overall significance of minor.

18.186 Commercial diving boats operating within the Study Area are based in Stromness Harbour. Stromness Harbour experiences high levels of recreational boating activity, particularly during summer months. It is therefore considered to be of high vulnerability. However, there is a dedicated dock (Copelands Dock) for marine renewables activity where project activity could be based. Therefore, there would not be any conflicts anticipated with use of pier space, relegating the vulnerability to medium. Any impacts would be limited to increased traffic within the harbour. Activity during construction of the Project is considered to result in a moderate increase on current activity levels. This would be managed by the harbour master to ensure that conflicts were avoided. As part of the Marine Licence, a navigation safety plan and vessel management plan will be prepared and agreed with stakeholders. This plan will address potential impacts of navigation between ports and the Project site and address mitigation where needed (see Chapter 13 Shipping and Navigation and marine safety NRA (Appendix 13.1 for reference). Other measures will include those to avoid or reduce disturbance to other harbour users, i.e. issuing prior notification of activities. Given the specific and industry standard mitigation that will be put in place the magnitude of effect is considered to be low. Therefore, the overall significance of impacts on recreational users of piers, slipways and anchorages, if Stromness harbour was used is considered to be minor.

Recreational sailing

18.187 The north coast of Scotland is a popular area for recreational boating activity, resulting in the receptor being of high vulnerability. The RYA advises that the Project site lies between two areas of medium recreational boating activity (Figure 18-6 and see Section 18.10). It is recognised that the nature of routes taken by sailing boats and any other recreational users is highly variable and dependent on factors including tide, swell and wind conditions. Recent port developments at Scrabster and increased recreational interest in the waters to the north west of Scotland may result in increased use of this route in the future, particularly in conditions of deteriorating weather.

18.188 Due to the short duration of export cable laying, landfall construction activities and platform installation, which will be carried out during favourable weather conditions it is unlikely that these activities will cause significant disturbance to sailing activity. Furthermore, consultation with the RYA highlighted that the type of sailor who passes through the Pentland Firth is skilled in seamanship and knowledge of The International Regulations for Preventing Collisions at Sea (ColRegs) and is used to noticing and avoiding obstacles, whether charted or not. Therefore, although the vulnerability remains high, the magnitude of effect is reduced to negligible after standard and specific mitigation measures such as Notices to Mariners have been applied and will result in an overall of significance minor.

Surfing

18.189 The north coast of Scotland is a popular surfing destination for locals and tourists alike (see Section 18.10). Consultation highlighted that the Study Area is not within an extensively surfed part of the north coast and is therefore of medium vulnerability.

18.190 The small nature of the Project and its location far from shore means it is very unlikely to affect the wave climate or the area available for surfing. In the inshore area the export cable will either be installed by HDD or pinned to an existing outfall at Dounreay which means there will be no change to long-term beach morphology which could have a possible detrimental impact to surfing in the area. The magnitude of effect is therefore considered to be low, giving an overall significance of minor.

Canoeing and kayaking

18.191 It is recognised that sea kayaking and canoeing are generally not limited to any particular locations throughout the PFOW region, beyond remaining generally closer to shore for safety reasons. There are number of kayak clubs in the area and so kayaking is assigned a vulnerability of medium.

18.192 Construction activities have the potential to adversely affect kayakers in the Study Area; however any disruption will be temporary and mitigation including notification of construction activities and clear navigational marking to enable safe passage of the export cable construction area result in a magnitude of effect dropping to negligible and an overall significance of minor.

SCUBA diving

18.193 SCUBA diving is an important activity in the Study Area. However, the greatest concentration of diving activity occurs out with the Study Area in Orkney waters particularly in Scapa Flow. Nonetheless the north coast still represents an area of importance for diving (see Figure 18-7) so is considered to be of medium vulnerability.

18.194 The Study Area lies out with any dive sites as shown in Figure 18-7, the small scale of the Project and the relatively short construction period coupled with mitigation measures such as continuing consultation with dive companies and notices of construction activities will result in a magnitude of effect of negligible, thus the overall significance remains at a level of minor.

Recreational angling

18.195 Atlantic salmon and sea trout fishing support a large number of estates along the north coast of Scotland. Behavioural changes to fish movements may be linked to the ecological impact of the Project, such as disturbance to fish species during anchoring and cable laying. Chapter 9 Fish Ecology assesses the overall ecological effects of the development on migratory fish. The inshore area around Sandside Bay is a designated no fishing zone due to the dangers posed by the Dounreay Nuclear Plant, recreational angling is therefore considered to be of medium vulnerability. The timescale of the construction phase of the Project of 2-3 months is short so is unlikely to cause a significant adverse effect to the migratory routes of salmon and sea trout.

18.196 The magnitude of effect is considered negligible due to the small ecological impact and therefore, behavioural changes that are likely to occur as a result of the Project, thus not affecting the availability of fish for recreational anglers in the area. An overall significance of minor is therefore assigned to the impact on recreation angling.

Direct impact on onshore recreational activities during the construction period

Deterrence of walkers in the Study Area

18.197 Although walking is a well-practised activity in the Study Area, the immediate area around the location of cable landfall doesn’t represent an area of intense walking activity. It is therefore considered to be of low vulnerability.

18.198 With standard and specific mitigation measures such as, procedures to reduce noise impacts from construction activities and maintenance of access routes along core paths during construction the magnitude of effect is considered to drop to negligible resulting in an overall significance of negligible.

Direct impact on tourism whereby visitors are deterred from visiting the Site during construction

18.199 The north coast of Scotland is a relatively popular destination for tourists and provides an essential source of income for the local economy. It is therefore considered to be of high vulnerability.

18.200 The Study Area is already relatively industrialised. Visitors to the area will see onshore wind farms in the area as well as the Dounreay Nuclear Plant, so any additional industrialisation caused by the Project is unlikely to be a deterrent to tourists. Furthermore, the small scale of the Project and the relatively short construction period means any impacts on tourism will only be temporary. Mitigation such as ensuring all core paths remain open and procedures to follow to reduce the noise during construction of the onshore substation results in the magnitude of effect droping to negligible, giving an overall significance of minor.

Industrialisation of the local seascape reducing tourists' visual amenity during construction works

18.201 The worst case scenario considers that there is a potential for reduction in tourism as a result of the reduced visual amenity during construction including cable landfall construction works. However, assessment of this impact (Chapter 15 Seascape, Landscape and Visual Amenity) has shown that this is unlikely to be a significant impact. It is also possible that there could be an increase in visitors to the area as a result of the Project construction. The impact of industrialisation of the landscape on tourists' visual amenity is therefore not assessed further in this section.

18.21 Residual effects - Operations and Maintenance

Disruption to offshore recreation during O&M activities

18.202 The use of the area by recreational boaters, surfers, and kayakers results in this receptor being assigned a vulnerability of medium. The small footprint of the Project, and the Notices To Mariners, and updates to sailing directions and almanacs that will be carried out in accordance with navigation interests (see Chapter 13 Shipping and Navigation and NRA supporting document) means any impacts to activities such as recreational boating activity, canoeing and kayaking and surfing is likely to be highly localised and therefore not significant. Therefore the magnitude of effect is considered negligible, resulting in an overall significance of minor.

18.203 The small number of vessels required for O&M activities (one workboat) and the relatively infrequent maintenance schedule (one visit per week) will result in any disruption from O&M activities (e.g. recreational vessels avoiding O&M vessels) being limited and easily avoidable and is also considered to be of minor significance.

18.204 Consultation with the Pentland Canoe Club, highlighted that the Project site is too far offshore to pose a problem to kayakers during the operational phase. They confirmed that they would like to be informed about cable laying activities so they can avoid the area during construction (see Section 17.5). They also confirmed that they are included on the circulation list for Notices to Mariners in Caithness. This reaffirms the assertion that impacts to kayakers will be negligible.

18.205 Although the north of Scotland is a popular surfing destination and the west side of Sandside Bay a popular surf spot (see Section 18.10), the small footprint of the Project means it is unlikely to have an adverse effect on the wave climate in the area.

Direct impacts on tourism whereby visitors are deterred from visiting due to the Project's physical presence

18.206 Tourism provides an important source of income for businesses in the Study Area so is therefore considered to be of high vulnerability. Once again the area around the Project is already industrialised with the Dounreay Nuclear Plant and various wind farms, therefore the magnitude of effect of the Projects operation and maintenance is considered negligible, giving an overall significance of minor.

Additional topic of interest creating a new draw for tourists providing socio-economic benefit to the local area

18.207 For recreational traffic such as cruises and yachts, anecdotal experience at EMEC suggests that marine energy developments tend to attract a small amount of visitors (media, government representatives, industry representatives, tourism) due to the novel nature of the marine energy industry (wave and tidal). This Project comprises a novel wind development which may have a similar impact. Any increase in visitors will likely have a positive effect with potential visitors sampling the various amenities in the Caithness area, thus contributing to the local economy.

18.22 Decommissioning

18.208 Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.

18.23 Cumulative Impact Assessment

Socio-economics

18.209 This assessment of cumulative effects considers the socio-economic benefits and impacts that may potentially arise from the Dounreay Trì Ltd. floating wind demonstration site, combined with existing baseline trends along with any future planned projects. For each project the distance to port from any particular site will play an important role in keeping the costs down and also being able to take advantage of weather windows on site. This could become a factor in site choice within the region as the ports assessed for this Dounreay Trì Ltd. Project will be the same as are available for other projects being developed in the region. The following proposed projects have the potential to result in cumulative effects to socio-economic receptors:

- The SHE-T Orkney-Caithness interconnector cable;
- HIE Dounreay Demonstration Centre (DDC);
- Brims Tidal Array Limited, Brims Ness;
- MeyGen, Inner Sound;
- Scotrenewables, Lashy Sound; and
- DP Energy, Westray South.

18.210 The key regional construction and O&M options that have been identified within the socio-economic assessment are Scrabster in Caithness, Lyness in Orkney and Stromness in Orkney and the small port of Sandside Close in Caithness. The capacity of each area to absorb more than the Dounreay Trì Ltd. Project is described below.

Scrabster

18.211 This port is the busiest for larger vessels and has a more built up area adjacent to the piers. The Scrabster Harbour Trust has a laydown area designated on a farm close to the port that could be developed for other projects. This port has already been used as a service base for the MeyGen Inner Sound project and is also advertising its capability for other offshore projects. It has been planning a reconstruction development that would include building more pier space and some land reclamation which would increase its capability but as yet the design is not finalised and funding is not in place. The port, being on the mainland, has road transport links with the A9 trunk road feeding through to central Scotland.

Lyness

18.212 This is a key port development for Orkney; as such Orkney Islands Council (OIC) has promoted the port for any offshore renewables project. The site although recently upgraded is still a relatively open and undeveloped site with a large area (14 Ha) of land available adjacent to the pier designated by the OIC as development land. Lyness has already supported a number of projects related to the EMEC wave test site at Billia Croo near Stromness. Both OIC and HIE suggested in consultation that they would be willing to support, in principal, building infrastructure including new pier space to ensure any large project does not impinge on other projects.

Stromness

18.213 The recent construction of Coplands Dock in Stromness, was part of the three port strategy to improve infrastructure in order to better service the marine renewables industry. It has supported renewable operations related to the EMEC wave test site. Stromness Pier is a smaller port and laydown area compared to Lyness, whilst being a relatively busy port with fishing vessels, ferries and recreational craft all competing for space. The aforementioned Copland's Dock has enhanced capacity at Stromness and in the absence of marine renewables development can be used by these other vessels.

18.214 The list below highlights the impacts assessed within the socio-economic assessment that have the potential to have cumulative effects:

- Local employment and business opportunities;
- Improvements to local infrastructure;
- Clustering effect; and
- Pressure on local infrastructure and services.

Discussion of potential cumulative impacts

18.215 The following sections consider the various possible cumulative or in-combination impacts associated with these plans and projects in terms of the impact categories already assessed for this Project.

Local employment and business opportunities

Construction

18.216 The increased level of activity that more than one project would bring to each area would increase the employment and business opportunities within each area and therefore the socio-economic benefits. These benefits are substantial although not fully defined for any of the projects due to their early stage of development. Stromness being a smaller port would find it harder to host more than one larger project.

O&M

18.217 Each area would welcome the operation and maintenance activity and all three bases would be able to support these types of operation and the subsequent enhanced benefits.

Decommissioning

18.218 The uncertainty in schedules for decommissioning is too high to determine the cumulative and in-combination impacts. If decommissioning of two or more sites happened simultaneously they may require similar operations to the construction phase and so impacts would be similar.

Improvements to Local Infrastructure

18.219 The Project itself may not require significant improvements to infrastructure, however other projects in the area, e.g. HIE Dounreay Demonstration Centre (a proposed test site for floating wind devices), may require upgrades to infrastructure. These upgrades would be beneficial to any planned or future projects, as well as providing a long lasting benefit to the communities in which they are carried out.

Clustering effect

18.220 All phases of the Project will support positive benefit from the clustering around the Project. This will only increase if more than one project is co-located.

Pressure on local infrastructure and services

18.221 The pressure on the local infrastructure would be enhanced if more than one project was developed in the same port. However, this increased pressure may result in upgrades to the local infrastructure which is likely to be welcomed and financially supported by the local authority. The operations and maintenance phase of the Project would have much less impact on local infrastructure and services, due to the reduction in numbers of people required.

Recreation and tourism

18.222 No significant adverse cumulative impacts are expected on tourism or recreational interests in terms of disruption to activities as these impacts are likely to be highly localised, and as those associated with the proposed projects are mostly restricted to the construction phase, are temporary in nature.

18.223 There is potential for the Project and HIE Dounreay Demonstration Centre to have a cumulative effect on recreational boating activity in the area. If the demonstration centre goes ahead there could be a number of floating wind turbine structures, with associated mooring lines that could potentially impact on recreational sailing routes and may also cause an increased navigational hazard (see Appendix 13.1: Navigational Risk Assessment (NRA)). Visitors to Pentland Firth and Orkney Waters (PFOW) are skilled in seamanship and are likely to be well aware of potential hazards and how to avoid them. Any new projects in the area will be subject to separate NRA and EIA procedures which will highlight any specific issue related to recreational and tourism interests.

18.224 The potential cumulative impacts on tourists' visual amenity are assessed in Chapter 15 Seascape, Landscape and Visual Amenity.

18.24 Summary and Conclusions – Socio-economics

18.225 The majority of socio-economic impacts from the Project are positive at a national, regional and local level.

18.226 Key findings of the socio-economic assessment include:

Construction

- The main impact for the Project, the creation of local employment and business opportunities will be most significant during the construction phase with the potential for up to 72 jobs to be created in the local area; and
- There is potential for an increase in pressure to local infrastructure and services, such as the availability of accommodation particularly during the construction phase, however the Project construction will require a dry dock and is therefore likely to be constructed far from the local area in a more developed area, where the ability to absorb the required workforce will be greater compared to the more rural Caithness area.

Operations and maintenance

- The Project may provide increases to the quality of life of residents in the local and regional area, through methods such as wage inflation, population increase and the attraction of younger people into the local area;
- The clustering effect of having the Project located close to other marine renewables activity, such as that at EMEC will result in a positive effect for developers and the local supply chain through the ability to learn from expertise gained from previous projects and through providing business opportunities to the local supply chain;
- The novelty of the Project has the potential to provide a knowledge base from which future developers of offshore floating wind technology can visit the site and the supply chain that helped construct the Project in order to gain knowledge and smooth any future operations of floating wind farms. This is another positive impact; and
- There is potential for the Project to provide increases to energy security and to provide further stimulus for renewable energy development in the area providing security to local businesses and creating employment opportunities.

Decommissioning

18.227 Potential impacts arising during the decommissioning phase e.g. creation of job opportunities and pressure to local infrastructure and services are expected to be similar to, but not exceeding, those arising during the construction phase.

18.228 Other more general positive socio-economic impacts that may potentially arise from the Project include:

- The consultees within the assessment were all supportive of the Project and some were willing to consider using their resources to help mitigate any issues;
- The Project fits into the national aspirations as well as regional and local economic development strategies; and
- There would be a lasting benefit from the Project in which ever area the construction or the O&M base is located, these benefits will be larger in the more rural and remote areas.

18.229 Table 18-25 below provides a summary of the potential benefits and impacts of the Project. Where impacts are likely to occur at more than one phase of the Project (e.g. local employment and business opportunities will be created at all phases of the Project) it is only discussed in the phase in which it is judged to have the most significant impact (i.e. construction for the creation of local employment and business opportunities). Summary reflects design envelope considerations i.e. best case (positive scenario) for positive impacts and worst case (negative scenario) for negative impacts.

Table 18-1365 Summary of potential benefits and impacts to socio-economics throughout all stages of the Project

Potential Impact	Magnitude
Construction	
Local employment and business opportunities	Positive
Improvements to local infrastructure	Positive
Operations and Maintenance	
Quality of life	Positive
Increased knowledge	Positive
Clustering effect	Positive
Energy security	Minimal
Decommissioning	
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase	

18.25 Summary and Conclusions – Recreation and Tourism

Construction

- Impacts on existing tourism and recreational businesses during construction and installation is likely to be a combination of both positive (related to increase local spend) and negative (due to short-term local disruption around onshore and offshore construction works).
- Installation of the subsea cable, anchors and mooring lines will take around three months and will be done as late as possible prior to platform installation. These will be buoyed and will take up a small area of sea space, thus minimising disruption to recreational activities in the area.

Operations and maintenance

- The small nature of the Project means that any disruption to recreational activities will be of minor or negligible significance. The fact that the floating platform will be towed out with the turbines pre-installed, only requiring hooking up to the mooring lines and export cable, means that any disruption to, e.g. recreational sailing activity during installation will be limited and short-term.

- The novel nature of the Project has the potential to act as a positive impact through creating an additional topic of interest which may attract visitors to the site.

Decommissioning

- Impacts during commissioning are expected to be similar to those occurring during construction of the Project, or to have less of an impact as a result of specific mitigation measures developed during the course of the Projects' construction, which could potentially further reduce any adverse impacts.

18.230 Table 18-26 below provides a summary of the potential effects to recreation and tourism of the Project. Where impacts are likely to occur at more than one phase of the Project (e.g. disruption to recreational activities) it is only discussed in the phase in which it is judged to have the most significant impact (i.e. construction for given example).

Table 18-137 Summary of potential effects to tourism and recreation throughout all stages of the Project

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction Phase			
Congestion and disruption at piers slipways and anchorages as a result of project vessels affecting recreational and tourism activities in the Study Area.	Low	Low	Minor
Direct impact on offshore recreational activities in the Study Area:			
Recreational Sailing	Negligible	High	Minor
Surfing	Low	Medium	Minor
Canoeing and Kayaking	Negligible	Medium	Minor
SCUBA Diving	Neglible	Medium	Minor
Recreational Angling	Neglible	Medium	Minor
Direct impact on onshore recreational activities during the construction period: Deterence of walkers in the Study Area	Negligible	Low	Negligible
Potential for impacts on tourism where visitors are deterred from visiting due to disruption throughout the construction phase	Negligible	High	Minor
Operation and Maintenance Phase			
Direct impact to tourism whereby tourists are deterred from visiting due to the physical presence of the Project	Negligible	High	Minor
Additional topic of interest creating a new	Any impact will be positive in nature, but		

Potential Impact	Magnitude	Vulnerability	Overall Significance
draw for tourists providing socio-economic benefit to the local area.	is not expected to be significant		

19 Mitigation and Summary of Residual Impacts - Offshore

19.1 Mitigation summary

19.1 The following mitigation summary should be read inconjunction with the embedded mititgation identified in Section 4.3.

Chapter 6: Physical and Coastal Processes

Ref	Title	Description
PCP1	Cable protection management	Should rock placement be used, all contractors will ensure that the volume of any rock used in rock placement activities will be kept to a minimum. The width of rock covering should be minimised to avoid seabed disturbance and minimise waste and cost.
PCP2	Use of clean rock for cable protection	Should rock placement be used, in cable protection and scour protection, all contractors will be required to use clean rock only. The preference would be to source this rock locally, from an existing onshore quarry to reduce transportation costs.
PCP3	Cable route survey	The developer will undertake to survey the final agreed cable route to ensure final positioning is acceptable from both an engineering and ecological position.

Chapter 7: Intertidal Ecology

No specific mitigation measures but project commitments apply (See Section 4.3).

Chapter 8: Benthic and Shellfish Ecology

Ref	Title	Description
BSE01	Use of clean rock for cable protection	Should rock placement be used, in cable protection and scour protection, all contractors will be required to use clean rock only. The preference would be to source this rock locally, from an existing onshore quarry to reduce transportation costs.
BSE02	Cable protection management	Should rock placement be used, all contractors will ensure that the volume of any rock used in rock placement activities will be kept to a minimum. The width of rock covering should be minimised in order to minimize the risk of introduction of non-native species

Chapter 9: Fish Ecology

Ref	Title	Description
FE01	Routine inspection of moorings and cables	Routine inspections of mooring lines and cables will be undertaken, helping ensure that all infrastructure remains in place and in good condition. This will also ensure that any debris such as fishing gear caught in mooring system/cables is detected.
FE02	Removal and reporting of debris (including fishing gear) from moorings and cables	Debris detected during routine inspections which is deemed to pose a risk to marine wildlife will be removed at the earliest possible opportunity. A notification system will be established with the MCA to ensure the developers are aware of any fishing gear lost in the vicinity of the development. The developers will also inform the MCA of any fishing gear removed from moorings and other project structures. Details will be listed within the CEMD.

Chapter 10: Marine Onithology

No specific mitigation measures but project commitments apply (See Section 4.3).

Chapter 11: Marine Mammals

No specific mitigation measures but project commitments apply (See Section 4.3).

Chapter 12: Commercial Fisheries

Ref	Title	Description
CF01	Fisheries Management Plan (FMP)	The Applicant will develop, manage and implement a Fisheries Management Plan that will be reviewed and monitored over a defined timescale. The FMP will be implement by a working group whom will focus on minimising disruption and displacement of the relevant commercial fisheries and ensure dissemination of project information and activities to the wider fishing community.
CF02	Appointment of a Fisheries Liaison Officer	The FMP will be actioned by a dedicated fisheries liaison working group, coordinated by an appointed Fisheries Liaison Officer (FLO) for the planning and duration of installation activities and any operational maintenance or repairs. This person, appointed by the fishing community, will be the key point of contact between the fishing community and the Applicant.
CF03	Cable Protection Monitoring	Operational performance and safety inspections of the export cable will ensure that the cable remains buried, any protection

Ref	Title	Description
		material remains in place and that the cable is not vulnerable to snagging or damage from fishing gear or anchors and that no debris hazardous to fishing activity is present.

Chapter 13: Shipping and Navigation

Ref	Title	Description
SN01	AIS on floating platform	The floating platform will have AIS on board so will be visible to all vessels with electronic charts
SN02	Local tugs on standby	Local tugs will be on stand-by for the duration of the towage to ensure that vessels can assist, if required
SN03	Chartings and notifications when platform offsite	Hazard warning will emphasise that even when the floating platform is not on station the moorings and cabling on-site is a risk to fishing gear
SN04	Project vessel able to respond in an emergency	The Project vessel(s) based at the O&M base will be able to provide assistance to SAR operations in an emergency
SN05	Floating platform and WTGs remain lit even if the platform was to lose station	The platform shall have batteries to ensure navigational safety systems remain operational in the event that either the electrical or mooring system fails
SN06	Appointment of a marine co-ordinator	Appointment of a marine co-ordinator to manage construction traffic movements
SN07	AIS on work vessels	Work vessels will carry AIS making them visible to all vessels with electronic charting
SN08	Circulation of information	Targeted circulation of information directly to local ports, ship operators, fishermen, recreational organisations
SN09	Advisory Area	The Project Site will be designated as an advisory area warning vessels not to enter the Site

Chapter 14: Aviation and Radar

Ref	Title	Description
AR01	MoD Low Flying	Details of the Site are required to be promulgated through the DGC and the UK AIS, to enable the depiction of the platform and turbines on appropriate aviation charts and documentation as required. Lighting of turbines shall be in accordance with CAP 393 Article 220 (CAA, 2015 (a)).

Ref	Title	Description
AR02	SAR Operations	An ERCoP will be in place for the construction, tow out, operation and decommissioning phase of the Project. The ERCoP is completed initially in discussion between the developer and the Maritime and Coastguard Agency (MCA), SAR and Navigation Safety Branches, in cooperation with the Maritime Rescue Coordination Centre (MRCC). The SAR helicopter bases will be supplied with an accurate chart of the final platform location, and yawing attributes.

Chapter 15. Seascape, Landscape and Visual Amenity

No specific mitigation measures but project commitments apply (See Section 4.3).

Chapter 16: Archaeology and Cultural Heritage

Ref	Title	Description
ACH1	Avoidance	All sites of high importance and, sites of potential archaeological or cultural heritage importance will be avoided through Project design e.g. placement of floating wind farm platform anchors and dredging for them, and location of export cables route. Geophysical anomalies identified from only a single type of response may be given an avoidance buffer of 20 m, while anomalies identified from further geophysical surveys may be given an avoidance buffer of 50 m. This is in order to take account of a potential debris scatter field around a wreck, or a multiple response representing the tip of a wreck that extends further than the core location of the anomaly. This may result in layout redesign to avoid highly sensitive remains.
ACH2	Archaeological Survey and Recording	Where layout redesign and avoidance are not possible, targeted archaeological survey (high resolution remote sensing survey/drop down camera/Remote Operated Vehicle (ROV) survey/geotechnical) is to be undertaken to identify the nature, extent and potential importance/sensitivity of any remains of potential archaeological or cultural heritage importance affected by the Project. Archaeologically significant remains necessitate full archaeological recording and reporting, conducted by experienced maritime archaeologists.

Chapter 17: Other Users of the Marine Environment

Ref	Title	Description
OM01	Liaison with other marine users during construction and maintenance	Management and notification of activities in consultation with HIE, DSRL, MoD and SHE-T.
OM02	Installation of acoustic transponder	If necessary, Hexicon will investigate the feasibility of installing an acoustic transponder to alert military submarines to the presence of the floating platform
OM03	Negotiations on location of export cable route and landfall.	HIE for the DDC and SHE-T for interconnector electricity cable.

Chapter 18: Socio-economics, Recreation and Tourism

Ref	Title	Description
SE01	Continued Consultation	Continued consultation with local diving, sailing, surfing, angling and canoeing clubs to inform them of the timescales of Project activities so they can avoid the study area during construction periods, if necessary;
SE02	Temporary Accommodation	Additional dedicated temporary accommodation will be provided for project workers if, at any stage of the Project it appears there may be pressure to existing accommodation. This will reduce pressure on local residential and tourism accommodation
SE03	Core Path Network	In order to minimise impacts on any walking routes, including the core path network, during construction, access to and along the core paths will be maintained along the construction corridor using diversions where required; Consultation with key stakeholders will be continued during the detailed design phase to ensure that all are up to date on any diversion that may be put in place in relation to existing paths.

19.2 Summary of Offshore Residual Impacts

Chapter 6: Physical and Coastal Processes

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Loss of, and/or alteration of the physical and chemical characteristics of the seabed due to placement of infrastructure (cables, moorings, anchors).	Negligible	Low	Negligible
Changes in water quality related to the installation of subsea infrastructure - primarily increased suspended sediment concentrations.	Negligible	Low	Negligible
Sediment quality impacts due to the dispersal of historic radioactive particles into wider environment resulting from potential disturbance of contaminated sediments.	Negligible	Low	Negligible
Changes in water and sediment quality due to pollution from routine and accidental discharges from vessels.	Negligible	Low	Negligible
Operations and Maintenance			
Changes to local sediment transportation processes and seabed features due to altered hydrodynamics related to interactions between mooring cables, anchors and cables with the action of water currents and waves.	Negligible	Low	Negligible
Changes in water and sediment quality due to pollution from routine and accidental discharges from vessels.	Negligible	Low	Negligible
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	N/A	N/A	N/A

Chapter 7: Intertidal Ecology

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Loss of habitat or species through work at the cable landfall	Negligible	Low	Negligible
Disturbance to or displacement of fauna in proximity to the Study Area through construction activities	Negligible	Low	Negligible
Introduction of new species	Low	Low	Minor
Operations and Maintenance			
Habitat creation as a result of cable protection	Negligible (Positive)	Low	Negligible (Positive)
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	N/A	N/A	N/A

Chapter 8: Benthic and Shellfish Ecology

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Substrate, habitat and species loss due to placement of infrastructure (cables, mooring, anchors)	Low	Medium	Minor
Increased suspended sediment and turbidity due to installation of subsea infrastructure	Low	Low	Minor
Release of radioactive particles present in sediment into wider environment as a result of disturbance of sediment	Negligible	Low	Negligible
Operations and Maintenance			
Hydrodynamic changes leading to scour around subsea infrastructure	Low	Medium	Minor
Damage to habitat or species due to pollution from routine and accidental discharges	Low	Medium	Minor
Introduction of marine non-natives as a result of vessel movement or through use of subsea	Low	Medium	Minor

Potential Impact	Magnitude	Vulnerability	Overall Significance
infrastructure as stepping stones			
Creation of habitat for benthic fauna through colonisation of subsea infrastructure	Positive (Low)	Low	Positive (Minor)
Impact to benthic communities from any thermal load or EMF arising from the cables during operation	Low	Medium	Minor
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase	N/A	N/A	Negligible

Chapter 9: Fish Ecology

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Disturbance or damage to sensitive species due to underwater noise generated from construction activities	Low	Low	Minor
Direct habitat loss due to disturbance of spawning and nursery grounds during the installation of export cables and placement of anchors on seabed	Low	Low	Minor
Effects of increased sedimentation / smothering on fish during placement of anchors and export cable	Low	Low	Minor
Operations and Maintenance			
Habitat loss of spawning and nursery grounds due to presence of anchors and export cable on the seabed	Low	Low	Minor
Effects of thermal changes and electromagnetic fields (EMF) from subsea and dynamic cables on sensitive species	Low	Medium	Minor
Effects of operational noise on sensitive species	Low	Medium	Minor
Fish aggregation around the floating structure and associated infrastructure	Low	Low	Minor
Entanglement with mooring lines and	Low	Medium	Minor

Potential Impact	Magnitude	Vulnerability	Overall Significance
dynamic cables			
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.	N/A	N/A	N/A

Chapter 10: Marine Mammals (construction)

		Magnitude	Vulnerability	Impact Significance
Construction Noise	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
Collision Injury	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
Water Quality (sediment)	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Low	Negligible
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked	Negligible	Low	Negligible

		Magnitude	Vulnerability	Impact Significance
	dolphin			
	Bottlenose dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
Water Quality (contaminants)	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Low	Negligible
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
Indirect Impacts (prey species)	Grey seal	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible

Chapter 10: Marine Mammals (operation)

		Magnitude	Vulnerability	Impact Significance
Collision/ Entanglement	Grey seal	Negligible	Low	Negligible
	Harbour seal	Negligible	Low	Negligible
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible

		Magnitude	Vulnerability	Impact Significance
	Bottlenose dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Medium	Minor
Operational Noise	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
Vessel Disturbance	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
Vessel Collisions	**Grey seal**	Negligible	Low	Negligible
	Harbour seal	Negligible	Medium	Minor
	Harbour Porpoise	Negligible	Low	Negligible
	White-beaked dolphin	Negligible	Low	Negligible
	Bottlenose dolphin	Negligible	Low	Negligible
	Minke whale	Negligible	Low	Negligible
EMF	**Grey seal**	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible

		Magnitude	Vulnerability	Impact Significance
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
Long Term Habitat Change	Grey seal	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
Habitat Exclusion	Grey seal	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible
Fisheries Practices	Grey seal	Negligible	Negligible	Negligible
	Harbour seal	Negligible	Negligible	Negligible
	Harbour Porpoise	Negligible	Negligible	Negligible
	White-beaked dolphin	Negligible	Negligible	Negligible
	Bottlenose dolphin	Negligible	Negligible	Negligible
	Minke whale	Negligible	Negligible	Negligible

Chapter 11: Marine Ornithology

No residual effects exist.

Potential Impact	Fishery	Magnitude	Vulnerability	Overall significance
Construction				
Loss of access to fishing grounds due to the presence of vessels and safety zones during construction	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Obstruction of regular fishing vessel transit routes due to the presence of vessels and safety zones during construction	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Change in the abundance or distribution of target species and resulting impact on fisheries resource due to construction activities	Pelagic, Demersal, Scallop, Creel	Negligible	Low	Negligible
Operation and Maintenance				
Loss of access to fishing grounds due to the presence of floating platform, associated moorings and safety zone	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Displacement to other fishing grounds resulting in increase pressure on resources or conflict with other sea users, due to the presence of floating platform, associated moorings and safety zone	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor
Obstruction of regular fishing vessel transit routes due to the presence of floating platform, associated moorings and safety zone	Pelagic, Demersal, Scallop	Low	Low	Minor
	Creel	Low	Medium	Minor

Potential Impact	Fishery	Magnitude	Vulnerability	Overall significance
Potential for fishing gear to become entangled with floating and subsea structures, resulting in damage or loss of fishing gear	Pelagic, Demersal, Scallop, Creel	Low	Medium	Minor
Change in the abundance or distribution of target species and resulting impact on fisheries resource due to the presence of operational infrastructure	Pelagic, Demersal, Scallop, Creel	Negligible	Low	Negligible

Chapter 13: Shipping And Navigation

Potential Impact	Magnitude	Vulnerability	Overall significance
Construction			
Disruption to navigation created by support vessels during construction	Low	Medium	Minor
Increased pressure on Search and Rescue services	Low	Medium	Minor
Project vessel collides with a third party vessel	Low	Negligible	Negligible
Operations and Maintenance			
Disruption to navigation created by floating platform or any 'advisory area'	Low	Low	Minor
Increased pressure on search and rescue services	Low	Medium	Minor
Vessel collides with floating platform	Low	Low	Minor
Project vessel collides with a third party vessel	Low	Low	Minor
Disruption to navigation created by support vessels during operation and maintenance	Low	Low	Minor
Fishing interaction with export cables, mooring lines or anchors	Low	Medium	Minor
Decommissioning			
Impacts during decommissioning are expected to be similar to but not exceeding those during construction			

Chapter 14: Aviation and Radar

Potential Impact	Magnitude	Vulnerability	Overall Significance
Operations and Maintenance			
The mitigation measures relating to the notification of the Project to the appropriate aviation agencies for inclusion in documents and charts is anticipated to be sufficient in terms of military Low Flying and SAR operations; therefore, ensuring negligible residual impacts during tow-out, operation and decommissioning.	Negligible	Medium	Minor

Chapter 15. Seascape, Landscape and Visual Amenity

Potential Impact	Magnitude	Vulnerability	Overall Significance
Operations and Maintenance			
Effect on LCCA 19: Tor Ness to Rack Wick	Very High	Moderate/Minor	Moderate
Effect on LCCA 21: Rack Wick to Rora Head	Very High	Moderate/Minor	Moderate
Effect on LCCA 22: Rora Head to Kame of Hoy	Very High	Moderate/Minor	Moderate
Effect on LCCA 40: Sandside Bay	Medium	Moderate	Moderate
Effect on Farr Bay, Strathy and Portskerra SLA	High/Very High	Moderate/Minor	Moderate

Chapter 16: Archaeology and Cultural Heritage

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through excavation (e.g. cable ploughing, jetting, vertical injection)	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through compression (e.g. rock armour, anchors, etc)	Low	Negligible	Negligible

Potential Impact	Magnitude	Vulnerability	Overall Significance
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through dredging	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through burial (e.g. drag embedded anchors)	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through mooring lines and cable coming into contact with the seabed	Low	Negligible	Negligible
Damage to wrecks, anthropogenic anomalies, unknown cultural material or deposits through pre-laying grapnel run	Low	Negligible	Negligible
A change in seabed dynamics resulting from the addition of the floating wind farm and cable export may affect site formation processes in any unknown wrecks located within or near by the Site	Low	Negligible	Negligible
Operations and Maintenance			
A change in seabed dynamics resulting from the addition of the floating wind farm and cable export may affect site formation processes in any unknown wrecks located within or near by the Site	Negligible	Negligible	Negligible
Movement of the mooring cable could expose areas of seabed which could affect sites of cultural heritage interest	Negligible	Negligible	Negligible
Decommissioning			
A change in seabed dynamics resulting from the addition of the floating wind farm and cable export may affect site formation processes in any unknown wrecks located within or near by the Site	Negligible	Negligible	Negligible

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction Phase			
Obstruction of marine renewable energy activities due to the presence of safety zones and construction vessels during installation activities	Low	Low	Minor
Obstruction of military activities due to the presence of safety zones and construction vessels during installation activities.	Low	Low	Minor
Obstruction of electricity cable installation (SHE-T) activities due to cable landfall construction activities, the presence of safety zones and construction vessels during installation activities	Low	Low	Minor
Operation and Maintenance Phase			
Obstruction of marine renewable energy activities due to the presence of the floating structure, associated moorings and export cable; and the presence of safety zones and vessels during maintenance activities	Low	Low	Minor
Obstruction of military activities due to the presence of the floating structure and associated moorings; and the presence of safety zones and vessels during maintenance activities	Low	Low	Minor
Obstruction of electricity cable installation (SHE-T) activities due to the presence of the floating structure, associated moorings and export cable; and the presence of safety zones and vessels during maintenance activities	Low	Medium	Minor

Potential Impact	Magnitude	Vulnerability	Overall Significance
Construction			
Local employment and business opportunities			Positive
Improvements to local infrastructure			Positive
Congestion and disruption at piers slipways and anchorages as a result of project vessels affecting recreational and tourism activities in the Study Area.	Low	Low	Minor
Recreational Sailing	Negligible	High	Minor
Surfing	Low	Medium	Minor
Canoeing and Kayaking	Negligible	Medium	Minor
SCUBA Diving	Neglible	Medium	Minor
Recreational Angling	Neglible	Medium	Minor
Direct impact on onshore recreational activities during the construction period: Deterence of walkers in the Study Area	Negligible	Low	Negligible
Potential for impacts on tourism where visitors are deterred from visiting due to disruption throughout the construction phase	Negligible	High	Minor
Operations and Maintenance			
Quality of life			Positive
Increased knowledge			Positive
Clustering effect			Positive
Energy security			Minimal
Direct impact to tourism whereby tourists are deterred from visiting due to the physical presence of the Project	Negligible	High	Minor
Additional topic of interest creating a new draw for tourists providing socio-economic benefit to the local area.	Any impact will be positive in nature, but is not expected to be significant		
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase.			

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VOLUME 3: Onshore Environment

21 Geology and Hydrology

21.1 Introduction

21.1 This chapter describes the geological, hydrological and hydrogeological baseline at and around the onshore Project Site as defined in Chapter 4: Project Description and in Figure 21-1. The baseline which has been considered includes the surface and solid geology (including the geological characteristics of the soils present) and geomorphological features, land contamination, surface water, and the groundwater resource.

21.2 The chapter presents the assessment of the predicted impacts on geological, hydrological and hydrogeological receptors from the Project, encompassing works associated with construction and operation of the landfall/cable joint transition bay, laydown areas, cable corridor (and cable joint bays), access tracks and substation site. The temporary impacts of Project construction (and decommissioning) and the permanent and operational impacts of development on these receptors are predicted and reported.

21.3 Related issues including predicted impacts on soils as an agricultural resource and associated impacts on agricultural activities from construction and operation of the proposals are covered in Chapter 22: Land Use, Agriculture and Soils.

21.2 Study Area

21.4 Figure 21-1 identifies the Study Areas applicable to assessment of impacts on geological, hydrological and hydrogeological receptors. The criteria for defining the Study Areas have been established based on the professional judgement and experience of the technical authors with regard to likely access and working areas, and with consideration of the relevant guidance noted in Section 21.3 below.

21.5 The assessment of geological impacts (the geology Study Area) has focused on the onshore cable corridor Study Area within which the route of the onshore Cable Corridor from the Onshore Cable Landfall to the proposed substation site (see Figure 21-1) would be contained. This area includes the inter-tidal area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS).

21.6 The assessment considers effects on surface water receptors within 1 km of the cable corridor Study Area (including the coastal waters of the Pentland Firth), referred to as 'the surface water Study Area', and on groundwater resources within 250 m of the edge of the cable corridor Study Area, the 'groundwater Study Area'.

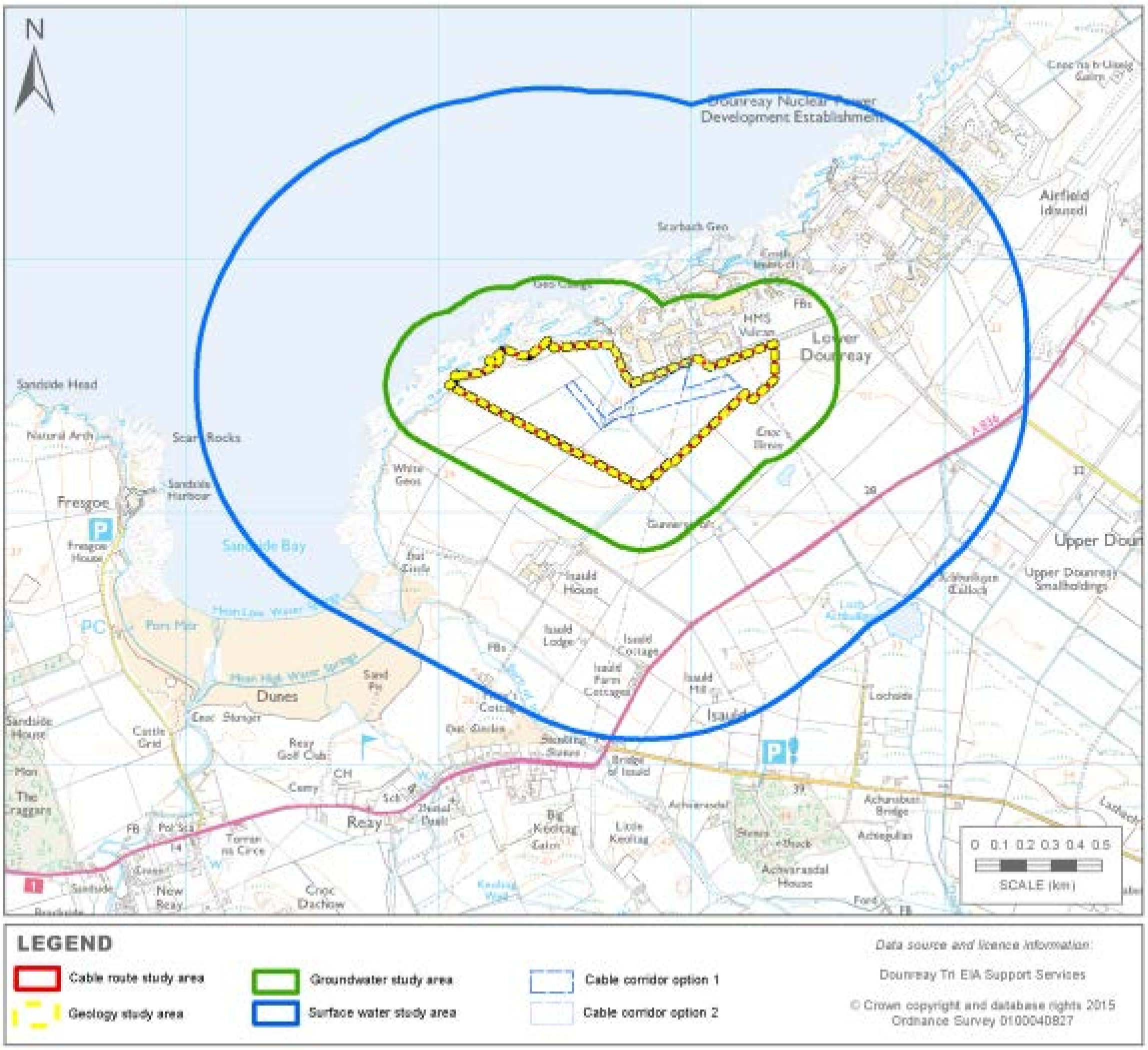

Figure 21-54 Geology, Hydrology and Hydrogeology Study Areas

21.3 Legislation and Guidance

21.7 The following relevant legislation and guidance relating to geology, hydrology and hydrogeology was used in the preparation of this chapter:

- The Water Framework Directive (WFD); the WFD is the European legislation which was developed to establish systems to manage Europe’s water environment - rivers, lochs, estuaries, coastal waters and groundwater;
- The Water Environment and Water Services (Scotland) Act 2003; this Act transposes the requirement of the WFD into Scottish law;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended); these regulations were introduced under the 2003 Act to specify the control regimes for discharges to, abstractions from and impoundments and engineering activities affecting the water environment;

- The Private Water Supplies (Scotland) Regulations 2006; these regulations set out standards of water quality in private water supplies that are used for human consumption;
- The Water Environment (Oil Storage) (Scotland) Regulations 2006; these regulations set out standards for the design and installation of oil storage containers, including those used on construction sites;
- The Flood Risk Management (Scotland) Act 2009; This Act established a flood risk management planning process for the assessment and sustainable management of flood risks with the aim of reducing the adverse consequences of flooding from all sources, including surface water flooding;
- SEPA Land Use Planning System Guidance Note 7: Guidance on the Water Framework Directive including river basin planning; provides guidance on implementing the requirement of WFD within development planning;
- Planning Advice Note (PAN) 51 Planning, Environmental Protection and Regulation; provides guidance regarding the integration of environmental protection within planning policy;
- PAN 79 Water and Drainage; this specifically sets out the requirements for developers in delivering appropriate drainage infrastructure which meets planning policy;
- Pollution Prevention Guidelines (PPG) 1 General Guide to the Prevention of Pollution, PPG2 Above Ground Oil Storage Tanks, and PPG6 Working at Construction and Demolition Sites;
- Additional SEPA guidance including 'Special Requirements for Civil Engineering Contracts for the Prevention of Pollution v2' and 'Guidance on the Special Requirements v2';
- Groundwater Protection Policy for Scotland V3, November 2009; and
- CIRIA C532 'Control of Water Pollution from Construction Sites - Guidance for Consultants and Contractors'.

21.4 Sources of Information

21.8 A review was undertaken of the literature and data relevant to this assessment relating to geology, hydrology and hydrogeology, and was used to give an overview of the existing environment. The major data sources used in the preparation of this chapter are listed below in Table 21-1.

Table 21-1 Key data sources

Source	Content
1: 25 000 and 1:50 000 Ordnance Survey (OS) maps	Current land use and topography within the geology Study Area, locations and routes of surface watercourses within the surface water Study Area.

Source	Content
SEPA River Basin Management Planning (RBMP) online interactive map http://map.sepa.org.uk/rbmp/	Information on the WFD classification (ecological and chemical status) given by SEPA to surface water and groundwater bodies within the groundwater and surface water Study Areas, together with information on any specific pressures on the water bodies, and environmental objectives.
SEPA online Flood Risk Management maps http://map.sepa.org.uk/floodmap/map.htm	Information on the likelihood of river, coastal and surface water flooding within the surface water Study Area.
Published geological mapping of the Study Area: Scotland Sheet 115E Reay, 1:50 000 scale Bedrock and Superficial (2003)	Geological formations underlying the geological Study Area.
Hydrogeological Map of Scotland, 1:625 000 scale (1988)	Key characteristics and productivity of the aquifer underlying the groundwater Study Area.
Private Water Supply records held by The Highland Council	Confirmation from The Highland Council that there are no recorded Private Water Supplies in the vicinity of the Study Area.
Borehole logs from previous site investigations within the Cable Corridor Study Area, available from the British Geological Survey (BGS)	Information on geology underlying the geology Study Area, together with information on observed groundwater depths.

21.9 In addition, the following information has also been referenced in the preparation of this assessment:

- Information on geology, geomorphology watercourses and drainage, identified by the Project team from site visits including photographs of the Project Site and its environs; and
- Feedback from consultees (see Section 21.6).

21.5 Surveys and Studies Carried Out to Date

Field surveys

21.10 The Project team undertook site visits in 2015 to the area of the onshore Project and recorded key information relating to geology, geomorphology, watercourses and drainage within the Study Area and the surrounding area.

21.6 Consultation

Pre-application consultation

21.11 The Highland Council was consulted in January 2016 for any information it holds regarding Private Water Supplies within, or in the vicinity of the Cable Corridor Study Area.

Scoping responses

21.12 In its Scoping Response, dated 25th January 2016, SEPA noted that it would expect the Proposed Project, including any temporary works, to avoid impacts on watercourses, deep peat and groundwater dependent terrestrial ecosystems.

21.13 In Appendix A of the SNH Scoping Response dated 4th March 2016, it is stated that physical disruption from landfall trenching within Sandside Bay SSSI could be a key potential significant impact and therefore it should be avoided if possible. SNH further advises that cumulative impacts with the HIE Dounreay Demonstration Centre should be scoped in. The Highland Council (1st March 2016) has noted that parts of the Study Area lie within 1 in 200 year fluvial flood risk areas. It is further notes that by minimising the impact on the watercourses then impact on flood risk would also be minimised.

Table 21.2 Summary of scoping responses

Consultee	Comment	Relevance/Cross Reference
Local Authority	The Contaminated Land Team provided no comment.	Not Applicable
SEPA	Encourages provision of a National Vegetation Classification (NVC) survey in order to better allow SEPA to advise on Groundwater Dependent Terrestrial Ecosystems (GWDTE). SEPA would look for the development to avoid (or if avoidance is not possible, minimise) impacts on watercourses, deep peat and GWDTE. Assess impacts on any groundwater abstractions within 250 m of the works. A Flood Risk Assessment may be required, depending on the specific infrastructure locations. A Drainage Impact Assessment should be provided, outlining how surface water will be treated and discharged. The use of Sustainable Drainage Systems (SuDS) is encouraged.	NVC survey report is provided in Appendix 24.1. Watercourses are discussed in Section 21.8. GWDTE is discussed in Chapter 24: Terrestrial Ecology. The Highland Council has reported no recorded Private Water Supplies in the vicinity of the site. Baseline information obtained from the River Basin Management Plan

Consultee	Comment	Relevance/Cross Reference
SEPA	Consideration should be given to the following possible issues: • Increases in silt and sediment loads and point source pollution incidents during construction; • Drainage issues; and • Seabed and land contamination. The ES should identify the location of, and protective/ mitigation measures in relation to, all private water supplies within the catchments impacted by the scheme. SEPA's interactive River Basin Management Plan mapping should be used in assessing the development proposal. A draft Schedule of Mitigation should be produced as part of this process. Details of the specific issues that SEPA expects to be addressed are available on the Pollution Prevention and Environmental Management section of SEPA's website. Authorisation under the Controlled Activity Regulations (CAR) may apply to onshore works so SEPA would expect information on what activities will be undertaken and how the risk of pollution will be minimised. The Project should be assessed for flood risk, with reference to available online flood mapping and the local authority. If a flood risk is identified then a Flood Risk Assessment should be carried out. Information on surface water drainage should be provided.	mapping is presented in Section 21.8. Mitigation for geology, hydrology and hydrogeology presented in Section 21.12. Flood risk is discussed in Section 21.8. Surface water drainage is discussed in Section 21.8.
Scottish Water	It is essential that Scottish Water assets are protected from the risk of contamination and damage. Scottish Water provides a list of precautions to be taken, to ensure that this does not occur. These include provision of a detailed method statement and risk assessment to Scottish Water prior to operations taking place, and various protective measures to be enacted during construction.	Mitigation for geology, hydrology and hydrogeology presented in Section 21.12.

21.7 Assessment Methodology

21.14 The overarching approach to the environmental assessment is described in Chapter 5: Environmental Impact Assessment Methodology. This section sets out the specific criteria which have been used to evaluate the impacts of the proposals on geology, hydrology and hydrogeology. The assessment has been based on an understanding of the sensitivity of the current baseline to changes resulting from Project construction and operation and the magnitude of the effects from these activities.

21.15 Impacts scoped out in the Scoping Phase included cumulative impacts, as it was considered that there was no potential for cumulative impacts affecting the onshore physical environment, including geology, hydrology and hydrogeology.

Design envelope considerations

21.16 The Project Description is set out in Chapter 4. Specific assumptions relevant to the assessment in this chapter are:

- The onshore cable footprint;
- The potential length and route of the onshore cable;
- The cabling method; and
- The new substation footprint.

21.17 In the case of geology, hydrology and hydrogeology, the aspects which have the potential to cause the greatest impacts include: the landfall location and associated works between the MHWS and MLWS; the length and route of the onshore cable; the method of cable installation at the landfall (trenching, horizontal directional drilling (HDD), or pinning to the existing Dounreay cooling water intake); and the location and footprint of the substation and HDD compound, if required. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

21.18 Table 21.3 describes the Design Envelope parameters specific to geology, hydrology and hydrogeology.

Table 21.3 Design envelope parameters specific to geology and hydrology

Design Envelope Parameter	Value/Description
Longest potential cable corridor, nearest to watercourses, installation technique most disruptive to surface geology. Largest substation site, nearest to watercourses.	Cable corridor of up to approximately 800m length and working corridor up to 20 m wide. Landfall to south west of Lower Dounreay. HDD and trenching combined method. Approximately 2,500 m^2 for substation.
Longest and deepest potential cable corridor (within surface geology), cutting across natural groundwater flow gradient. Largest and deepest foundation for substation.	Cable corridor of up to approximately 800m length and working corridor up to 20 m wide. Trenching method, depth up to 2 m. Approximately 2,500 m^2 for substation.
Longest potential drilled hole between landward working area and MLWS, cutting across natural groundwater flow gradient.	Landfall incorporating HDD, with drilled hole up to 400 m length.
Permanent works within flood risk area(s).	HDD compound within area at high risk of surface water flooding, north east / north central site area. (NB: No part of the new substation area of search is within a flood risk area.)

21.19 The assessment presented in this chapter allows for the development of a cable landfall and onshore cable corridor, HDD compound and substation within the zones identified in Figure 4-9 (and Figure 21-1) and the assessment has taken account of the 'worst case' parameters broadly set out in Table 21-3.This involves consideration of the effects of a horizontal directional drilling method and pinning for cable landfall.

21.20 Trenching the cable landfall across a section of Sandside Bay SSSI was previously considered, however following consultation this option has been removed and is not considered further in this assessment.

Methods of prediction

21.21 For geology, hydrology and hydrogeology, potential ***effects*** are identified and significance of each ***impact*** is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions.

21.22 The methodology is as described in Chapter 5: Environmental Impact Assessment Methodology. The assessment of effects and impacts on geology, hydrology and hydrogeology has been undertaken qualitatively with reference to quantitative information where available such as on the construction working areas for the cable and the land taken and assumed locational requirements for the cable infrastructure and substation (drawing on parameters set out above in Table 21-3).

21.23 Significance is attributed using the following attributes:

Magnitude of effect

21.24 The magnitude of effect is based on the predicted temporary and permanent changes to geological, hydrological and hydrogeological receptors, including effect on quality and quantity of resources, as well as associated changes to the hydrological and hydrogeological flow regime. The characterisation of magnitude of effects on geology, hydrology and hydrogeology also takes account of the spatial extent and severity of the effect, its duration and frequency.

21.25 For geology, hydrology and hydrogeology, the characteristics of magnitude of effect are defined as follows.

Table 21.4 Magnitude of geology, hydrology and hydrogeology effects

Magnitude of Effect	Description
High	Total loss of, or alteration to, key features of the baseline resource such that post development characteristics or quality would be fundamentally and irreversibly changed, for example, realignment of sizeable watercourses (i.e. those given RBMP classifications by SEPA), extensive and permanent change to groundwater flow regime.
Medium	Loss of, or alteration to, key features of the baseline resource such that post development characteristics or quality would be particularly changed, for example, in-stream permanent infrastructure, moderate change to groundwater flow regime.
Low	Small changes to the baseline resource, which are detectable but the underlying characteristics or quality of the baseline situation would be similar to pre-development conditions e.g. culverting of very small watercourses/drains (i.e. those not given RBMP classifications by SEPA), minor and localised change to groundwater flow regime.
Negligible	A very slight change from baseline conditions, which is barely distinguishable, and approximates to the ‘no change’ situation.

Sensitivity of receptor

21.26 The sensitivity (vulnerability) of the receptor is also taken into account. For geology, hydrology and hydrogeology, the sensitivity analysis has taken account of water quality and quantity, water usage, scarcity or importance of geological resources and geomorphological features, and risk of flooding. The sensitivity of receptors (and effects on them) also takes account of other attributes including their adaptability, tolerance to change, recoverability and value. A set of guideline criteria for determining sensitivity are set out in Table 21-5.

Table 21.5 Sensitivity of geology, hydrology and hydrogeology receptors

Sensitivity[53]	Description
High	Areas containing geological, geomorphological or hydrological features considered to be of national interest, for example, Natura sites, Special Areas of Conservation (SACs), SSSIs. Highly permeable superficial deposits allowing free transport of contaminants to groundwater and surrounding surface waters. Wetland/watercourse of High or Good Ecological Potential according to SEPA's RBMP framework. High risk of flooding.
Medium	Areas containing features of designated regional importance, for example, Regionally Important Geological and Geomorphological Sites (RIGS) considered worthy of protection for their educational, research, historic or aesthetic importance. Moderately permeable superficial deposits allowing some limited transport of contaminants to groundwater and surrounding surface waters. Wetland/watercourse of Moderate Ecological Potential. Moderate risk of flooding.
Low	Geological features not currently protected and not considered worthy of protection. Low permeability superficial deposits likely to inhibit the transport of contaminants. Wetland/watercourse of Poor or Bad Ecological Potential or no RBMP classification. Low risk of flooding.

Significance of impact

21.27 Magnitude of effect is combined with sensitivity of the receptor to produce an overall significance of impact. The evaluation of impact significance is informed by the matrix presented in Table 21-6 and by the professional judgement of the assessment team. Impacts assessed as moderate or greater are considered to be significant.

[53]Criteria for negligible sensitivity has not been used for this assessment.

Table 21-6 Significance Matrix

Vulnerability of receptor	Magnitude of effect			
	Negligible	Low	Medium	High
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

21.8 Data gaps and uncertainties

21.28 The information sources used to establish the baseline environment for Geology, Hydrology and Hydrogeology are deemed sufficient to inform a robust impact assessment. Where there is uncertainty about the location, timing or activity of particular receptors, a precautionary approach is taken either in their assessment of sensitivity or the potential magnitude of impact associated with the Project.

21.9 Description of the Current Environment

Designated sites

21.29 Sandside Bay, which is located just over 800 m to the south west of the Study Area, is designated as a Site of Special Scientific Interest (SSSI) for its sand dune features and associated plant species (see Chapter 24: Terrestrial Ecology). The site is in two parts, the main part of which includes the foreshore, dunes, dune slacks and the banks of the Burn of Isauld. The second part is located within the grounds of Reay Golf Course and is an area of herb-rich grassland.

21.30 There are no geological conservation sites[54] or noted features within the onshore Project site. The nearest is located adjacent to the Project boundaries at the western head of Sandside Bay from Sandside Head to Melvich Bay, Red Point Coast SSSI and Geological Conservation Review (GCR) site.

21.31 The Red Point Coast site contains two geological features: ancient lake margin sediments from the Middle Devonian; and Quaternary sediments deposited by Ice Age glaciers.

Superficial geology

21.32 A review of the relevant BGS geological mapping indicates that the whole of the cable corridor Study Area is underlain by glacial till comprising sandy clay (see Figure 21-2).

21.33 BGS trial pit and borehole logs available for the geology and groundwater Study Area generally confirm the published geology. Trial pits encountered topsoil to approximately 0.2 m to 0.3 m depth below ground level (bgl) in most pits, underlain by natural sands and/or sandy, silty clays (glacial till). Bedrock was encountered at depths of generally 1 m to 2 m bgl, with the exception of one trial pit in the south west part of the Study Area, where topsoil was found to directly overlie bedrock at a depth of 0.25 m bgl.

[54] Geological conservation sites in the UK can include geoparks, geological sites of special scientific interest and geological conservation review sites.

21.34 One trial pit, at the far eastern edge of the site and immediately south west of the Dounreay Nuclear Facility, recorded made ground (broken stone with traces of trick, timber and concrete overlying sandy silt and gravel with roots and topsoil) to 1.3 m bgl. Underlying the made ground was soft peat and sandy gravel to the extent of the pit at 1.9 m bgl. Aerial photography of this area indicates evidence of ground disturbance, highly localised to an area of approximately 50 m by 120 m. Given the absence of peat, either mapped or encountered in any of the other excavations (including the nearest trial pit less than 75 m away), it is considered likely that the recorded peaty soils at this location represent either a highly localised residual deposit, or emplaced made ground containing peaty materials. No peat has been identified, from published geological mapping, within 1.5 km of the geological Study Area.

21.35 The extent of superficial deposits, based on BGS geological mapping, is illustrated on Figure 21-2 below.

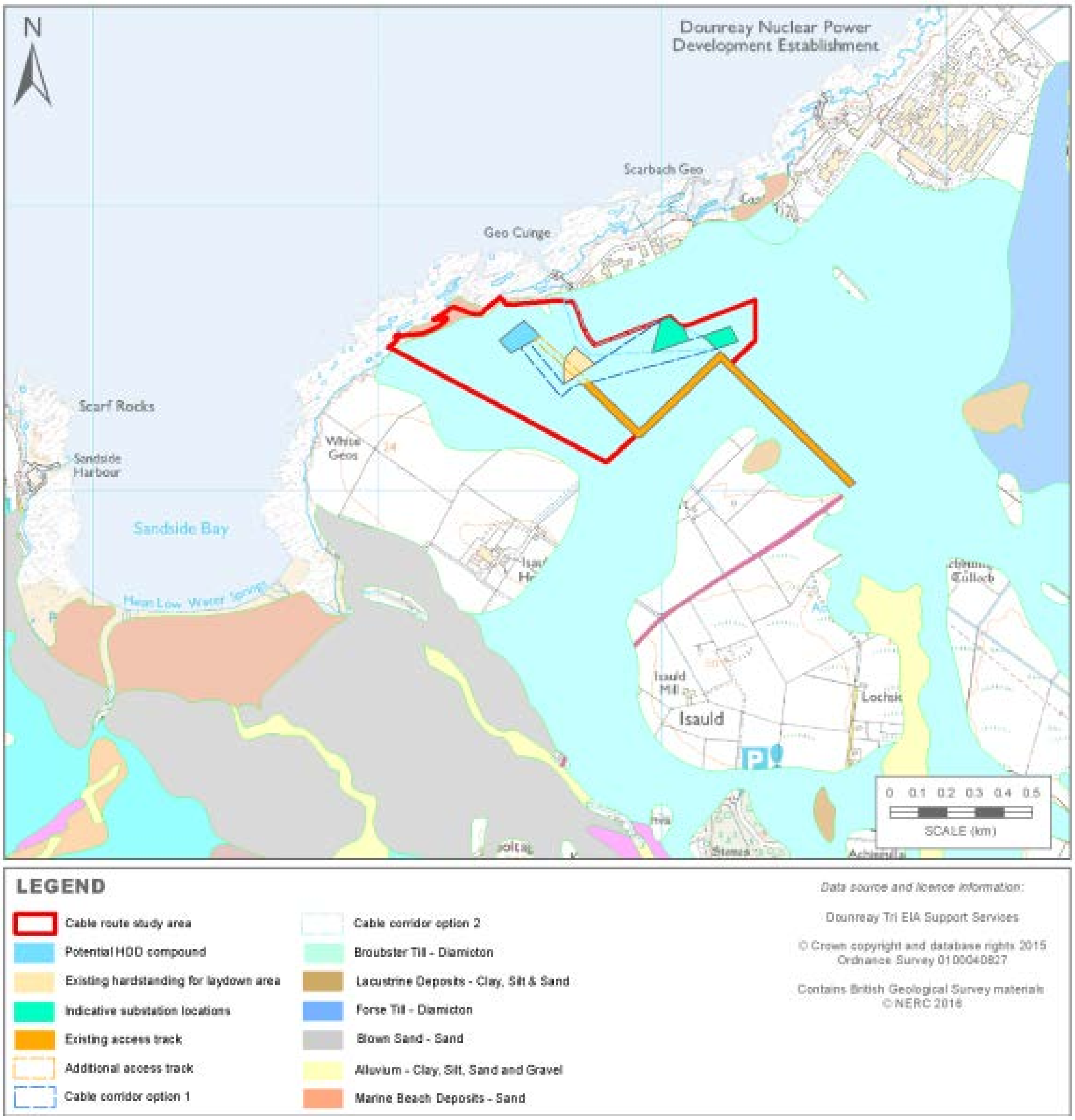

Figure 21-55 Superficial deposits

Bedrock geology

21.36 BGS mapping shows bedrock beneath the onshore cable corridor Study Area to comprise sedimentary Dounreay siltstone and sandstone.

21.37 Five limestone beds are shown to be present to the west of the Study Area, passing beneath Sandside Bay.

21.38 BGS trial bit and borehole logs for the geological Study Area generally confirm the published geology. Trial pits were recorded as encountering weathered sandstone and siltstone at depths of generally 1 m to 2 m bgl. Rotary boreholes drilled at the eastern end of the site recorded layers of weathered sandstone, siltstone and mudstone.

21.39 The extent of bedrock deposits, based on published BGS geological mapping, is illustrated on Figure 21-3 below.

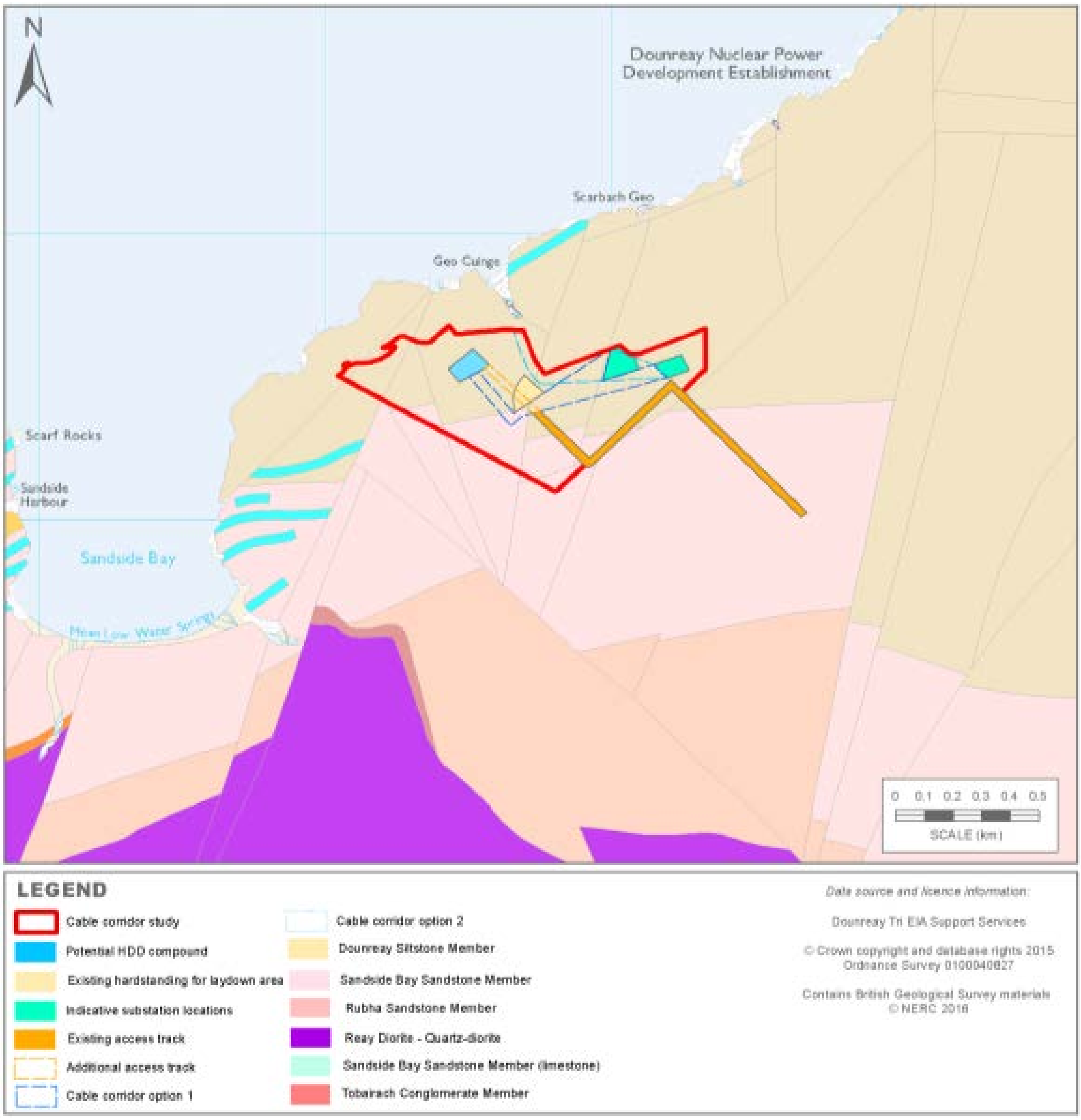

Figure 21-56 Bedrock

Climatic conditions

21.40 Rainfall data from Strathy East climate station (12.5 km to the west of the site boundary) indicates average annual rainfall of 1,002 mm from 1981 to 2010. April and May are shown to be the driest months (55 mm – 58 mm) with half the rainfall of winter months, October to January, receiving 100 mm – 115 mm on average. The North Scotland District received an average annual rainfall of 1721 mm, with January receiving up to 200 mm and May the lowest level at 87 mm.

21.41 Average annual maximum temperatures were 11.1 degrees, peaking to 16.6 degrees in July and August and annual minimum temperatures of 4.9 degrees, lowest during January and February at 0.8 degrees. The North Scotland District average annual maximum temperature was 10.2 degrees, peaking in July at 16.1 degrees and minimum temperature of 4.0 degrees, lowest in February at - 2 degrees. The Strathy East area experienced on average 43.5 frost days throughout the 1981 – 2010 period, while the average for the North Scotland District was 67.6 days.

Surface water

21.42 Other than a field drain, there are no watercourses present within the onshore 'cable corridor Study Area'. A review of aerial mapping indicates that there is a small pond located immediately to the north west of Isauld House, outwith the Study Area. Another small pond is located approximately 350 m south east of the onshore 'cable corridor Study Area', and the slightly larger Loch Achbuiligan just extends into the south east part of the surface water Study Area. None of the field drains, ponds, or Loch Achbuiliganare classified by SEPA under its RBMP system. Therefore, in accordance with the sensitivity criteria presented in Table 21.5, the sensitivity of these water features is considered to be low.

21.43 The layout of the field drain and topography indicates that the site drains to the north west towards the Pentland Firth, with an outflow shown immediately west of the Dounreay plant. This water body (Strathy Point to Dunnet Head) is classified as having an overall status of High according to SEPA's RBMP interactive map. It is therefore considered to be a high sensitivity receptor.

21.44 There are two watercourses within the surface water Study Area, which have SEPA water quality classifications, according to SEPA's RBMP interactive map.

21.45 The Burn of Isauld flows in a north westerly direction in close vicinity to the south western boundary of the Project site boundary, where it discharges into Sandside Bay. SEPA has classified this burn (referred to on the SEPA RBMP map as Achvarasdal Burn) as having a Good overall status with High confidence that it meets the requirements of the Water Framework Directive. It is therefore a high sensitivity receptor.

21.46 The Dounreay Burn flows in a north westerly direction, approximately 350 m to the north east of the Project site boundary, within the eastern part of the surface water Study Area. This watercourse discharges to the Pentland Firth approximately 500 m east of the Project site. It appears to have been extensively modified at this location, flowing through a channel alongside the access road from the A836 into and through the Dounreay Nuclear Facility. Notwithstanding these modifications, SEPA has classified the Dounreay Burn as having a Good overall status with High confidence that is meets the requirements of the Water Framework Directive. It is therefore a high sensitivity receptor.

21.47 The locations of surface water features, including watercourses and field drains are illustrated on Figure 21-4.

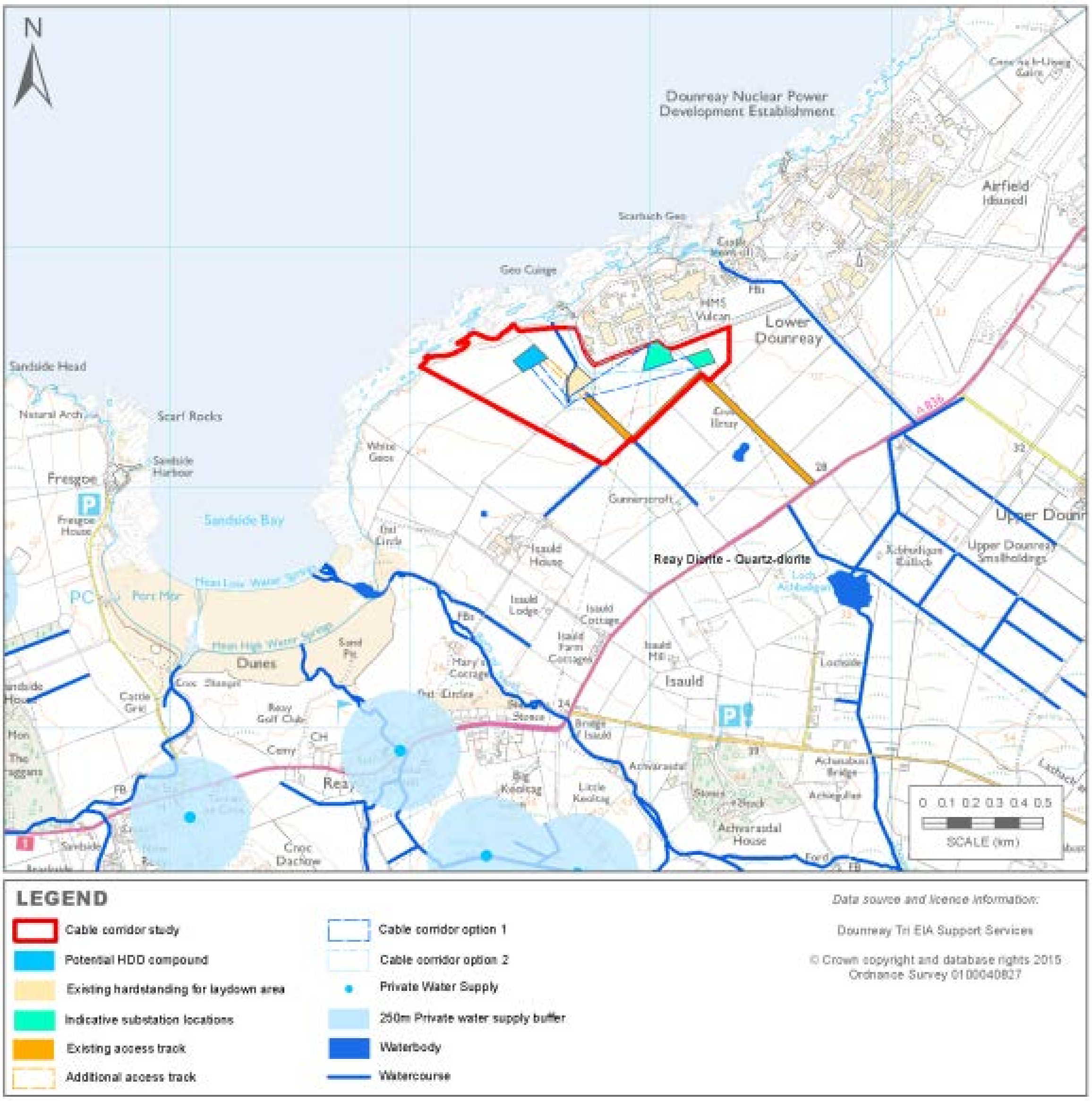

Figure 21-57 Surface water features

Groundwater

21.48 A review of the BGS 1:625,000 scale digital hydrogeological dataset indicates that the site sits above Middle Old Red Sandstone (sandstone, siltstone, mudstone and conglomerates), which is a moderately productive aquifer in which flow is virtually all through fractures and other discontinuities.

21.49 The SEPA RBMP map refers to the underlying groundwater body as Thurso bedrock and localised sand and gravel aquifers. It provides a classification of Good overall status with High confidence that is meets the requirements of the Water Framework Directive.

21.50 The different geological units in this area interact to control the movement of groundwater. Surface sediments, particularly base of the boulder clay (till) where it lies on the weathered surface of the bedrock, form the major groundwater transport layer. Surface runoff relates to the slope steepness, however the burns described above are the major water transport mechanism.

21.51 BGS trial pit logs for the Study Area generally recorded groundwater seepage at the base of the natural superficial deposits or in the upper part of the weathered bedrock, at depths of around 1 m to 2 m bgl. Trial pits at the far south west of the site were dry.

Private water supplies

21.52 The Highland Council (THC) has reviewed its records of known Private Water Supplies in the wider area of the site and has reported that there are no recorded Private Water Supplies in the vicinity of the onshore cable corridor Study Area. The nearest Private Water Supply, identified from OS mapping, is located approximately 1 km to the south of the Study Area boundary at NGR 296975 964905(see Figure 21-4).

Flood risk

21.53 A review of the SEPA online flood map (http://map.sepa.org.uk/floodmap/map.htm) indicates that the banks and immediate local area around both the Burn of Isauld and Dounreay Burn are at risk of a 1 in 200 year flood event (flooding from rivers), however these potential flood events are unlikely to encroach into the cable corridor Study Area.

21.54 Small areas of surface water flood risk are indicated within the site boundary, immediately to the west of Lower Dounreay associated with lower lying field drains. This is likely due to the general topography of the site which slopes down to the north towards the Pentland Firth and therefore surface water drainage would naturally follow this slope towards the lowest lying areas.

Contaminated land

21.55 The site is located adjacent to the former Dounreay Nuclear Power Facility. Contamination has previously been identified within the ground at the Dounreay site, which is currently being remediated (http://www.dounreay.com/decommissioning/end-state-of-site/contaminated-land) and there is some potential for contaminants to have leached into the site boundary.

21.56 Made ground was recorded in one BGS trial pit, at the north east edge of the cable corridor Study Area, where aerial photography suggests there to be a highly localised area of disturbed ground (see Paragraph 21.33). Made ground was described as broken rock with traces of brick, timber and concrete, overlying sandy silt, gravel, roots and topsoil. The description does not suggest evidence of contamination, although no chemical testing is understood to have been carried out.

Summary of Baseline Conditions

21.57 The Study Area for the cable corridor is underlain by glacial till above sedimentary Dounreay siltstone and sandstone. Other than a field drain, there are no watercourses present within the Study Area. The site sits above Middle Old Red Sandstone (sandstone, siltstone, mudstone and conglomerates), which is a moderately productive aquifer in which flow is virtually all through fractures and other discontinuities. There are no recorded Private Water Supplies in the vicinity of the onshore cable corridor Study Area.

21.58 A review of the SEPA online mapping indicates that the banks and immediate local area around both the Burn of Isauld and Dounreay Burn are at risk of a 1 in 200 year flood event (flooding from rivers), however these potential flood events are unlikely to encroach into the cable corridor Study Area.

21.59 Small areas of surface water flood risk are indicated within the site boundary, immediately to the west of Lower Dounreay associated with lower lying field drains. This is likely due to the general topography of the site which slopes down to the north towards the Pentland Firth and therefore surface water drainage would naturally follow this slope towards the lowest lying areas.

21.60 There is considered to be some potential for contaminants associated with the former Dounreay Nuclear Power Facility to have leached into the site boundary.

21.10 Identification of Potential Effects

21.61 This section sets out the key potential effects of the onshore proposals on Geology, Hydrology and Hydrogeology and presents an initial assessment of the effects including their predicted significance prior to mitigation.

Potential effects in the construction phase

- Pollution of watercourses from silt-laden runoff;
- Pollution of watercourses from chemical contaminated runoff;
- Disruption to drainage characteristics and groundwater flow; and
- Mobilisation of ground contamination.

Potential effects in the operational phase

- Alteration of surface drainage; and
- Increase in downstream flooding.

Potential effects in the decommissioning phase

- Impacts would be predicted to be similar to those for the construction stages of the onshore works.

21.11 Impact Assessment - Construction Phase

Pollution of watercourses from silt-laden runoff

21.62 Without appropriate drainage and surface water treatment around the construction works there is predicted to be the potential for a significant effect on on-site field drains and off-site watercourses from surface run-off which contains silt and sediments (moderate adverse).

Pollution of watercourses from chemical contaminated runoff

21.63 Without appropriate good practice and environmental management of the construction works there is predicted to be the potential for a significant effect on field drains and off-site watercourses from fuel and oil spillages and leaks (moderate adverse).

Disruption to drainage characteristics and groundwater flow

21.64 Trenching works and HDD have the potential to alter existing surface water and groundwater flows through excavation, storage and reinstatement of soils and superficial materials, and installation of solid linear infrastructure. These activities are predicted to result in significant effects to on-site drainage unless appropriate temporary drainage measures are installed within the working area during the construction phase of the works (moderate adverse effect).

Mobilisation of ground contamination

21.65 Trenching works have the potential to expose contaminants that may be bound in soils and superficial deposits. These contaminants can then be mobilised off-site through surface water run-off or wind blow. There is predicted to be a significant (moderate adverse) effect on receiving watercourses (on-site field drains or off-site watercourses).

21.12 Impact Assessment – Operations and Maintenance Phase

Alteration of surface drainage

21.66 Installation of Project infrastructure, including cable ducts and the substation / switchgear, has the potential to alter existing ground levels and topography and therefore alter surface water drainage. This is predicted to result in significant effects on long term drainage characteristics in the absence of mitigation to ensure appropriately designed drainage is installed (moderate adverse effect).Modification of water table and groundwater flow.

21.67 Installation of solid structures below ground such as the cable ducts and foundations for the substation/switch station have the potential to alter existing groundwater flows. These activities are predicted to result in significant effects to on-site drainage unless appropriate drainage measures are installed within the cable trenches and around foundation bases (moderate adverse effect).

Increase in downstream flooding

21.68 In the absence of appropriately designed drainage, there is the potential for increased localised downstream flooding (moderate adverse effect).

Impact assessment - decommissioning phase

21.69 Impacts would be predicted to be similar to those for the construction stages of the onshore works.

21.70 Without mitigation there is potential for significant (moderate adverse) impacts on soils and superficial deposits, hydrological resources and groundwater during some stages of decommissioning, in particular for the substation.

21.13 Mitigation Measures

21.71 Project commitments, described in Chapter 4: Project Description, which comprise general measures relevant to the mitigation of impacts on geology and hydrology include:

- GM18 Cable Laying Strategy and Method Statement;
- GM2 Construction Environmental Management Document; and
- GM3 Operational Environmental Management Plan.

21.72 Receptor specific mitigation measures are summarised in Table 12.7 below.

Table 21-7 Specific Mitigation Measures

Mitigation measures specific to Geology and Hydrology		
Ref	**Title**	**Description**
GH1	Ground contamination	A targeted intrusive ground investigation will be undertaken within the Project area to characterise ground conditions, including groundwater. This will inform the routeing of the cable and identify the most appropriate locations for the substation / switchgear. As part of this investigation, a programme of soil and groundwater sampling and monitoring will be undertaken to identify if existing ground and groundwater based contaminants are present and to assist in development of the detailed design of aspects such as surface and groundwater drainage. In the event that existing contaminants are identified, a Remedial Strategy will be prepared for agreement with the relevant authorities.
GH2	Best practice in pollution management	With specific reference to the SEPA 'Guidelines for Water Pollution Prevention from Civil Engineering Contracts' and 'Special Requirements', the Contractor will produce a Construction and Environmental Management Document (CEMD) which contains a construction method statement that includes: • a detailed breakdown of the phasing of construction activities; • a detailed plan showing the extent of permitted working areas and the routes of internal construction haul roads; • a pollution risk assessment of the site and the proposed activities; • identification of all water environment receptors that may be affected by the works and temporary discharge points to these water bodies; • planning and design of appropriate pollution control measures during earthworks and construction; • management of the pollution control system, including dewatering of excavations away from watercourses; • contingency planning and emergency procedures; and on-going monitoring of construction procedures to ensure management of risk is maintained.
GH3	Earth movement	All earth moving works or similar operations will be carried out in accordance with BSI Code of Practice for Earth Works BS6031:2009.
GH4	Pollution management in wet weather	Site management will check the local weather forecast daily and prime all site staff to ensure that everyone is aware of their responsibilities to maintain the pollution control system during wet weather.
GH5	On-site drainage	Where topography dictates that working platforms are needed, these will be formed to ensure that surface water drains away from ditches on-site and watercourses/bodies in the vicinity including Burn of Isauld and Pentland Firth.

Mitigation measures specific to Geology and Hydrology		
Ref	**Title**	**Description**
GH6	Best practice fuel storage	All fuel and other chemicals will be stored in accordance with best practice procedures, including in a designated fuelling site located at a safe distance from existing watercourses and in appropriate, impermeable, bunded containers/areas which will be defined within the CEMP. These will be designed to capture any leakage, whether from a tank or from associated equipment such as filling and off-take points, sighting gauges etc., all of which will be located within the bund.
GH7	Emergency pollution control	Oil booms and soakage pads will be maintained in all work areas and spill kits kept in all vehicles to enable a rapid and effective response to any accidental spillage or discharge. All construction staff will be trained in the effective use of this equipment.
GH8	Vehicle maintenance	Construction vehicles and plant will be regularly maintained and all maintenance, fuelling and vehicle washing will be undertaken on appropriate impermeable surfaces away from watercourses in order to minimise risks of leaks to soil and surface waters.
GH9	Best practice management of concrete	The Contractor will develop a method statement to address the transport, transfer, handling and pouring of liquid concrete at substation / switchgear foundations.
GH10	Concrete transfer	Cement, grout and unset concrete will not be allowed to enter the water environment. No operations involving concrete transfer between vehicles or into vehicles will take place within 50 m of watercourses and waterbodies.
GH11	Cement washout	All vehicles used for delivery of concrete will only be washed out at locations to be agreed with SEPA. Excess concrete or wash-out liquid will not be discharged to drains or watercourses on site or at compounds. Drainage from washout facilities will be collected and treated or removed to an appropriate treatment point/licensed disposal site.
GH12	Minimise dewatering	The requirement for dewatering, for example for the substation foundation, will be minimised by timely and efficient excavation of the foundation void and subsequent concrete pouring and backfilling.
GH13	Groundwater management	Appropriate drainage management measures, as detailed in the CEMP, will be implemented to help minimise modifications to near surface groundwater flows and levels. Water ingress will be monitored and limited during excavation works using temporary interceptor (cut-off ditches) and toe drains around the base of excavations.

Mitigation measures specific to Geology and Hydrology		
Ref	**Title**	**Description**
GH14	Drainage Strategy	Prior to construction, a detailed Drainage Strategy (DS) for the operational phase of the onshore Project will be prepared and agreed with SEPA and THC. The DS would detail the site drainage design, including any necessary ponds, swales, cross drains and bunds, to ensure that runoff from hard surfaces within the substation / switchgear will be controlled and managed. The DS will also detail how groundwater flows will be maintained around sub-surface structures such as substation foundations and cable duct.

21.73 All key mitigation measures will be incorporated within the Project's Environmental Management Document and within the Construction Environmental Management Document (see Chapter 4: Project Description; Project Commitments) which will be prepared and submitted for approval by the relevant authorities prior to construction.

21.14 Residual Impacts

21.74 This section reports the predicted residual impacts of the onshore proposals on geology, hydrology and hydrogeology, taking account of the committed mitigation set out in Section 21.12.

Construction Impacts

21.75 Pollution of on-site field drains and off-site watercourses from contaminated runoff during construction was predicted to have an adverse impact of moderate significance in the absence of mitigation (see Section 21.12). Development, implementation and management of a robust CEMP on site would ensure that the risk of pollution is minimised, reducing the residual significance of impact to minor (and not significant). It is vital that all staff are made aware of the requirements of the CEMP and are fully aware of their responsibilities in ensuring that it is implemented fully and at all times during construction.

21.76 The design and implementation of appropriate drainage management measures, as detailed in the CEMP, would help to minimise modifications to near surface groundwater flows and levels.

21.77 The targeted intrusive ground investigation will identify if existing ground and groundwater based contaminants are present and assist in development of a Remedial Strategy if required that will be prepared for agreement with the relevant authorities.

Operations and maintenance impacts

21.78 The Drainage Strategy (DS) referenced in mitigation measure GH14 would be critical to ensure that there are no adverse residual operational impacts on hydrology, hydrogeology and flood risk. The strategy would detail the site drainage design, including any necessary ponds, swales, cross drains and bunds, to ensure that runoff from hard surfaces within the substation / switchgear would be controlled and managed. The DS would also detail how groundwater flows would be maintained around sub-surface structures such as substation foundations and cable ducts.

Decommissioning impacts

21.79 The predicted impacts of decommissioning the onshore cable would depend on the method of decommissioning employed. If it was necessary to fully remove the cable and any joint bays then the predicted impacts would be very similar to those described previously for cable construction. If the cable and associated infrastructure was left in situ as part of the decommissioning plan then activities involving disturbance to geology, hydrology and hydrogeology would be very minor and no significant impacts on geological resources or the water environment would be predicted.

21.80 Substation / switchgear decommissioning would not be predicted to have any significant impacts. Following any removal of the substation / switchgear, it is likely that concrete foundations would be removed to approximately 0.5 m below ground surface, backfilled with suitable imported soils and returned to agricultural use. There is potential for release of some sediment as the backfilled material settles and revegetates, however this is unlikely to be significant in effect with appropriate monitoring and management and given the distance to any receiving watercourse.

21.15 Cumulative impacts

21.81 Proposals for the SHE-T Orkney-Caithness interconnector project and the HIE Dounreay Demonstration Centre are understood to be at an early stage[55] and with several options for the landfalls and cable routes being considered. This assessment has assumed that cable landfalls and onshore cable works for both projects would include a combination of HDD and open trenching methods, that cable routes could potentially cross the onshore cable route Study Area for the Project and that cables would be connected with existing substations at the Dounreay Nuclear Facility. Both projects are still in development and it is unlikely that they would be consented or constructed in advance of, or in parallel with, the Project's onshore infrastructure.

21.82 Prediction of cumulative impacts is therefore uncertain given the absence of specific spatial and temporal information. As a worst case, any proposal for simultaneous construction of the onshore works for these two projects with the proposed Project onshore construction is predicted to have significant residual cumulative impacts on geology, hydrology and hydrogeology.

21.83 These impacts would be predicted as a result of increased requirement for earthworks and excavation and disruption to local drainage. With mitigation to ensure collaboration between respective developers and scheduling of construction works for these projects to avoid simultaneous construction, it is predicted that significant impacts would be avoided.

21.84 The Orkney-Caithness Interconnector project and the HIE Dounreay Demonstrator project would have similar operational characteristics to the proposed Project with limited long-term disturbance to geological and hydrological resource. It is also anticipated that the onshore cabling from these projects would connect with existing substations within or close to the Dounreay Nuclear Facility limiting the requirement for additional permanent loss of geological resource. No significant cumulative impacts are predicted as a result of the permanent development or operation and maintenance of these projects in-combination in the longer-

[55] A screening opinion for the DDC (see http://www.gov.scot/Topics/marine/Licensing/marine/scoping/dfowdc/screening-op) was issued in 2015 but as of March 2016 no scoping information has been made publicly available. It is understood from discussions with SHE-T that cable routing options are being considered for the Orkney-Caithness interconnector project and information on previous options work has been accessed at https://www.ssepd.co.uk/OrkneyCaithness/ProjectDocuments/

term provided that all construction works were fully restored and the cumulative developments were operated following good environmental practice and adopting similar mitigation to that set out in this ES for the proposed Project.

21.16 Summary

21.85 The following is a summary of the key findings of the assessment:

- There are no geologically designated sites within the site boundary for the onshore Project. Sandside Bay SSSI is located just over 800 m to the south west edge of the cable corridor Study Area. Whilst this is not designated specifically for its geological interests, the sand dunes present are fundamental to the plant species found at this location for which the site has been notified. The route of the cable duct and associated infrastructure should be designed to avoid these dunes, if possible. If this is not possible, then HDD should be the preferred method of installing the cable duct below the dunes. Trenching through the dunes is considered likely to result in significant residual effects on the structural integrity of the dune system.
- Superficial geology comprises glacial till across the site. Trial pit records for the Study Area recorded bedrock close to the surface (generally 1 m to 2 m below ground level) across the site. Bedrock comprises sedimentary rocks including sandstone and siltstone.
- Other than field drain, there are no watercourses present within the site boundary. The nearest watercourses are the Burn of Isauld, which flows in a north westerly direction approximately 800 m from the south western boundary of the site, and the Dounreay Burn, which flows in a north westerly direction, approximately 350 m to the north east of the site boundary. Both of these watercourses have a good overall status of water quality.
- There is no identified major aquifer present below the site. Geological conditions indicate that groundwater flows will be mainly between the base of the glacial till deposits and the weathered surface of the bedrock, with some movement also in fissures and cracks within the bedrock.
- No Private Water Supplies have been identified either within or in close proximity to the site boundary.
- A review of SEPA flood mapping indicates that the site is at very limited risk of flooding.
- Other main impacts associated with construction activities are predicted to be associated with potential for pollution of watercourses and disruption to groundwater flow. No significant residual impacts are predicted from construction activities, provided that the committed mitigation measures are implemented on site, following the strict requirements of the Construction Environmental Management Document (CEMD) for the Project.
- A Drainage Strategy, which will be developed and agreed prior to construction beginning, will be critical to ensure that there are no adverse residual operational impacts on hydrology, hydrogeology and flood risk. The Strategy will detail the site drainage design to ensure that runoff from hard surfaces within the substation / switchgear will be controlled and managed. It will also detail how groundwater flows will be maintained around sub-surface structures such as substation foundations and cable duct.
- The effects of decommissioning on geology, hydrology and hydrogeology are anticipated to be similar to or less than those reported for construction and no significant impacts are predicted.

Table 21.8 Summary of residual impacts

Potential Impact	Magnitude	Vulnerability	Overall significance
Construction Phase			
Pollution of watercourses from silt-laden runoff	Medium	Medium	Minor
Pollution of watercourses from chemical contaminated runoff	Medium	Medium	Minor
Disruption to drainage characteristics and groundwater flow	Medium	Low	Minor
Mobilisation of ground contamination	Medium	Medium	Minor
Operations and Maintenance Phase			
Alteration of surface drainage	Medium	Low	Minor
Increase in downstream flooding	Medium	Low	Minor

22 Land Use, Agriculture and Soils

22.1 Introduction

22.1 This chapter describes the land uses including agriculture and associated soils within and around the area defined in Chapter 4: Project Description and in Figure 22-1 as the cable route Study Area. This area has been used to define the spatial extent of the Study Area for land use (see Section 22.2). The assessment considers the key land uses including agricultural land, land in the coastal area between the shore and the agricultural land, settlements and areas of residential and commercial properties and utilities together with the locations of transport routes, access tracks and routes used for informal recreation. Agricultural activities including the types of agricultural land management undertaken are addressed and the chapter takes account of soils present across the site including general information on their types and focusing in particular on agricultural aspects of soils and their economic use.

22.2 The chapter briefly describes the land uses in the vicinity and surroundings of the Study Area to provide a broad land use context for the assessment. It then presents more detail for the Study Area (see Figure 4-7) which would encompass works associated with the landfall cable joint transition bay, construction laydown areas (including a Horizontal Directional Drilling (HDD) compound for Option 1), the onshore cable corridor (and cable joint bays), access tracks, and the substation site. The temporary effects of Project construction (and decommissioning) and the permanent, maintenance and operational effects of development on these land uses and associated agricultural activities and soils are predicted and reported.

22.3 Predicted impacts on onshore geology including on bedrock (solid) geology, superficial deposits and on any potential for contaminated land are addressed in Chapter 21: Geology and Hydrology. Chapter 21 also assesses the impacts of the onshore works on hydrogeology and hydrology including flood risk. The traffic and transport requirements of the proposals are reported in the Project description in Chapter 4: Project Description.

22.2 Study Area

22.4 The assessment of land use impacts has focused on the area defined by the onshore cable route 'Study Area’ (Figure 22-1) within which the route of the onshore cable corridor from the onshore cable landfall to a proposed new substation would be developed, including the proposed access track to the cable corridor and substation. This area includes land uses in the inter-tidal rocky shore area between Mean High Water Springs (MHWS) and Mean Low Water Springs (MLWS). Land uses in the wider vicinity of the Study Area are also briefly described in Section 22.8.1 to provide a context for the assessment.

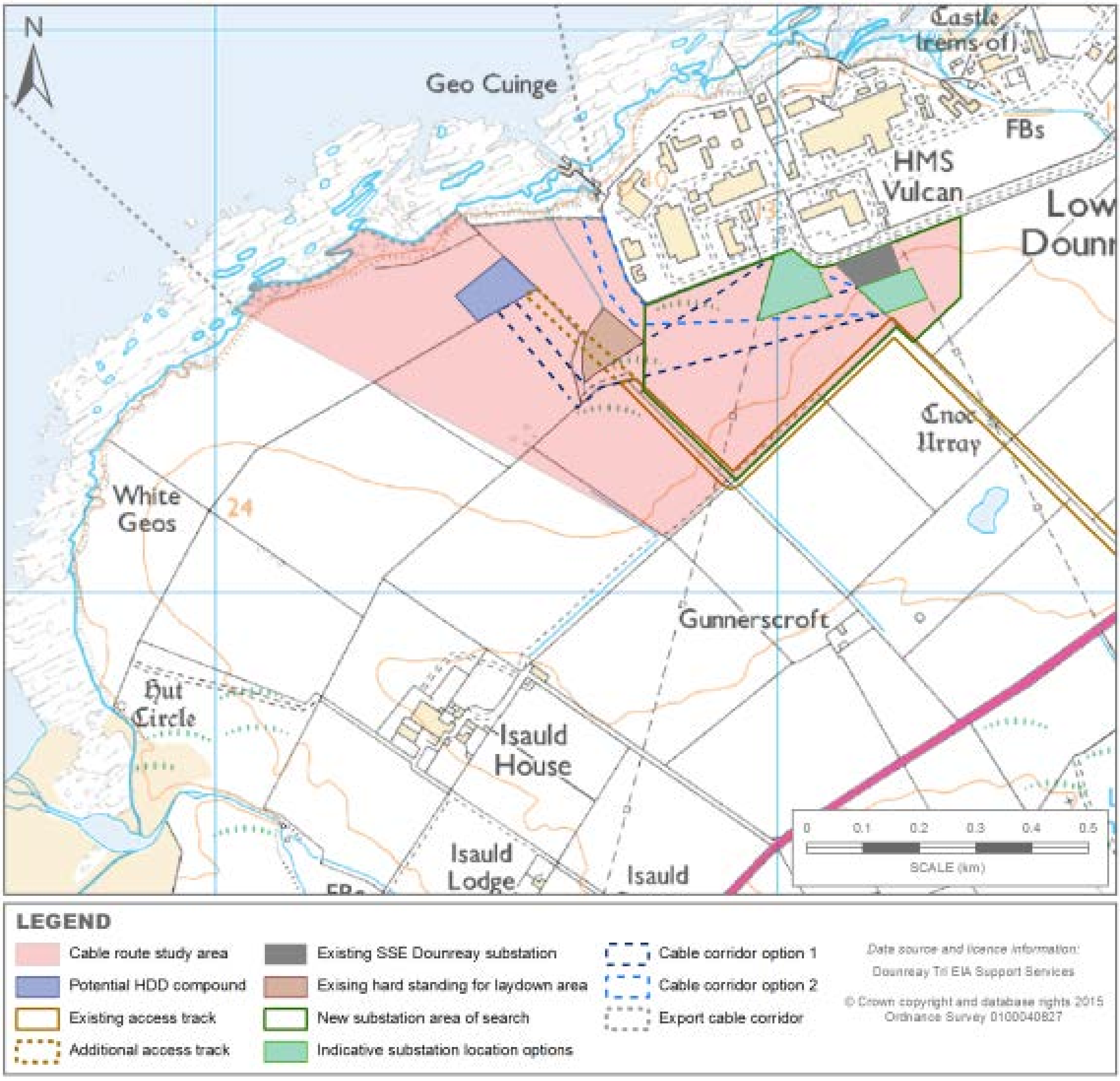

Figure 22-58 Onshore cable route Study Area

22.3 Legislation and Guidance

22.5 The following relevant legislation and guidance relating to Land Use, Agriculture and Soils was used in the preparation of this chapter:

- Department for Business, Enterprise and Regulatory Reform (2008) Review of Cabling Techniques and Environmental Effects Applicable to the Offshore Wind Farm Industry, Technical Report, January 2008: this document provides information on potential methods of construction of cables which has informed the prediction and assessment of impacts on Land Use, Agriculture and Soils in Section 22.9;
- Department for Environment, Food and Rural Affairs (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites: providing good practice on soil management which has been reflected where relevant in the mitigation measures in Section 22.8; and
- Scottish Government (2009) The Scottish Soils Framework: setting out high level principles for the management and protection of soils which have generally been taken into account in the assessment and mitigation presented in this chapter.

22.4 Sources of Information

22.6 A review was undertaken of the existing literature and data relating to Land Use, Agriculture and Soils in the locality of the site and was used to give an overview of the existing environment. The major data sources used in the preparation of this chapter are listed below in Table 22-1.

Table 22-138 Key data sources

Source	Content
Macaulay Institute for Soil Research (now James Hutton Institute) (http://www.soils-scotland.gov.uk/data/soil-survey)	Soil maps of Scotland at a scale of 1:250 000. Macaulay Institute for Soil Research, Aberdeen. Scotland's Soils. 2015. Soil maps - Scotland's Soils.
Scotland's Soils (http://www.soils-scotland.gov.uk/data/lca)	The Land Capability Classification for Agriculture presents information on soils, climate and relief to present mapped information which ranks land on the basis of its potential productivity and cropping flexibility for agricultural use. Land capability maps – Scotland's Soils.
The Highland Council Core Paths http://www.highland.gov.uk/downloads/download/199/core_paths_in_caithness	Maps and information on core paths designated in The Highland Council area.
Borehole logs from previous site investigations within the Study Area available from the British Geological Survey (BGS)	Information on geological conditions including soil depth.

22.7 In addition, the following information has been referenced in the preparation of this assessment:

- Information on land uses identified by the Project team from site visits in 2015 including photographs of the Project site and its environs;
- Information provided by the Client including land ownership and agricultural activity between the cable landfall and substation site;
- 1: 25 000 Ordnance Survey (OS) map (Sheet 449: Strath Halladale and Strathy Point); and
- Feedback from consultees (see Section 22.6).

22.5 Surveys and Studies Carried out to Date

Field surveys

22.8 The Project team undertook site visits in 2015 to the area of the onshore Project and recorded key land uses on the Project site and in the surrounding area. Additional terrestrial ecology surveys have been undertaken and these are reported in Chapter 24: Terrestrial Ecology.

22.6 Consultation

Scoping responses

22.9 Issues identified from responses from consultees to the Scoping Report that are relevant to Land Use, Agriculture and Soils are collated and summarised in Table 22-2 and cross-referenced to the appropriate section of the ES.

Table 22-139 Summary of scoping responses

Consultee	Comment Relative to the Physical Environment	Relevance/Cross Reference
The Highland Council	The ES should recognise any existing land uses affected by the development, having particular regard for Highland Council's Development Plan, other supplementary planning policies and Scottish Planning Policy. There are a number of core paths in the onshore area of interest and these should be considered in any proposals as well as more general access rights and the common law right of access on the foreshore.	Existing land uses and access routes are described in Section 22.8. Predicted impacts on land uses, walking and access routes (including core paths and access to and along the foreshore) are reported in Section 22.14.
Scottish Government	Impacts to onshore soils from spill or leakage of pollutants should be discussed, particularly during the construction and decommissioning stage (e.g. from vehicles, vessels, storage of chemicals onsite). The ES is expected to provide detail on mitigation measures, such as avoiding/managing spills and leaks, and the development of emergency response plans.	Mitigation for land use and agriculture including measures to prevent accidental soil contamination from construction works are presented in Section 22.13.
Sports Scotland	It will be important for the land-based elements of the proposal not to impact negatively on access rights in the area.	The predicted impacts of onshore works on access are discussed in Section 22.14.

22.7 Assessment Methodology

22.10 The overarching approach to the Environmental Impact Assessment is described in Chapter 5: Environmental Impact Assessment Methodology. This section sets out specific criteria which have been used to evaluate the impact of the proposals on Land Use, Agriculture and Soils. The assessment has been based on an understanding of the sensitivity of the current land uses to changes resulting from the Project's construction, operations and maintenance and decommissioning and the magnitude of the effects from these activities.

22.11 The assessment also briefly considers the potential for significant cumulative land use impacts for the proposals in-combination with two other reasonably foreseeable projects with onshore works:

- The Orkney-Caithness interconnector cable; and
- The HIE Dounreay Demonstration Centre (DDC).

22.12 Further information on the overall approach to cumulative impacts assessment is provided in Chapter 5: Environmental Impact Assessment Methodology.

Design envelope considerations

22.13 The Project description is set out in Chapter 4: Project Description including design assumptions about the Project envelope (the Design Envelope). Specific and key assumptions relevant to the assessment in this land use chapter are:

- The footprint of the cable landfall, onshore cable and associated works (during construction and permanently);
- The potential length and route of the onshore cable; and
- The new substation footprint.

22.14 For Land Use, Agriculture and Soils the length, route and overall land take/footprint of the landfall works, onshore cable, substation and (for Option 1) HDD compound have the potential for impacts as a result of loss or alteration to agricultural land and soils and temporary disturbance of land and land management activities during construction. Worst case effects are particularly associated with the HDD option (Option 1) which would have the greater permanent change in land use as the cable corridor to the substation would be longer than for Option 2 and would have greater potential for severance effects on fields. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario has been assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

22.15 Table 22-3 describes the Design Envelope parameters specific to land use, agriculture and soils.

Table 22-140 Design envelope parameters specific to land use, agriculture and soils

Design Envelope Parameter	Value / Description
Largest substation site	Areas of permanent land take expected to be in the order of up to 2,500 m^2 for substation compound (all Options).
Longest potential cable trench route across agricultural land	Cable route of up to approximately 800m length, trench 1 m deep and working corridor up to 20 m wide (Option 1 slightly longer than Option 2).
Route of cable trench across agricultural land	Cable route working length of approximately up to 800m and (Option 1) with greatest potential to sever fields.

22.16 The assessment presented in this chapter allows for the development of a cable landfall and onshore cable route, HDD compound and substation within the zones identified on Figure 22-2 and the assessment has taken account of the worst case parameters set out in Table 22-3.

Methods of prediction

22.17 For Land Use, Agriculture and Soils, potential ***effects*** are identified and significance of ***impact*** is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions.

22.18 The methodology is as described in Chapter 5: Environmental Impact Assessment Methodology. The assessment of effects and impacts on land use and agriculture has been undertaken qualitatively with reference to quantitative information where available such as on the construction working areas for the cable and the land take and assumed locational requirements for the cable infrastructure and substation (drawing on parameters set out above in Table 22-3).

22.19 Significance is attributed using professional judgement and with reference to guideline matrices (see Table 22-6) drawing on an understanding of the magnitude of predicted effects and the baseline sensitivity.

Magnitude of effect

22.20 The magnitude of effect is based on the predicted temporary and permanent change in land use and associated loss of land from farm units, properties or other land uses such as coastal habitats between the inter-tidal area. The effects of changes in land use have also been considered on access routes such as roads, tracks and other facilities. The characterisation of magnitude of effects on land use also takes account of its characteristics including the spatial extent and severity of the effect, its duration and frequency.

22.21 For land Use, agriculture and soils the characteristics of magnitude of effect are defined as follows.

Table 22-141 Magnitude of effects

Magnitude of Effect	Description
High	Loss of a large proportion of land from a farm or land holding Permanent change or restriction to agricultural land management, soils or production requiring major management adjustments to a farm unit Permanent changes to access routes, rights of way or other facilities
Medium	Loss of a small proportion of land from a farm or land holding Permanent change or restriction to agricultural land management, soils or production requiring some management adjustments to a farm unit Temporary but noticeable changes to access routes, rights of way or other facilities
Low	Permanent change or restriction to agricultural land management, soils or production requiring small scale management adjustments to a farm unit Small scale changes to access routes, rights of way or other facilities
Negligible	Negligible change to land use, soils or agricultural operations

Sensitivity of receptor

22.22 The sensitivity (vulnerability) of the receptor is also taken into account in the assessment of significance. The sensitivity analysis has taken account of the types of property potentially affected, uses of other land and access routes and the quality of agricultural land and nature of associated economic activity. The sensitivity of land uses (and effects on them) also takes account of other attributes including its adaptability, tolerance to change, recoverability and value. A set of guideline criteria for determining sensitivity are set out in Table 22-5. A criterion for negligible sensitivity has not been used in this assessment.

Table 22-142 Sensitivity of agriculture, soils and land use receptors

Sensitivity	Description
High	Residential and community property including land within their curtilage Prime quality agricultural land (Class 1, 2 or 3_1) Intensive arable cropping and/or intensive livestock system Soils or agricultural land with designations (e.g. Nitrate Vulnerable Zone (NVZ) or other agri-environmental status) Key access facilities including Core Paths and National Cycle Network routes Utilities and other commercial or industrial land (e.g. high pressure pipelines, high voltage transmission lines, assets at the Dounreay Nuclear Facility) which are complex or expensive to relocate
Medium	Non-prime quality agricultural land in productive use Mixed livestock and crop systems of moderate intensity Non-designated access routes including tracks, walking and cycling routes Other commercial/industrial property and surrounding land which is important for the commercial activity
Low	Low intensity grazing land or land not in agricultural use Land from other commercial/industrial facilities which is not important for the commercial activity Soils within developed areas (including made ground)

Significance of impact

22.23 Magnitude of effect is combined with sensitivity/vulnerability of the receptor to provide an assessment of an overall significance of any impact. The evaluation of impact significance is informed by the matrix presented in Table 22-6 and by professional judgement of the assessment team. An impact of moderate or major significance is considered to be a significant impact in this assessment.

Table 22-143 Significance matrix

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

22.8 Data gaps and uncertainties

22.24 The information sources used to establish the baseline environment for Land Use, Agriculture and Soils are deemed sufficient to inform a robust impact assessment. Where there is uncertainty about the nature of particular receptors (e.g. changes in agricultural cropping from year to year), a precautionary approach is taken either in their assessment of sensitivity or the potential magnitude of impact associated with the Project.

22.9 Description of the Current Environment

Overview of land uses in the locality of the site

22.25 The onshore Project site is located on the north coast of Scotland, in the north west of Caithness within the administrative area of The Highland Council. The nearest town to the Project is Thurso, some 15 km to the east of the Study Area and the small village of Reay is the closest settlement, located approximately 1 km to the south. It lies in a coastal location between Sandside Bay to the west and the large industrial facility of the Dounreay Nuclear Facility to the east.

22.26 Sandside Bay is a long sandy bay backed by a sand dune system which is designated as a Site of Special Scientific Interest (SSSI) (see Chapter 24: Terrestrial Ecology). The southern part of the bay includes undulating dunes with gentle and steep slopes. The sand dunes are noted for their biological interest, whilst also having an important role in natural sea defence. The western and eastern edges of the bay are flanked by rock shores. The sand dunes in the southern part of Sandside Bay are backed by a golf course located between the bay and Reay village to the south. There are a number of walking routes from Reay village to Sandside Bay through the dunes including two core paths (see Figure 22-2).

22.27 A number of small watercourses outwith the Study Area drain into Sandside Bay from the land to the south (see Figure 22-2), the closest being the Burn of Isauld which drains into the south east corner of the bay over 500 m to the south west of the Study Area (see Chapter 21: Geology and Hydrology).

22.28 The Dounreay Nuclear Facility occupies a large site in a coastal location approximately 2 km north east of Reay village and adjacent to, but just outwith, the Study Area (see Figure 22-2). This site includes a large number of industrial buildings which house facilities associated with the former nuclear reactor. An electrical 132/33/11 kV substation has recently been constructed in a compound near the south west corner of the facility which, along with some areas of hard standing, form the nearest land uses within the facility which lie adjacent to the north eastern boundary of the Study Area. Part of the eastern section of the facility includes an open area of a former airfield. The boundary of the site is fenced off from surrounding land. Dounreay Site Restoration Limited is the decommissioning operator of the facility.

22.29 The principal transport route in the vicinity of the site (but outwith the Study Area) is the A836 road which provides the main road link along the Caithness coast between Thurso to the east and Bettyhill to the west. This road provides the main access to the Dounreay Nuclear facility and it passes through the centre of the village of Reay. A minor road joins the A836 at the eastern end of Reay (at Bridge of Isauld) providing local vehicular access to small settlements to the east including Shebster, Westfield and on to Thurso.

Land uses of the study area

22.30 The onshore cable route Study Area (approximate centre grid reference NGR NC 2977 9664, see area enclosed by the red line in Figure 22-2) occupies a coastal location bounded to the north by the coastal foreshore which is predominantly rocky in nature (see Chapter 21: Geology and Hydrology).

22.31 The eastern side of the Study Area is flanked by the western end of the Dounreay Nuclear Facility and the southern and western edge is contiguous with agricultural land which continues south towards the A836 which lies approximately 600 m to the south of the Study Area boundary.

22.32 Land use in the Study Area is predominantly agricultural in nature. The land rises gently from the coast to a maximum height of approximately 20 m above ordnance datum (AOD). There are no named surface watercourses in the Study Area although there are some minor channelised drainage ditches in the north and south west of the site (see Figure 22-2 and Section 22.8).

22.33 The Study Area is predominantly in the ownership of one land owner who farms the land from the farm steading at Isauld House (see Section 22.8.6). The farm house is located approximately 500 m south west of the western boundary of the Study Area (see Table 22-7). The fields within the Study Area are divided by a combination of post and wire fences with some dry stone dykes and the area lacks any significant tree cover.

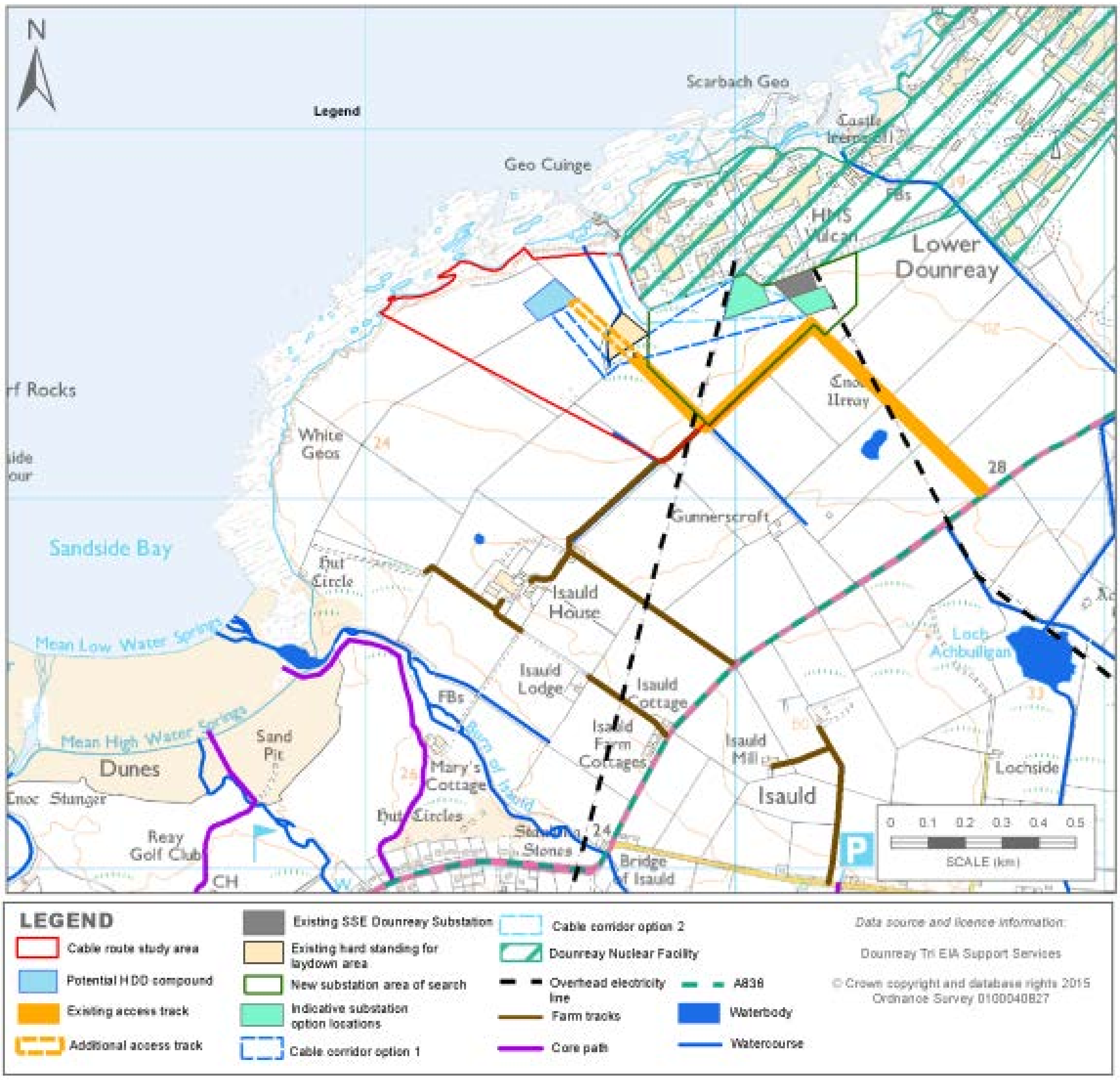

Figure 22-59 Land uses in the Study Area

22.34 The route of the proposed vehicle access to the cable corridor and to the substation and DD compound areas would follow the line of an existing track which was constructed for recent electrical grid works associated with the Dounreay – Mybster line. This track runs from the A836 towards the Study Area between three fields to a point close to the south west corner of the Dounreay Nuclear Facility (see Figure 22-2) before joining an existing farm track which leads south westwards along the southern boundary of the Study Area then on to Isauld House. The new section of existing access track also provides access from the A836 to a recently constructed substation (see Section 22.8.1) adjacent to the southern boundary of the Dounreay Nuclear Facility.

22.35 Land uses specific to the proposed onshore infrastructure options and locations are:

- For Option 1 (HDD), the proposed HDD compound would be located on an area of rough grazing approximately 100 m south of the foreshore. The cable corridor from the HDD compound to either of the substation option locations would cross two large fields, the first under grazing and the second to the east used for arable land. Both substation option locations lie within arable land.

- For Option 2 (Pinning), the cable route would follow a corridor from the landfall close to the Dounreay facility's western boundary fence first through grazing land and then along the northern part of a large arable field to one of the substation option locations.

Property

22.36 There are no residential or commercial properties within the Study Area. Properties identified within 500 m of the boundary of the Study Area are listed in Table 22-7 and are shown on Figure 22-2.

Table 22-144 Residential and commercial properties within 500 m of Study Area

Property	Description
Residential Property	
Gunnerscroft (1 house)	Located c350 m east of the Study Area boundary
Isauld House (1 farm house)	Located c500 m south west of the Study Area boundary
Commercial Property	
Isauld House	Farm steading located c500 m south west of the Study Area boundary
Dounreay Nuclear Facility	Former nuclear power station facility, located adjacent to north east edge of Study Area boundary

22.37 A group of residential properties lies approximately 700 m south of the Study Area at Isauld Farm Cottages which are located on the edge of the A836, and the settlement of Reay lies approximately 1.1 km south west of the Study Area.

Access, recreation and utilities

22.38 A single lane hard surfaced access road provides vehicle access to the farm and property at Isauld House from the A836 some 600 m to the south east of the farm. This road would not be used for construction or operational access to the onshore cable or substation.

22.39 There are no Core Paths in the Study Area. The closest designated Core Path is Path CA11.07 which provides a walking route from Reay village to the beach area in the south of Sandside Bay (see Figure 22-2) and which lies approximately 900 m south west of the Study Area at its closest point.

22.40 An unsurfaced farm track runs in a north easterly direction for a distance of approximately 900 m from Isauld House (farm steading) to the boundary of the Dounreay Nuclear Facility providing farm access to fields on either side of the track and which is used for occasional informal walking and cycling. A spur runs off this track leading 300 m north westwards to an area of ground under hard standing which is located adjacent to the south west corner of the boundary of the Dounreay plant. This hard standing was created during works in 2013 for the new 132/33/11 kV Dounreay substation on the southern boundary of the Dounreay Nuclear Facility (see Chapter 4: Project Description; Section 4.2). A further track approximately 650 m long has recently been constructed to connect the northern end of the farm track with the

A836 to provide access to the new Dounreay substation[56] (see Section 22.8.2). This new access track is proposed to be used to provide construction and operational access to the onshore cable corridor working area and substation site (see Section 22.11).

22.41 There are no other marked paths or formal tracks across the Study Area and there is no public vehicular access to the Study Area. The beach at Sandside Bay (approximately 1 km west of the Study Area) and the rocky coast to the north of the beach (and adjacent to the onshore cable route Study Area) provide local walking routes. The main walking routes to the beach are from Reay to the south west of the Study Area.

22.42 National Cycle Network Route 1 (Aberdeen to the Shetland Islands) follows a route along the Caithness coast and at its nearest location to the Project it passes along the route of the A836 road through Reay village to the south of the Study Area. There are no designated cycle tracks within the Study Area or connecting to it from the A836.

22.43 The eastern part of the Study Area is crossed by two overhead transmission lines which are supported by steel towers (see Figure 22-2). These lines originate in the substation compound on the south west side of the Dounreay Nuclear Facility and are in close proximity to the potential substation option locations for the proposed Project.

Soils

22.44 Reference to the 1:250 000 scale National Soil Map of Scotland indicates there are a limited number of soil types present within the Study Area. These are primarily podzols[57] and gleys[58] (see Figure 22-3 and Section 22.8).

22.45 Information from previous site investigations in the Study Area (BGS borehole and trial pit records – see Section 22.8) indicates that topsoils on land above MHWS are generally up to 0.3 m in depth and typically described as grey and sandy topsoil overlying natural sand, silts, clays and weathered rock. An area of disturbed ground was encountered to the immediate south west of the Dounreay Nuclear Facility where made ground overlies topsoil, this area is now under hard standing following construction of the Dounreay substation (see Section 22.8.4). At the northern edge of the Study Area where the agricultural land meets the foreshore there is an area of rocky shore between MHWS and MLWS with little or no topsoil.

22.46 Information on superficial and solid geological deposits under the topsoil together with potential for contaminated land in the area is provided in Chapter 21: Geology and Hydrology.

22.47 The south western of the Study Area is composed of humus-iron podzols (dry and acidic soil). These soils are usually free-draining and have a deep organic layer but are also naturally acidic and nutrient deficient. Associated vegetation in this particular area includes arable and permanent pastures and acid grassland (see Chapter 24: Terrestrial Ecology).

22.48 The soils in the majority of the Study Area are associated with poorly drained non-calcareous gleys (wetter soils). Gley soils tend to develop under conditions of intermittent or permanent waterlogging. Arable and permanent pastures are generally associated with this soil type and landform in the Study Area.

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[56] Public access to the Dounreay substation and the Dounreay Facility from this section of the track is restricted by a locked gate

[57]Podzols are generally free draining acidic soils from which minerals have been heavily leached (see http://www.macaulay.ac.uk/soilquality/Soils%20and%20their%20main%20characteristics.pdf)

[58]Gleys are poorly drained organic soils which are subject to permanent or periodic waterlogging (see http://www.macaulay.ac.uk/soilquality/Soils%20and%20their%20main%20characteristics.pdf)

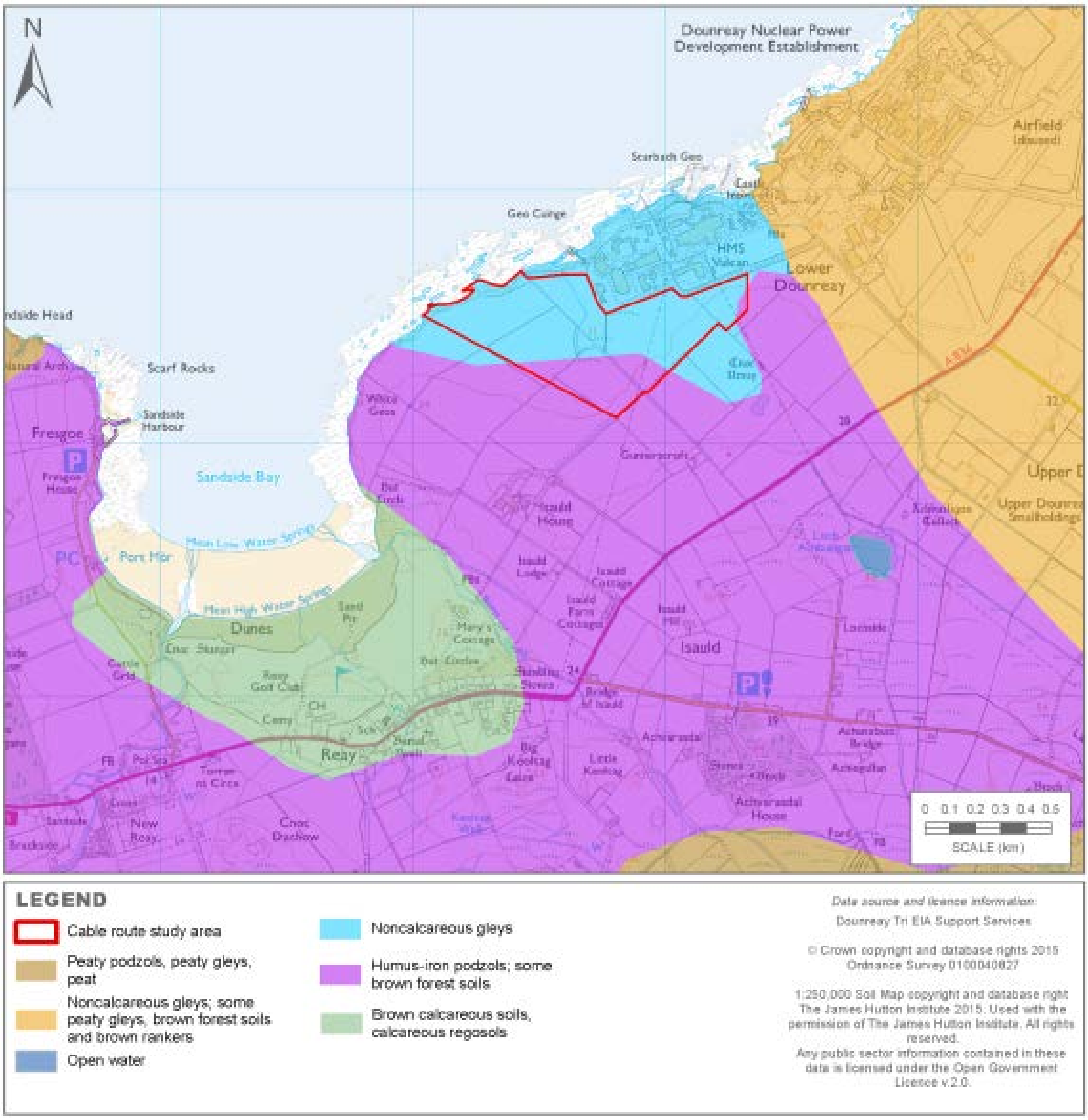

Figure 22-60 Soil types in the Study Area and its wider locality

Agriculture

22.49 The land in the western part of the Study Area is owned and farmed by a single individual. The ownership of the eastern part of the site is understood to be associated with the Dounreay Nuclear Facility and the land here is managed under a tenancy agreement by the same farmer. The Study Area has therefore been considered in this assessment as part of a single farm unit. The farm unit associated with Isauld House is much more extensive than the land within the Study Area[59] with adjacent fields to the south, west and east of the Study Area also falling within the same farm unit.

[59] Land ownership plans indicate a land holding in excess of approximately 220 hectares

22.50 Land use in the Study Area predominantly comprises grazing land (particularly on the fields immediately inland from the coast). A large field in the eastern part of the Study Area in proximity to the Dounreay Nuclear Facility is used for arable production.

22.51 The land within the Study Area falls within agricultural land capability class 3_2, which is defined as land capable of producing a moderate range of crops, with good yields from a narrow range of crops including cereals and grass and moderate yields from other crops such as potatoes and some vegetables. Limiting factors here may include wetness, unfavourable soil structure or texture or variable climate (MISR, 1981). Further information on the characteristics of the soil underlying the Project site is provided above (under 'Soils').

22.52 The Project site is not located within a Nitrate Vulnerable Zone (NVZ)[60].

Summary of baseline conditions

22.53 The Study Area for Land Use, Agriculture and Soils is bounded to the north by the Caithness coast, to the east by the Dounreay Nuclear Facility and to the west and south by land used for agriculture. The land is generally flat rising to approximately 20 m above sea level and there are no significant surface watercourses. The eastern part of the Study Area is crossed by two overhead transmission lines which are supported by steel towers. These lines originate at the substation on the south west side of the Dounreay Nuclear Facility.

22.54 There are no residential or commercial properties within the Study Area which is approximately 1.1 km distant from the nearest settlement of Reay to the south west. There is an unsurfaced track through the Study Area which provides agricultural access to fields and an access track which connects the A836 road to the south of the Study Area with a recently constructed substation compound at the Dounreay Nuclear Facility which is located to the immediate north east of the Study Area.

22.55 There are no formally designated walking or cycling routes within the Study Area. The beach at Sandside Bay (approximately 1 km west of the Study Area) and the rocky coast to the north of the beach (and adjacent to the Study Area) provide local walking routes.

22.56 Agricultural land uses predominate in the Study Area with a mix of grazing land and arable production within a single farm unit operated from a farm at Isauld House which is located approximately 500 m south west of the Study Area. The soils in the Study Area are predominantly gleys (poorly drained organic soils) and their agricultural land capability is class 3^2 which is capable of producing a moderate range of crops.

22.10 Identification of Potential Impacts

22.57 This section sets out the key potential effects of the onshore proposals on Land Use, Agriculture and Soils and presents an initial assessment of the effects including their predicted significance prior to mitigation.

Potential impacts in the construction phase

- Permanent loss of land including fields under agricultural production as a result of construction of the new onshore substation;
- Changes to agricultural drainage patterns from construction of the onshore cable route;

[60] NVZs are designated by the Scottish Government to control agricultural activities in order to reduce the introduction of nitrates in areas of sensitive receiving watercourses

- Temporary occupation of agricultural land during construction of onshore works including for the cable corridor, substation and HDD compound;
- Temporary interference with agricultural operations during construction requiring changes to land management, access etc.;
- Permanent fragmentation and severance of farm units and/or fields associated with the development of the cable corridor, with potential impacts on farm unit operations or viability;
- Pollution of soils from spillage of fuels, oils and other materials used in construction;
- Physical damage to soils from sealing, compaction, storage and handling causing impacts on quality and success of restoration;
- Changes to soil quality and associated agricultural land classification in the longer-term following restoration of land used temporarily during construction;
- Impacts on utilities crossing the Study Area; and
- Temporary and permanent changes in vehicular, pedestrian and cycle access to and within the Study Area and for access to any nearby properties.

Potential impacts in the operations and maintenance phase

- Improved access to the site for land managers and agricultural operations;
- Interference with agricultural activities from maintenance vehicles;
- Increased hazards to users of the area from operation of the onshore works; and
- Spillage or leaks of fuels, oils or other chemicals from operation of the substation.

Potential impacts in the decommissioning phase

- Impacts would be predicted to be similar to those for the construction stages of the onshore works.

22.11 Impact Assessment – Construction Phase

Permanent loss of land including fields under agricultural production as a result of construction of the new onshore substation

22.58 Taking account of the relatively minor change in permanent land uses and associated loss of productive land for construction of the substation, it is not predicted that significant effects on Land Use, Agriculture and Soils would occur (minor adverse effect).

Changes to agricultural drainage patterns from construction of the onshore cable route

22.59 Construction works including cabling which intercepts or damages field drains would be predicted to have the potential for significant (moderate adverse) effects on agricultural drainage and on the associated use and productivity of agricultural soils.

Temporary occupation of agricultural land during construction of onshore works including for the cable corridor, substation and HDD compound

22.60 Construction works are predicted to occupy an onshore corridor approximately 5.1 ha (see Table 22-8) and across a number of fields in agricultural production. Without mitigation of these works it is predicted that impacts on land management would be significant (minor to moderate adverse).

Temporary interference with agricultural operations during construction requiring changes to land management, access etc.

22.61 Construction activities across the agricultural land in the Study Area would be predicted to have potentially significant effects on agricultural operations through severance of access to fields and disruption to farm management generally. Effects are predicted to be minor to moderate adverse (and significant) without mitigation.

Permanent fragmentation and severance of farm units and/or fields associated with the development of the cable corridor, with potential impacts on farm unit operations or viability

22.62 Depending on the final alignment of the cable corridor and any associated requirements for access to the cable (e.g. cable joint bays) it is predicted that some minor effects on farm operations would occur but as the cable would be buried no significant permanent effects (minor adverse) are predicted.

Pollution of soils from spillage of fuels, oils and other materials used in construction

22.63 Without appropriate good practice and environmental management of the construction works there is predicted to be the potential for a significant effect on soils from fuel and oil spillages and leaks (moderate adverse).

Physical damage to soils from sealing, compaction, storage and handling causing impacts on quality and success of restoration

22.64 Cable works would involve excavation, storage and reinstatement of agricultural soils which are predicted to result in significant effects on the success of long-term site restoration in the absence of mitigation to ensure soil protection (moderate adverse effect).

Changes to soil quality and associated agricultural land classification in the longer-term following restoration of land used temporarily during construction

22.65 Cable works would involve excavation, storage and reinstatement of agricultural soils which are predicted to result in significant effects on long-term land quality and productivity in the absence of mitigation to ensure soil protection (moderate adverse effect).

Impacts on utilities crossing the Study Area

22.66 Construction works have the potential to adversely affect buried and surface utilities without checks on services and specific controls on construction works. There is predicted to be a significant (moderate adverse) effect on utilities.

Temporary and permanent changes in vehicular, pedestrian and cycle access to and within the Study Area and for access to any nearby properties

22.67 During construction it is predicted that some restriction on public access for walking and cycling would be required to the farm and utility tracks on site with a significant (moderate adverse) effect on these groups. Construction plant and vehicle access would be taken using the access track from the A836 towards the new Dounreay substation and would be kept separate from farm vehicle access to Isauld House/farm unit and significant effects on access to this and any other property are not predicted.

22.12 Impact Assessment – Operations and Maintenance Phase

Improved access to the site for land managers and agricultural operations

22.68 Operational access would use the existing utility track from the A836 and no significant effects (adverse or beneficial) are predicted.

Interference with agricultural activities from maintenance vehicles

22.69 Maintenance traffic is predicted to be infrequent and would primarily be between the A836 and substation (with very infrequent access to the cable route itself) which would not be predicted to have a significant adverse effect on agricultural activities.

Increased hazards to users of the area from operation of the onshore works

22.70 The substation would be located in a secure compound and adjacent to existing utility and industrial land uses. It is not predicted that the new works would significantly increase hazards to users of the area.

Spillage or leaks of fuels, oils or other chemicals from operation of the substation

22.71 There is potential over the operational life of the substation and without appropriate facility design to result in soil contamination from spillages and leaks of oils, fuels or other chemicals which could be significant (moderate adverse).

22.13 Impact Assessment – Decommissioning Phase

22.72 Impacts would be predicted to be similar to those for the construction stages of the onshore works.

22.73 Without mitigation there is potential for significant (moderate adverse) impacts on land use and agriculture during some stages of decommissioning, in particular for the substation.

22.14 Mitigation Measures

22.74 Project commitments, described in Chapter 4: Project Description, which comprise general measures relevant to the mitigation of impacts on land use include:

- GM18 Cable Laying Strategy and Method Statement;
- GM2 Construction Environmental Management Document; and
- GM3 Operational Environmental Management Plan.

22.75 Receptor specific mitigation measures are summarised in Table 22-8 below.

Table 22-145 Receptor specific mitigation measures

Mitigation Measures Specific to Land Use, Agriculture and Soils		
Ref	**Title**	**Description**
LA1	Land take	The land take for the proposals and disturbance to soil and agricultural land will be kept to the minimum required for safe construction and permanent development of the onshore works.
LA2	Temporary storage and laydown area	The area of existing hard standing ground close to the south west corner of the Dounreay Nuclear Facility will be used for temporary storage and laydown to minimise land take and compaction of productive agricultural land during construction.
LA3	Cable route position	The cable route will be aligned as far as possible with existing field boundaries to minimise disruption to agriculture and long-term damage to agricultural soils.
LA4	Good practice construction measures to protect soils	Construction works will be undertaken in accordance with all relevant good practice guidance for the protection of soils and agricultural land in particular to prevent compaction, mixing of topsoils and subsoils and erosion from wind and water.
LA5	Soil stripping in wet conditions	Soil stripping, handling and storage activities will be avoided during periods of very wet weather.
LA6	Measures to protect soils from compaction	Construction works on arable agricultural land will employ appropriate soil protection techniques including, where necessary, the use of geogrids and low ground pressure vehicles along the cable route to reduce the effects of compaction on soils and in other working areas to limit compaction effects of storage of plant and materials and temporary buildings.
LA7	Containment of fuels and oils on site	Fuels, oils and chemicals will be stored in designated and appropriately bunded locations within the site construction compound(s) in accordance with all relevant regulatory requirements and good site environmental management. Mobile fuel and oil storage and all plant will be regularly checked to ensure risks to soils are minimised.
LA8	Soil Resource Plan	A Soil Resource Plan will be developed in detail prior to construction as part of the Construction Environmental Management Document (CEMD) to ensure that soil resources are managed in accordance with legislation and good practice and that soil mitigation measures are fully implemented and audited on site.
LA9	Wheel washing of plant and vehicles	Plant and vehicles which are used to track and work across areas of arable land will be subject to wheel washing and disinfecting procedures to avoid the introduction or spread of agricultural pests.

Mitigation Measures Specific to Land Use, Agriculture and Soils		
Ref	**Title**	**Description**
LA10	Temporary storage of soils	Temporary spoil and topsoil bunds will be managed to minimise compaction, erosion by rainfall and wind and mobilisation of sediment. Topsoil storage areas will not exceed 1.5 m in height.
LA11	Management of contaminated soils	If any suspected contaminated soil is encountered during construction this will be dealt with in accordance with regulatory requirements and good industry practice.
LA12	Access to properties during construction	Access to all residential and commercial properties will be maintained during construction.
LA13	Use of existing access tracks	The existing access track to the A836 shall be used to avoid additional land take and compaction of productive agricultural land.
LA14	Field accesses	Gated access into agricultural fields will be provided in the fences along either side of the route of the proposed temporary and permanent access track to the onshore infrastructure.
LA15	Construction access routes	Access by construction vehicles and plant to the cable landfall and coastal working areas will be taken from the access tracks in the Study Area to avoid additional disruption to properties in Reay.
LA16	Temporary closure of access routes	Any required closure of the farm and utility tracks between Isauld House, the Dounreay Nuclear Facility (substation) and the A836 during construction to walkers and cyclists would be minimised by the contractor and public access reinstated when safe to do so (e.g. after the busiest phase of works).
LA17	Protection for people taking access to the shoreline area during construction	Method statements for the construction of the cable landfall which crosses the rocky shore will take account of the health and safety of people walking in these areas, including the use of temporary fencing or exclusion of working areas where access restrictions are required.
LA18	Services and utilities searches	A full search for all utilities will be undertaken by the Contractor to ensure that the location of any existing services and supplies are identified and safeguarded, prior to construction.
LA19	Protection of utilities during construction	Any utilities which could be affected by construction will be protected (or diverted) to ensure that there will be no loss of services to affected properties/facilities. Any short-term disruption to utility services will be notified in advance to relevant properties/facilities.

Mitigation Measures Specific to Land Use, Agriculture and Soils		
Ref	**Title**	**Description**
LA20	Maintenance of agricultural water supplies	Water supplies for livestock will be maintained during construction and permanently or alternative provision made.
LA21	Maintenance and restoration of agricultural drainage	Disruption to field drains will be minimised through careful alignment of the cable route and the integrity of all drains to be intercepted during construction will be secured in advance through installation of temporary cut-off drains. All field drainage will be fully reinstated following cable installation.
LA22	Lighting of construction works	The onshore Project construction working areas will be lit as required for safe construction and taking account of the effects of light spill on nearby residential properties.
LA23	Fencing of construction working areas from livestock	Construction working areas will be fenced from adjacent agricultural land used for grazing to exclude livestock from the site but allowing for temporary access across the cable corridor and other working areas for agricultural operations (e.g. moving stock between fields, farm vehicle access).
LA24	Restoration of land, tracks, paths and fences following construction	The site and construction compound including any field boundary features will be restored making sure that agricultural land, access tracks and paths are restored to a condition as near as reasonably practicable to that existing before the start of construction works.

22.76 All key mitigation measures will be incorporated within the Project's Environmental Management Document and within the Construction Environmental Management Document (see Chapter 4: Project Description; Project Commitments) which will be prepared and submitted for approval by the relevant authorities prior to construction.

22.15 Residual Impacts

22.77 This section reports the predicted residual impacts of the onshore Project on Land Use, Agriculture and Soils taking account of the committed mitigation set out in Section 22.13.

Construction impacts

22.78 Construction of the onshore cable including any cable joint bays is predicted to require a temporary working corridor between the landfall and substation site of up to 1 km in length and up to approximately 20 m wide (approximately 1.6 hectares (ha) in total of mixed grazing and arable land). An area of up to approximately 0.5 ha is also predicted to be temporarily required to install the cable across the rocky shore inter-tidal area and provide an area for a Joint Transition Bay (JTB) on rough grazing land immediately inland from the shore.

22.79 It is anticipated that an area of up to a further 1 ha of arable land would be temporarily needed for ancillary plant such as cable pulling plant and for construction compounds and laydown areas between the landfall and substation. An area of up to 1 ha of arable land would also be temporarily occupied for the substation and its compound construction area, including a short corridor to extend existing access tracks to the substation site. For Option 1 an area of up to 1 ha of rough grazing land would also be temporarily required to establish the HDD compound construction area (c 0.1 ha) and for additional access tracks to the compound (c 0.9 ha).

22.80 It has been assumed that the existing access tracks on site would be used to provide the majority of the temporary and long-term operational access to the Study Area and that only a small area of new land would be required for additional access tracks from the end of the existing track to the HDD compound (see Table 22-9 and Figure 22-2). This is because the recently constructed utility access track from the A836 to the new substation at the Dounreay Nuclear Facility links with the existing farm tracks on site and provides a connection close to the area where a new substation would be constructed (and to the eastern end of the cable corridor). It is assumed that vehicles and plant accessing the cable corridor would also follow these routes then would track over farm land adjacent to the cable for temporary works access (including access to the working area at the landfall and shore). It is also assumed that no permanent tracks would be constructed along the cable route.

22.81 A summary of predicted land take requirements for the proposals during construction and from their permanent development is provided in Table 22-9.

Table 22-146 Land take estimates for the onshore Project[61]

Project Component	Land Take During Construction (ha)	Permanent New Land Take (ha)
Onshore cable route	1.6 ha	<0.05 ha (for access points and inspection boxes to cable joint bays)
Landfall cable joint transition bay and access tracks to landfall areas	0.5 ha	0 (Joint transition bay would be buried and temporary tracks reinstated)
Construction compound(s) and laydown/storage area(s)	1 ha	0 (compounds removed and land reinstated following construction)
New Substation	1 ha	0.35 ha (estimated overall permanent compound area (0.25 ha) and access track extension (0.1 ha))
HDD Compound (and additional temporary access track)	1 ha	0 ha (compound and track reinstated following construction)
Total Area of Temporary and Permanent Land Take	Approx. 5.1 ha	Approx. 0.4 ha

[61] The land take estimates are based on the largest anticipated footprints for each component and the design envelope described in Section 23.7. Although it is anticipated that the area of existing hard standing on site would be used for construction compounds, an additional 1 ha of temporary land occupation for these purposes has been assumed as a worst case

22.82 During construction, the line of the cable corridor would form a constraint to land management and agriculture by reducing accessibility of some areas of the farm unit and the ability to move animal stock, materials/feeds and vehicles between fields (or between fields and the farm steading) which are severed by the working corridor. These effects would be temporary (cable works are estimated to last up to approximately 2 months for a route of this length (see Chapter 4: Project Description; Section 4.2) and with mitigation, in particular the provision of access routes across the cable working corridor, impacts on agriculture and farm unit management would not be predicted to be significant. Construction working areas would be temporarily fenced in fields used for grazing to ensure that livestock were safely excluded from the works.

22.83 Temporary loss of productive agricultural land during construction of the onshore cable, substation, HDD compound and access track corridor is estimated to be up to 5.1 ha (see Table 22-9). It is not predicted that significant construction impacts on farm unit viability at Isauld would occur as the temporary loss of productive land is small in relation to the farm unit's overall size and mitigation would ensure continued access to all areas of the farm unit during construction other than in the immediate vicinity of works locations.

22.84 Construction activities in the cable corridor, particularly from plant movements along a working track parallel with the cable and from materials storage, are predicted to result in some compaction of agricultural soils along the line of the cable and in any areas for construction compounds and laydown. Provided that key mitigation including compliance with the Soil Resource Plan and good construction practices are followed, construction impacts on soils would be reduced and significant adverse impacts are not predicted in the longer-term.

22.85 Drainage and run-off of surface water from agricultural land and within the working cable corridor would be carefully managed (see Section 22.10) to reduce waterlogging of soil and longer-term damage to soil quality. Whilst some reduction in soil quality and long-term fertility are expected in the cable corridor these are not predicted to result in significant land use or agricultural impacts. Any field drains directly affected by the cable construction works would be reinstated as soon as practicable following cable installation and prior to cable trench reinstatement.

22.86 No properties would be directly affected during the onshore Project construction and there would be no changes to access to any properties within the Study Area or further away from it. Farm vehicles, deliveries and visitors to the farm at Isauld House would continue to be made via the main farm access road from the A836.

22.87 The existing access track between the Dounreay substation and the A836 is likely to be closed (for health and safety purposes) to traffic other than construction vehicles during the period of construction works. This could have a short-term significant effect on people making informal use of this track for walking or cycling (for example for journeys being made using a combination of this track with the farm track from Isauld House). These changes would be short-term for the duration of the construction works and would be reduced by minimising the period during which the tracks would need to be closed to walking and cycling by the general public.

22.88 People walking on the rocky foreshore area of the coast on the north east side of Sandside Bay may have their route affected when the cable landfall was being constructed (including the JTB). The temporary impacts of the works would be significant for a short duration as public access would be excluded from the immediate working corridor locations for safety. However it is expected that this would be limited to periods of a few days during critical elements of the work and that relatively small areas of the rocky foreshore would be affected. General access to the coast, and along the shore area, would be maintained throughout the construction phase.

Permanent impacts

22.89 In the longer-term, following reinstatement of the cable route and temporary works areas, there would be no significant permanent change in land use in the Study Area because the cable would be buried and the working corridor, including field drains, reinstated to its current agricultural use. All field boundaries intersected by the cable corridor and temporarily removed during construction would be reinstated and made stock proof.

22.90 Any farm unit severance effects from the recently constructed section of access track between the A836 and the existing farm track would be mitigated through the incorporation of additional field gates on either side of the track if required. It is not predicted that the permanent development and use of the substation access track would have significant impacts on land use or agricultural operations.

22.91 The new substation site would include a new building within a larger enclosed (fenced) compound and an extended section of access track resulting in a permanent change in land use from arable farm land to new utility infrastructure of approximately 0.35 ha. Minor permanent works such as access hatches to cable joint bays would not be predicted to result in a loss of more than 0.05 ha of farm land. The permanent loss of this area of agricultural land, (primarily arable) from a farm unit which currently extends to over approximately 220 ha, is not predicted to have a significant impact on farm unit viability or management.

22.92 Permanent development of a Joint Transition Bay (JTB) for the cable at the landfall point would result in a minor change in land use, potentially affecting an area of transitional land between the rocky shore and rough grazing land adjacent to the coast. This is not predicted to have a significant land use impact as the JTB is small in size and would be buried. There would be no significant long-term land use or recreational access impact in the inter-tidal area following installation of the cable (either by HDD under the foreshore or pinning the cable to former industrial structures).

22.93 The onshore works are not predicted to have any significant impacts on utilities. The new onshore substation would be connected to the nearby existing 132/33/11kV Dounreay Substation by underground cables and no works would be required to the existing overhead electrical lines which cross the eastern part of the Study Area.

22.94 Construction and permanent development of the onshore cable and substation is not predicted to have significant impacts on other recreational or walking/cycling routes in the area of the Project or on the coastline. Visual impacts on walkers are assessed in Chapter 27: Landscape and Visual Amenity.

Operations and maintenance impacts

22.95 The access track to the new substation for the onshore works may provide an opportunity for informal walking and cycling (depending on its agreed location) although this is not predicted to have significant beneficial impacts as it is anticipated that connection to the substation would be made primarily from the existing farm and utility tracks on site.

22.96 Occasional maintenance access would be required by vehicles using the access track to the substation (and potentially the cable corridor or joint transition bay at the landfall if faults occurred) however these are not predicted to have any significant impacts on agricultural activities, on soils and land use, or on any occasional walking and cycling use of the access route.

22.97 Long-term operation of the substation has some potential to result in contamination of underlying soils from equipment leaks. The potential for such leaks would be reduced through the design of the facility including sealed areas and adequate bunding of storage tanks and transformers. With mitigation it is not predicted that impacts on soils from these sources would be significant.

Decommissioning impacts

22.98 The predicted impacts of decommissioning the onshore cable would depend on the method of decommissioning employed. If it was necessary to fully remove the cable and any joint bays then the predicted impacts would be similar to those described previously for cable construction. If the cable and associated infrastructure were left in situ as part of the decommissioning plan then activities involving disturbance to soils and agricultural land would be minor and no significant impacts on land use and agriculture would be predicted.

22.99 Substation decommissioning is predicted to have some short-term significant land use impacts as a result of the change in use of the site from electricity infrastructure to land in agricultural use and from any temporary disruption to tracks and adjacent land management activities. Following any removal of the substation and any required remediation of the compound then the site may be returned to agricultural use in the long-term which would represent a minor beneficial impact on land use and agriculture.

22.16 Cumulative impacts

22.100 Proposals for the SHE-T Orkney-Caithness interconnector project and the HIE Dounreay Demonstration Centre are understood to be at an early stage[62] and with several options for the landfalls and cable routes being considered. This assessment has assumed that cable landfalls and onshore cable works for both projects would include a combination of HDD and open trenching methods, that cable routes could potentially cross the onshore cable route Study Area for the Project and that cables would be connected with existing substations at the Dounreay Nuclear Facility. Both projects are still in development and it is unlikely that they would be consented or constructed in advance of, or in parallel with, the Project's onshore infrastructure.

22.101 Prediction of cumulative impacts is therefore uncertain given the absence of specific spatial and temporal information. As a worst case, any proposal for simultaneous construction of the onshore works for these two projects with the proposed Project onshore construction is predicted to have significant residual cumulative impacts on Land Use, Agriculture and Soils.

22.102 These impacts would be predicted as a result of increased requirement for temporary occupation of agricultural land for construction and access, from increased vehicle and plant movements, from additional cable trenching and substation construction works affecting land management and from restrictions to other users of the area (including pedestrians and cyclists). With mitigation to ensure collaboration between respective developers and

[62] A screening opinion for the DDC (see http://www.gov.scot/Topics/marine/Licensing/marine/scoping/dfowdc/screening-op) was issued in 2015 but as of March 2016 no scoping information has been made publicly available. It is understood from discussions with SHE-T that cable routing options are being considered for the Orkney-Caithness interconnector project and information on previous options work has been accessed at https://www.ssepd.co.uk/OrkneyCaithness/ProjectDocuments/

scheduling of construction works for these projects to avoid simultaneous construction, it is predicted that significant land use impacts would be avoided.

22.103 The Orkney-Caithness Interconnector project and the HIE Dounreay Demonstrator project would have similar operational characteristics to the proposed Project with limited long-term occupation of agricultural land. It is also anticipated that the onshore cabling from these projects would connect with existing substations within or close to the Dounreay Nuclear Facility limiting the requirement for additional permanent land use. No significant cumulative impacts are predicted as a result of the permanent development or operation and maintenance of these projects in-combination in the longer-term provided that all construction works were fully restored and the cumulative developments were operated following good environmental practice and adopting similar mitigation to that set out in this ES for the proposed Project.

22.17 Summary

22.104 The following is a summary of the key findings of the land use assessment.

- The Study Area is bounded to the north by the Caithness coast, to the east by the Dounreay Nuclear Facility and to the west and south by land used for agriculture;
- Agricultural land uses predominate in the Study Area with a mix of grazing land and arable production within a single farm unit operated from a farm at Isauld House which is located approximately 500 metres (m) south west of the Study Area;
- No residential or commercial properties would be significantly affected by construction of the onshore Project, from changes in land use or from their operation;
- Works required for the construction of the onshore cable and its landfall, the substation and (for Option 1) an HDD compound are predicted to temporarily occupy an area of up to approximately 5.1 hectares (ha) during the construction phase;
- Following construction it is estimated that no more than approximately 0.4 ha of agricultural land (grazing or arable) would be permanently required for the onshore works (primarily the new substation and an access track to it) as the cable and landfall works would be buried. No significant permanent impacts on agriculture, soils and land use (including utilities) are predicted from this change in land use or from the longer-term effects of construction activities on agricultural soils;
- No significant effects on agriculture and soils are predicted from construction activities or from temporary occupation of the land needed to construct the cable route and substation provided that mitigation is implemented to ensure continued agricultural operations and to protect soils including a Soil Resource Plan. In the longer-term it is not predicted that the cable works and permanent use of land for the substation would have significant impacts on agricultural operations and land management;
- Significant temporary effects on walkers and cyclists using tracks between Isauld Farm and the A836 for informal recreation are predicted if it is necessary to close these tracks to the public during the busiest phases of the construction period. Some short-term significant effects on recreational users of the coast are also predicted during construction of the landfall cable works although these are expected to be limited to short periods of no more than a few days and passage along the coast would be maintained throughout these works;

- No significant changes in access to the Study Area would be predicted in the longer-term for operations and maintenance of the substation and onshore cable route as use would be made primarily of the existing farm and utilities access tracks between the A836 road and the proposed onshore works. Vehicle movements required for operation and maintenance of the substation (and cable) are not predicted to have significant impacts on other users of the tracks including farm operations or occasional walkers and cyclists;
- The effects of decommissioning on agriculture, soils and land uses are anticipated to be similar to or less than those reported for construction. There may be some short-term significant effects from changes in land use (return of the substation to agricultural use) and from temporary restrictions to non-motorised users of the access track however no long-term significant impacts are predicted; and
- No significant cumulative impacts with other proposed onshore projects in the vicinity of Dounreay are predicted provided that any potential for concurrent construction phases of these projects with the Project was avoided.

22.105 Table 22-10 presents a summary of the predicted residual impacts of the proposals on Land Use, Agriculture and Soils.

Table 22-147 Summary of residual impacts

Potential Impact	Magnitude	Vulnerability	Overall Residual Significance
Construction			
Temporary occupation of agricultural land by construction plant and works affecting agricultural activities	Medium	Medium	Minor
Temporary occupation of areas of landfall and restrictions to access tracks across the Study Area for construction works	Low to Medium	Medium to High	Minor to Moderate (for short periods)
Permanent changes in land use including impacts on agricultural operations from development of the substation, access track and cable	Low	Medium	Minor
Long-term effects on agricultural land and soils following construction and restoration of the cable corridor	Low to Medium	Medium	Minor
Operations and Maintenance			
Changes in access to the Study Area (e.g. for pedestrian and cycle use of access track to substation)	Negligible to Low	Medium	Minor
Vehicular and personnel access to substation, cable route and joint bays for maintenance	Negligible to Low	Medium	Minor
Contamination of agricultural soils from leaks or spills from the	Low	Medium	Minor

Potential Impact	Magnitude	Vulnerability	Overall Residual Significance
substation			
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase	Medium	Medium	Minor to Moderate (for short periods)
Cumulative Impacts			
Cumulative impacts from construction of one or more onshore developments simultaneously with the Project	Medium to High	Medium	Minor (provided concurrent work avoided)

23 Terrestrial Ornithology

23.1 Introduction

23.1 This technical chapter describes the terrestrial ornithology baseline conditions and impact assessment within and around the onshore project area as defined in Chapter 4: Project Description and in Figure 1-2.

23.2 The chapter details the methods used to establish the ornithological interest within and around the current onshore project area, and the process used to determine the importance of bird populations present and the level of potential effects on these populations. It then sets out the likely significant effects (including cumulative effects) on birds during construction, operation and decommissioning, and assesses the significance of potential effects on populations at an appropriate biogeographical scale. Means to mitigate any likely significant effects are proposed, and an assessment of residual effects is then provided. A summary of the key findings of the assessment is presented at the end of the chapter.

23.3 This technical chapter adopts a format in which baseline description, assessment of potential effects (including cumulative effects if appropriate) and assessment of significance are considered separately for each bird species or species group.

23.4 This technical chapter is supported by Technical Appendix 23.1: Terrestrial Ornithology, which includes a Confidential Annex containing information regarding sensitive species not suitable for general distribution.

23.5 An assessment of likely significant effects on non-avian terrestrial ecology within and around the onshore project area is considered in Chapter 24: Terrestrial Ecology, and complements this technical chapter.

Terminology

23.6 The following terms are used within this technical chapter and Appendix 23.1:

23.7 '**The Project**' is the term used to refer to the Dounreay Trì Floating Wind Demonstration Project;

23.8 The '**Project site**' is considered to be the offshore area delineated in Figure 5-1 in blue. The onshore cable corridor area of search is marked in orange on the same Figure and referred to as the ' **onshore cable corridor**'.

23.9 For the purposes of this chapter, the following definitions are used to describe the search areas for the terrestrial ornithology desk study and surveys:

- 'Initial onshore project area': the area of onshore land which was considered for the desk study and initial ornithology surveys (i.e. those carried out during the breeding season), and which covers larger area than the current onshore project area;
- 'Revised onshore project area': a revision to the initial onshore project area (a contraction of the western boundary) resulting in a slightly smaller area; this was the area considered during the non-breeding season and was also the area used in Scoping;
- 'Current onshore project area': all onshore land within the current Project site boundary; this comprises a smaller area than both the initial and revised onshore project areas.
- 'Search area': the initial or current onshore project area and an appropriate buffer around this, within which statutory sites were identified and existing records requested as part of

the desk study (unless specified otherwise). Details of the specific search area for each element of the desk study are provided in section 23.3 (Desk study methods).

- 'Survey area': the initial or revised onshore project area and an appropriate buffer around this, within which terrestrial ornithology surveys were undertaken. Details of the specific survey area for each survey type are provided in section 23.4 (Field study methods).
- 'Survey buffer': that part of a particular terrestrial ornithology survey area that extends beyond the initial or revised onshore project area.

23.10 The three iterations of the onshore project area are shown in Figure 23-1.

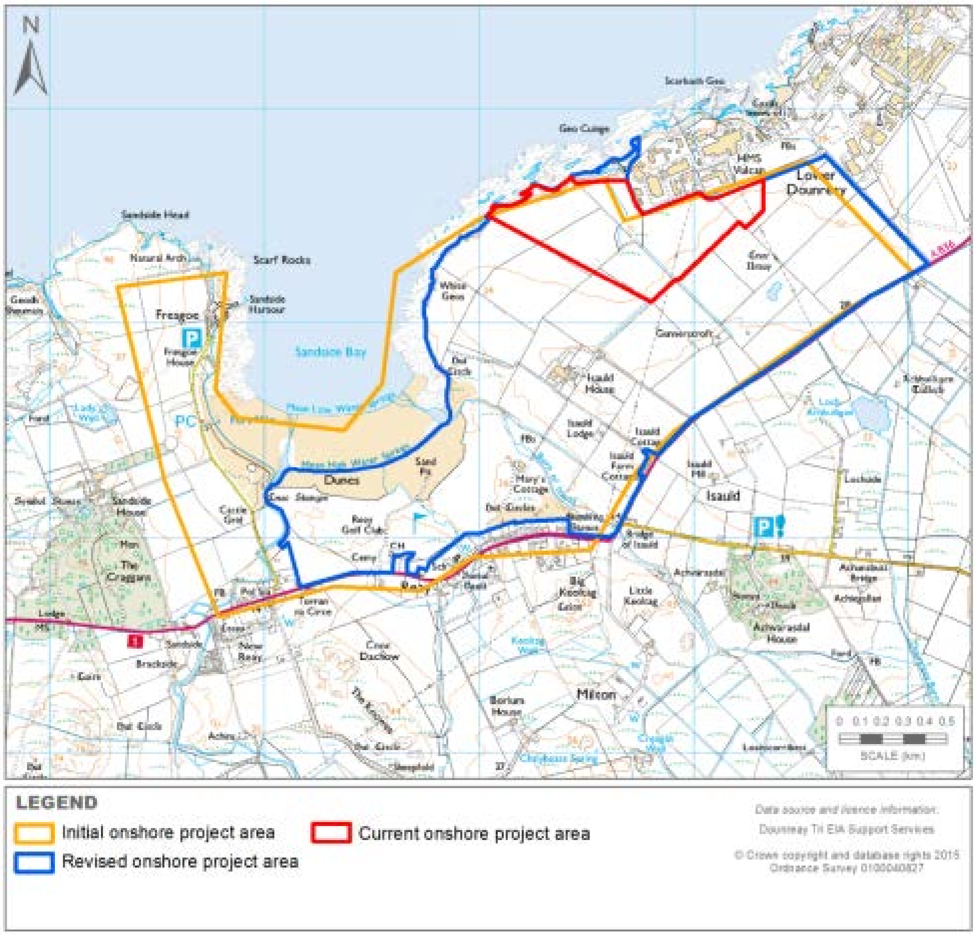

Figure 23-1: Onshore project areas

23.2 Guidance and legislation

23.11 The following relevant guidance and legislation relating to terrestrial ornithology was used in the preparation of this chapter:

- Directive 2009/147/EC on the Conservation of Wild Birds (the codified version of Council Directive 79/409/EEC as amended) (*Birds Directive*);
- Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (*Habitats Directive*);
- The Conservation (Natural Habitats, *&c.*) Regulations 1994 (*Habitats Regulations*);
- The Conservation of Habitats and Species Regulations 2010;

- Wildlife and Countryside Act 1981 (as amended);
- Nature Conservation (Scotland) Act 2004;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- Wildlife and Natural Environment (Scotland) Act 2011;
- Electricity Works (EIA) (Scotland) Regulations 2000;
- Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000;
- Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008;
- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment;
- Scottish Planning Policy 2014;
- National Planning Framework 3: A Plan for Scotland: Ambition, Opportunity, Place (Scottish Government, 2014);
- Government Circular 06/2005: Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System (Office of the Deputy Prime Minister [ODPM]);
- European Protected Species, Development Sites and the Planning System: Interim guidance for local authorities on licensing arrangements (Scottish Executive, 2001);
- Scotland's Biodiversity: It's In Your Hands. A Strategy for the Conservation and Enhancement of Biodiversity in Scotland (Scottish Executive, 2004);
- 2020 Challenge for Scotland's Biodiversity. A strategy for the Conservation and Enhancement of Biodiversity in Scotland (Scottish Government, 2013);
- The Highland Council Supplementary Guidance. Highland's Statutorily Protected Species (2011);
- Highland Biodiversity Action Plan 2015-2020;
- Caithness Biodiversity Action Plan 2003-2013;
- Birds of Conservation Concern 4: the Population Status of Birds in the UK, Channel Islands and Isle of Man (Eaton *et al*., 2015);
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (Chartered Institute of Ecology and Environmental Management [CIEEM], 2016);
- A Handbook on Environmental Impact Assessment (Scottish Natural Heritage [SNH], 2014a);
- Good Practice During Wind Farm Construction (Scottish Renewables *et al*., 2015);
- Survey Methods for Use in Assessing the Impacts of Onshore Wind Farms on Bird Communities (SNH, 2010);
- Recommended Bird Survey Methods to Inform Impact Assessment of Onshore Wind Farms (SNH, 2014b);
- Bird Monitoring Methods (Gilbert *et al*., 1998);

- Raptors: A Field Guide to Survey and Monitoring (Hardey *et al*., 2013);
- Barn Owl Survey Techniques (Barn Owl Trust, 2001);
- Barn Owl Conservation Handbook (Barn Owl Trust, 2012);
- Assessing Significance of Impacts from Onshore Windfarms on Birds Outwith Designated Areas (SNH, 2006);
- Monitoring the Impact of Onshore Wind Farms on Birds (SNH, 2009); and
- Assessing the Cumulative Impact of Onshore Wind Energy Developments (SNH, 2012).

Other sources of information

23.12 As described in section 23.3 (Desk study methods), a detailed desk study was undertaken of the existing literature and data relating to terrestrial ornithology in order to give an overview of the existing breeding and wintering bird communities present within the current onshore project area and surroundings.

23.13 The major data sources identified during the desk study and used in the preparation of this technical chapter are listed in Table 23-1.

Table 23-148: Summary of key information sources used in the preparation of this technical chapter

Source	Content
Birds of Scotland (Forrester *et al*., 2007).	Information about bird populations in Scotland, including population size, distribution and species ecology.
Scottish Raptor Monitoring Scheme Report 2014 (Challis *et al*., 2015).	Information about Scottish raptor populations, particularly relating to breeding populations.
Birds of Caithness *including* The Breeding & Wintering Atlas 2007-2012 (Davey *et al*., 2015).	Information about bird populations in Caithness.
Survey of the feeding areas, roosts and flight activity of qualifying species of the Caithness Lochs Special Protection Area, 2011/12 and 2012/13 (Patterson *et al*., 2013).	Distribution and movements of whooper swan (*Cygnus cygnus*), pink-footed goose (*Anser brachyrhynchus*) and Greenland white-fronted goose (*Anser albifrons flavirostris*)[1] from the Caithness Lochs Special Protection Area (SPA).
Study of 19 small wintering sites in Scotland used by Greenland white-fronted geese during the winters of 2009-10 and 2010-11 (Francis *et al*., 2011).	Information about distribution, status and population trends of Greenland white-fronted geese at 19 small wintering sites in Scotland.
Seabird Populations of Britain and Ireland: results of the Seabird 2000 census (1998-2002) (Mitchell *et al*., 2004).	Regional population sizes and distributions of UK breeding seabird populations, with results of all three national censuses provided in summary format.
Note: [1]Note that pink-footed goose is not a qualifying species of the SPA, but was included in the report because it was found in large numbers in the same areas as qualifying species.	

23.14 Additional data sources accessed for the preparation of this technical chapter are described in section 23.3 (Desk study methods).

Consultation

23.15 Consultation was undertaken with SNH, who agreed that all the major onshore natural heritage sensitivities had been identified and appropriate survey methods selected.

23.16 In addition, a formal Scoping Report was issued to statutory consultees, including SNH, in December 2015.

23.17 At the time of writing, Scoping Opinions with relevance to terrestrial ornithology had been received from SNH, the Scottish Government Planning and Architecture Division, SEPA and the Royal Society for the Protection of Birds (RSPB). These comments are summarised in Table 23-2.

23.18 In addition, it is assumed that comments and recommendations concerning the similar Hywind Floating Wind Farm development will be applicable to this Project and as such these comments have also been included to guide the development of this technical chapter. It is further assumed that comments received for other marine development, including the neighbouring Farr Point development and the large offshore wind farm developments in the Moray Firth and Firth of Forth, will also be applicable.

23.19 Summaries of comments that may be relevant to terrestrial ornithology are included in Table 23-2.

23.20 Should further comments pertaining to this development be received prior to Gate Check, they will be included in the table below and acted upon where possible.

Table 23-149: Summary of comments with relevance to the assessment of terrestrial ornithology

Consultee	Project	Comment relative to terrestrial ornithology	Relevance/Cross Reference
SNH	Dounreay Trì Floating Wind Demonstration Project	Stated that, as the scoping report describes a number of options for the onshore infrastructure and construction methods, advice provided was generic and covered a broad range of potential impacts. Recommended ongoing dialogue between the applicant and SNH, Marine Scotland and the Highland Council, to include discussions of landfall locations and onshore infrastructure and routes, to assist in identifying environmental sensitivities/mitigation and to provide more focused advice in relation to the finalised project details. With relation to onshore works, advised that these may have implications with regard to Natura sites and Sites of Special Scientific Interest (SSSIs), and provided initial comments relating to specific statutory sites (although noted that this was not a complete list of sites that should be considered). **North Caithness Cliffs SPA**: noted that the revised onshore project area lies adjacent to this SPA, which is designated for breeding populations of seabirds and peregrine (*Falco peregrinus*). Stated that the proposal has the potential to disturb birds at cliff nesting sites and when using the marine	Further details of the onshore infrastructure options and construction methods are provided in Chapter 4: Project Description, with specific assumptions relevant to the assessment of terrestrial ornithology presented in Section 23.5 of this technical chapter. Full details of engagement with stakeholders are provided in Chapter 3: Site Selection and Engagement to Date. Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in Section

Consultee	Project	Comment relative to terrestrial ornithology	Relevance/Cross Reference
		area of the SPA. Further stated that, based on the Figure provided in the Scoping Report[63], it did not appear that cliff nesting habitat would be directly affected by the proposal. However, should the proposal change significantly, this may need to be considered. **Red Point Coast SSSI**: noted that this SSSI forms the land-based component of the North Caithness Cliffs SPA, and designated features include its breeding guillemot (*Uria aalge*) population. Advised that breeding guillemots could be at risk of disturbance if they nest near the onshore search area during the construction year(s), and should therefore be scoped into the Ecological Impact Assessment (EcIA). **Caithness Lochs SPA**: noted that the revised onshore project area includes potentially suitable feeding habitat for whooper swan, Greenland white-fronted goose and (Icelandic) greylag goose (*Anser anser*), which are designated features of this SPA. Further noted that the revised onshore project area lies within the foraging range of SPA populations of both goose species. Advised that the proposal therefore has the potential to affect the SPA through disturbance to feeding birds and loss of suitable feeding habitat, and potential impacts to the qualifying features of this SPA should be considered in a Habitats Regulations Appraisal (HRA) Screening Report. Also provided references to two reports that include information relating to known feeding records of Caithness Lochs SPA species (Patterson *et al*., 2013) and Greenland white-fronted geese (Francis *et al*., 2011). Stated that, although they had not seen the results of the feeding distribution surveys, these reports suggest the revised onshore project area does not lie close to feeding records or known favoured feeding fields for Greenland white-fronted geese. Stated that, based on the information provided in the Scoping Report, foraging goose surveys appeared to broadly follow SNH guidance. Acknowledged that, although the number of survey hours was less than the recommended number stated in SNH guidance, the survey data would be supplemented with records from other relevant sources, which appeared to be a reasonable approach, although without seeing the data SNH were not able to comment on its	23.10, with potential effects on the sites themselves considered in Section 23.10. Species included in the EcIA (section 23.10) include nesting peregrine and guillemot, and foraging whooper swan and greylag goose. Potential effects on golden plover were also considered, although none were recorded during the breeding season (section 23.7). However, potential effects on Greenland white-fronted goose were scoped out because there were no records of this species during any terrestrial ornithology surveys (section 23.7), and information obtained via the desk study (section 23.6) indicated that birds were not known to forage within the initial onshore project area. The two reports cited by SNH (listed in Table 23-1) were consulted as part of the desk study (section 23.3), and relevant records of species that are designated features of SPAs were also sought from other sources as part of the desk study.

[63] Refers to Figure 9-1 of the Scoping Report, which illustrated the revised onshore project area

Consultee	Project	Comment relative to terrestrial ornithology	Relevance/Cross Reference
		suitability. Advised that the information should adequately cover the full study area and be based on up-to-date information, as outlined in SNH guidance (SNH, 2014). **Caithness and Sutherland Peatlands SPA**: noted that the revised onshore project area lies within the foraging range for some birds associated with this SPA, which is designated for its upland breeding birds, and that the Scoping Report stated that raptor species associated with the SPA are considered relevant to the Project. Further noted that the proposal also lies within the foraging range for golden plover (*Pluvialis apricaria*) from the SPA. Advised that potential impacts to these species should be assessed as part of the HRA.	
Scottish Government Planning and Architecture Division		Stated that there is the potential for environmental impacts to terrestrial receptors and that loss of, or damage to, coastal and terrestrial species associated with onshore works and installation of cabling at landfall sites should be given appropriate consideration within the ES. Recommended that the ES should look at the proximity of the proposed onshore site works to sites with national and international environmental designations, and the potential for impacts to protected species that will not be considered within the required and supporting HRA process. Further stated that the ES should set out appropriate mitigation of any identified impacts.	Potential effects on terrestrial ornithology are considered in section 23.10. Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in section 23.10, with potential effects on the sites themselves considered in section 24.11. Proposed mitigation measures are described in section 23.12.
RSPB		Recommended that sufficient detail is provided to fully inform any assumptions made in the terrestrial ornithology assessment. Further stated that, in particular, there is a requirement to fully compensate for the proposed constrained or limited survey data collection by setting out a clear and logical assessment process that fully justifies the potential risks and scale of impacts predicted on the various species and habitats, including those qualifying features of nearby SPAs, and habitats.	Full details of the assessment method, including any assumptions, are provided in section 23.5. Although the data was not collected over a full year, the terrestrial ornithology survey programme is considered to be sufficiently comprehensive to allow a robust assessment of potential effects on terrestrial ecology,

Consultee	Project	Comment relative to terrestrial ornithology	Relevance/Cross Reference
			particularly given the relatively small scale of the onshore element of the Project. Full details of the desk study and field survey methods are presented in sections 23.3 and 23.4 respectively.
Scottish Environment Protection Agency (SEPA)[1]	General Advice	Recommended that advice on designated sites and European Protected Species (EPS) should be sought from SNH. Stated that Marine and transitional Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) are identified as protected areas under the Water Framework Directive, and that their objectives are also river basin management plan (RBMP) objectives. Further advised that if any part of a proposal is likely to result in elevated noise levels, e.g. piling and blasting, SNH should be consulted with regard to potential impacts upon sea mammals, migratory fish and birds.	Information regarding designated sites and EPS was obtained from SNH and other sources as part of the desk study (as detailed in section 23.3). A formal Scoping Opinion from SNH has also been requested as part of the consultation process (section 23.2).

Consultee	Project	Comment relative to terrestrial ornithology	Relevance/Cross Reference
Scottish Ministers[2, 3, 4, 5]		With regards to species, the ES should show that the applicants have taken account of the relevant wildlife legislation and guidance, including: • Natural Habitats and of Wild Flora and Fauna, and on Conservation of Wild Birds (commonly known as the Habitats and Wild Birds Directives); • Wildlife & Countryside Act 1981; • Nature Conservation (Scotland) Act 2004; • Wildlife and Natural Environment (Scotland) Act 2011; • Conservation of Habitats and Species Regulations 2010; • Scottish Government Interim Guidance on European Protected Species; and • Development Sites and the Planning System and the Scottish Biodiversity Strategy and associated Implementation Plans. In terms of the Scottish Government Interim Guidance, applicants must give serious consideration to/recognition of meeting the three fundamental licensing tests set out in this Guidance. It needs to be categorically established which species are present on and near the site, and where, before the application is considered for consent. The presence of protected species such as Schedule 1 birds or EPS must be included and considered as part of the application process, not as an issue which can be considered at a later stage.	Relevant legislation and guidance (listed in section 23.1) has been consulted in the preparation of this technical chapter. The baseline terrestrial ecology within the current onshore project area and surroundings has been described (section 23.7), with particular attention paid to the presence of any protected species.
Joint Nature Conservation Committee (JNCC)/SNH[2]	Hywind	Provided the following comments with regard to landfall and onshore elements of the development: Noted that the scoping report identified the potential for impacts to habitats and protected species along the onshore cable route and at the onshore switching yard, and advised that there should also be consideration of impacts to habitats and protected species at the landfall site and how to mitigate any impacts. UK and Local Biodiversity Action Plan (LBAP) habitats and species should be assessed according to advice from the Local Authority. Further noted that the ES should provide details of appropriate mitigation and state whether or not licences are likely to be required.	Potential effects on terrestrial ecological features have been assessed, with species conservation status considered as part of the assessment process (assessment methods are described in section 23.5). Requirements for mitigation have been identified, and appropriate measures outlined (section 23.12).

Consultee	Project	Comment relative to terrestrial ornithology	Relevance/Cross Reference
SNH[3]	Farr Point Wave Farm	With regards to onshore infrastructure, noted that the onshore works may have implications with regard to HRA and highlighted the requirement to consider any Natura 2000 sites and SSSIs in the vicinity of the onshore works. With regards to terrestrial ornithology, the location of all elements of onshore infrastructure will need to be considered in respect of potential impacts to bird species, including species which are a qualifying interest of SPAs.	Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in section 23.10, with potential effects on the sites themselves considered in section 23.11.
RSPB[3]		Noted that onsite construction work was scheduled from May-September to avoid the uncertain winter weather, and advised that consideration should be given to the potential impact of working in May-July, a particularly sensitive time for seabirds, which will be foraging to feed chicks.	Potential effects of construction works on breeding birds have been assessed, with specific mitigation measures outlined in section 23.12.
SNH/JNCC[4]	Moray Offshore Renewables Ltd: Eastern Development Area	Noted that any HRA for Natura 2000 sites should address all elements of the development, including onshore works.	Potential effects on qualifying features of all Natura 2000 sites have been considered in section 23.10, with potential effects on the sites themselves considered in section 23.11.
JNCC[5]	Seagreen Round 3 Offshore Wind Farm	Noted that any HRA for Natura 2000 sites should address all elements of the development, including onshore works.	Potential effects on qualifying features of all Natura 2000 sites have been considered in section 23.10, with potential effects on the sites themselves considered in section 23.11.
RSPB[5]		Noted that any onshore wind farms in the vicinity, either consented or proposed, should be included in a cumulative impact assessment.	Potential cumulative effects on terrestrial ornithology interests have been assessed in section 23.10.

[1] SEPA Scoping Opinion provided to Marine Scotland Licensing Operations Team (MS-LOT): https://www.sepa.org.uk/media/143312/lups-gu13-sepa-standing-advice-for-marine-scotland-on-small-scale-marine-licence-consultations.pdf

[2] Scoping Opinion for the Hywind Floating Wind Farm development: http://www.gov.scot/Resource/0044/00446946.pdf

[3] Scoping Opinion for the Farr Point Wave Farm development: http://www.gov.scot/Resource/0046/00465046.pdf

[4] Scoping Opinion for the Moray Offshore Renewables Ltd: Eastern Development Area development:

Consultee	Project	Comment relative to terrestrial ornithology	Relevance/Cross Reference
http://www.gov.scot/Resource/Doc/295194/0114563.pdf [5]Scoping Opinion for the Seagreen Round 3 Offshore Wind Farm development: http://www.gov.scot/Resource/0046/00460525.pdf			

23.3 Desk study methods

23.21 A desk study was undertaken to collate relevant data and literature relating to terrestrial ornithology within the current onshore project area and surrounding area, in order to provide information on sensitive bird species, and statutory sites designated for their ornithological interest. Key sources of information identified during the desk study are listed in section 23.1 (Table 23-1).

23.22 The information obtained via the desk study, combined with baseline survey results, was utilised to put bird populations recorded at the current onshore project area into context in terms of their ecological importance.

Existing records

23.23 As part of the desk study, requests for existing terrestrial ornithological data recorded within and around the current onshore project area were made to several organisations on 19/04/2015. Details are provided in Table 23-3.

23.24 Note that the search area for the data requests was generally based on the initial onshore project area (with an appropriate buffer), and therefore covered a slightly larger area than required for robust consideration of effects within the current onshore project area.

Table 23-150: Summary of requests for existing terrestrial ornithological data recorded within and around the current onshore project area

Organisation	Information requested
SNH	• Information about statutory sites of ecological importance, and records of notable habitats and species.
RSPB	• Records of eagles (including nest locations if known) within 6 km of the initial project area; and • Records of all other bird species of conservation concern[1] (including nest locations if known) within 2 km of the initial project area.
Highland Raptor Study Group (HRSG)	• Records of breeding eagles within 6 km of the initial project area; and • Records of other protected raptor and owl species within 2 km of the initial project area.
British Trust for Ornithology (BTO)	• Wetland Bird Survey (WeBS) Core Count data for winter 2009-10 to winter 2013-14 (inclusive) from Sandside Bay; and • Records from the Bird Atlas 2007–11 surveys (Balmer *et al*., 2013) for the hectad (10 km grid square) NC96, within which the initial onshore project area is situated.
Wildfowl and Wetlands Trust (WWT)	• Records of foraging geese and whooper swans associated with Caithness Lochs SPA
Greenland White-fronted	• Records of foraging Greenland white-fronted goose associated with

Organisation	Information requested
Goose Study (GWFGS)	Caithness Lochs SPA
[1]Defined as birds included on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), Annex I of the Birds Directive, species included in the UK Birds of Conservation Concern (BoCC) Red list (Eaton *et al*., 2015) and LBAP priority species.	

Statutory sites

23.25 A search was also made for the following statutory sites designated for ornithological interests:

- Sites of international importance (SPAs and RAMSAR sites) within 20 km of the current onshore project area; and
- Sites of national importance (SSSIs and National Nature Reserves [NNRs]) within 5 km of the current onshore project area.

23.26 The following sources were accessed to obtain information on designated sites:

- The JNCC website (http://www.jncc.gov.uk; last accessed 20/01/2016); and
- The SNH Sitelink website (http://gateway.snh.gov.uk/sitelink/index.jsp; last accessed 20/01/2016).

23.4 Field survey methods

23.27 A summary of the terrestrial ornithology survey methods is provided in Table 23-4; further details of methods, including survey timings, are provided in Technical Appendix 23.1.

23.28 Note that the survey areas were based on the initial or revised onshore project areas (with an appropriate buffer), and therefore covered a slightly larger area than required for robust consideration of effects within the current onshore project area.

23.29 The terrestrial ornithology survey areas are shown on Figure 23-2.

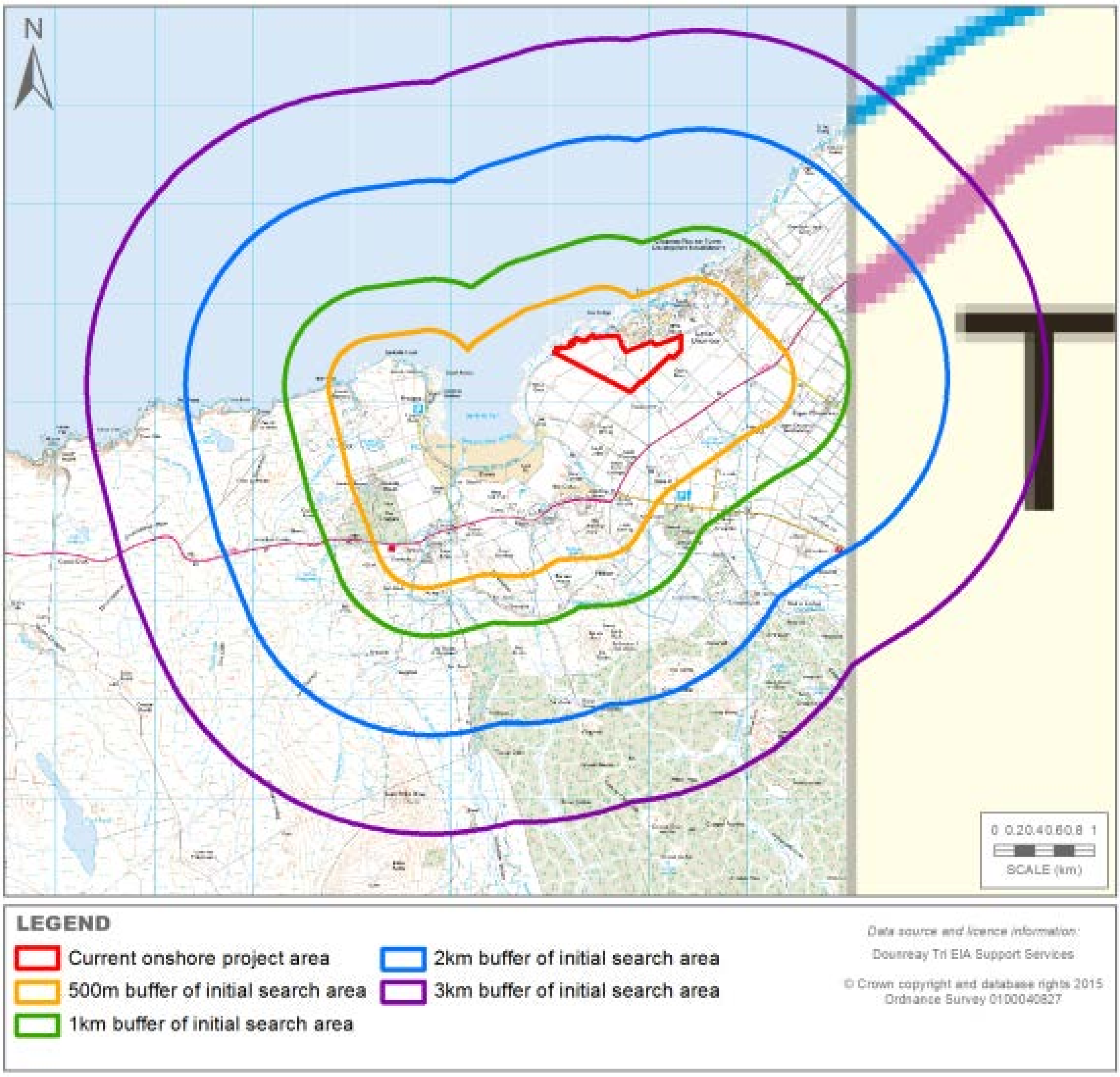

Figure 23-2: Terrestrial ornithology survey areas; buffers relate to the following surveys: 500 m = breeding bird, WeBS and winter walkover; 1 km = barn owl survey; 2 km = breeding raptor and seabird survey; 3 km = foraging geese survey

Table 23-151: Summary of methods used for terrestrial ornithology surveys undertaken in 2015

Survey	Method/ guidance followed	Survey area*	Survey period (inclusive)	No. of survey visits	Summary of method	Modifications to standard method
Breeding bird survey	Modified version of the Brown & Shepherd (1993) method for upland breeding waders	Initial onshore project area and 500 m buffer	Apr-Jul	Four visits	Walkover of areas of open ground, spending 20-25 minutes within each 500 m x 500 m quadrat, and approaching all areas to within 100 m. Location and behaviour of all birds seen and heard recorded on 1:10,000 scale maps using standard BTO notation.	Adapted to allow for recording of passerine species. Numbers of meadow pipits (*Anthus pratensis*) were tallied per 500 m x 500 m quadrat).
Breeding raptor and seabird survey	Methods detailed in Hardey *et al.* (2013) for raptors, and Gilbert *et al.* (1998), for seabirds	Initial onshore project area and 2 km buffer	Apr-Aug	Five visits (one per month)	Walkovers and short watches from suitable vantage points (VPs) in all areas of suitable breeding habitat. All observations and signs (e.g. pellets) of raptor species were recorded. For seabirds, the number of nests or individual birds (of species breeding in dense colonies) was recorded for each distinct colony observed.	
Barn owl (*Tyto alba*) survey	Hardey *et al.* (2013) and the Barn Owl Trust (2001; 2012)	Initial onshore project area and 1 km buffer	Undertaken during breeding raptor survey	One visit	Search of suitable nesting sites for direct observations of birds/nests, and signs of presence (e.g. pellets, feathers, egg fragments, staining, ammonia smell).	
Winter walkover survey	SNH (2010)	Revised onshore project area and 500 m buffer	Sep-Nov	Three visits	As per the breeding bird survey (described above), but with all areas approached to within 200 m.	
WeBS	WeBS Core Count method (Gilbert *et*	Revised onshore	Sep-Dec	Four visits	All waders and wildfowl species using the shore within the survey area were observed via	Standard method requires monthly visits from Sep to

Survey	Method/ guidance followed	Survey area*	Survey period (inclusive)	No. of survey visits	Summary of method	Modifications to standard method
	al., 1998)	project area and 500 m buffer			binoculars/telescopes from suitable VP locations and counted within a seven hour period commencing 3.5 hours before low tide and finishing 3.5 hours after low tide.	Mar inclusive; however, surveys only ran to Dec due to the project timeframe
Foraging geese survey	Method in line SNH guidance (SNH, 2014)	Revised onshore project area and 3 km buffer	Apr-May (spring) and Sep-Dec (autumn/winter)	11 visits (three spring; eight autumn/ winter)	Short watches from suitable VP locations offering good visibility of suitable foraging habitat, using binoculars/telescopes to aid detection and identification. All signs and observations of target species were recorded on large scale maps, using standard BTO notation.	Standard survey buffer is 500 m; a much wider area was surveyed in order to provide a robust dataset to allow an assessment of potential effects on geese and swans associated with Caithness Lochs SPA. Standard survey method requires fortnightly visits between Sep and mid-May inclusive; however, due to the project timeframe, the number of visits was limited, and visits could not be completed consecutively (i.e. surveys commenced in spring rather than autumn).

*Note that no access was permitted to the Dounreay Nuclear Power Development Establishment or HMS Vulcan military base, which are located within the buffer zone of all terrestrial ornithology surveys (see Survey limitations section below for further details)

Survey limitations

23.30 As access to the Dounreay Nuclear Power Development Establishment and HMS Vulcan military base was not permitted, a relatively small area within the 500 m buffer zone for the terrestrial ornithology surveys had to be surveyed at a distance using magnification (binoculars and telescopes). However, due to the limited size of this inaccessible area, as well as the small scale and temporary duration of the onshore works, this limitation is considered to be minor and unlikely to have any significant effect on the robustness of the baseline data or the terrestrial ornithology impact assessment.

23.31 Where possible, numbers of breeding seabird nests or breeding pairs were recorded. However, species such as guillemot, kittiwake (*Rissa tridactyla*) and razorbill (*Alca torda*) nest in dense colonies and it is often not possible to distinguish individual nests or breeding pairs. Where this was the case, the total number of birds was recorded. This is considered a suitable proxy, and is the recommended unit for standard monitoring methods of such colonial species (Gilbert *et al*., 1998). This approach is therefore not considered to represent a significant limitation.

23.32 The number of breeding seabirds recorded is likely to be an underestimate due to the inaccessibility of the cliffs they breed on. It was not always possible to access suitable vantage points safely in order to view all areas of cliffs. However, the majority of cliffs were visible, and this is not considered to represent a significant limitation, particularly considering the relatively small scale and temporary duration of the onshore works, which will also avoid the cliffs.

23.33 Access to search the interior of all structures within the 1 km survey buffer zone for barn owls was not possible. However, all structures within the onshore project area were assessed, and as the recommended disturbance buffer for nesting barn owls is only 100 m (Ruddock & Whitefield, 2007; Whitfield *et al*., 2008), this limitation is unlikely to present a significant data gap, provided appropriate mitigation is implemented.

23.34 Although the standard WeBS method requires monthly survey visits between September and March inclusive, due to the Project timeframe, it was only possible to undertake visits from September to December 2015. However, given the small scale and temporary duration of the onshore works, the shorter survey period should provide sufficient data to allow a robust assessment, and is unlikely to represent a significant data gap. Furthermore, WeBS data provided by BTO include counts for January and February from previous years, which provides an indication of use of Sandside Bay by waders during these months.

23.35 The standard survey method for foraging goose surveys requires fortnightly survey visits between September and mid-May. Due to the project timeframe it was only be possible to complete three visits between mid-April and mid-May 2015, and fortnightly visits between September and December 2015. However, given the small scale and temporary duration of the onshore works, the shorter survey period, combined with an assessment of habitat suitability and historic data, should provide adequate data to allow a robust assessment, and is unlikely to represent a significant data gap.

23.5 Assessment Method

23.36 The overarching approach to assessment is described in 5: Environmental Impact Assessment Methodology. To support this, the following is a description of the specific criteria which are used to evaluate the effects on terrestrial ornithology.

23.37 The approach adopted for the assessment of impacts on terrestrial ornithology involves the following stages:

- Determination of the importance of ecological features, through desk study and surveys;
- Identification and characterisation of potential effects to determine the overall level of effect;
- Assessment of likely significant impacts;
- Identification of requirement for measures to avoid and mitigate (reduce) these impacts; and
- Assessment of the significance of any residual impacts after mitigation.

23.38 This is in line with recently published guidance for EcIA produced by CIEEM (CIEEM, 2016).

Determining importance

23.39 According to the CIEEM guidance (CIEEM, 2016), determining which ecological features are important and should be subject to detailed assessment is one of the key challenges in the EcIA process. Ecological features can be important for a variety of reasons, and may relate, for example, to the quality or extent of designated sites or habitats, to habitat/species rarity, to the extent to which they are threatened throughout their range, or to their rate of decline. The rationale used to determine importance should be explained to demonstrate a robust selection process.

23.40 The level of importance of all bird species recorded during the terrestrial ornithology surveys has been determined using the criteria defined in Table 23-5.

23.41 In line with the CIEEM guidance, these criteria have been determined with regard to statutory requirements and policy objectives for biodiversity. A brief overview of legislation and conservation strategies relevant to determining levels of importance is provided below.

- **The Wildlife and Countryside Act 1981 (as amended)**: This Act is the primary legislation protecting animals, plants, and certain habitats in the UK, including all wild birds and their nests, eggs and chicks. Additional protection of birds at or around their nests is afforded to rare breeding species in the UK, and/or species under threat of human persecution. These species are listed on Schedule 1 of the Act.
- **The Birds Directive**: Annex I of Directive 2009/147/EC on the conservation of wild birds (the Birds Directive) lists bird species that are of conservation importance at a European level.
- **Scottish Biodiversity List (SBL)**: is a list of species and habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland. The SBL was developed to meet the requirements of Section 2 (4) of the Nature Conservation (Scotland) 2004 Act for the conservation of biodiversity, and (along with biodiversity lists from other UK countries) supersedes the UK Biodiversity Action Plan (BAP).
- **Local Biodiversity Action Plans (LBAPs)**: LBAP Partnerships were established in response to legislation at international and national levels, and operate at a local authority level to conserve and enhance biodiversity and engage local community input. LBAPs usually identify priority habitats and species for which conservation/enhancement measures are underway or planned. LBAPs relevant to this technical chapter are the Caithness LBAP and the Highland LBAP.

- **UK Birds of Conservation Concern (BoCC)**: a periodic national review assessing the population and trends for UK breeding bird species. It uses a traffic light system to indicate an increasing level of conservation concern. Species that have a declining range and/or population, or that are vulnerable to population effects due to their small population size are categorised as Red- or Amber-listed, depending on the extent of the decline or vulnerability, while those which are either stable, increasing, or experiencing only small declines, are Green-listed. The most recent review (BoCC 4) was published in December 2015 (Eaton *et al*., 2015).

23.42 In addition, where possible, use is made of contextual information about species distribution and abundance, including trends based on historical records.

23.43 As available quantitative data on a particular species may be limited, particularly below the international and national level, the evaluation of importance may also involve an element of professional judgement.

23.44 Evaluations are based upon a combination of information gathered via the desk study and field study results, along with professional experience, including knowledge of the current onshore project area and surroundings.

23.45 In addition to the importance of a bird species per se, the assessment of terrestrial ornithology presented in this technical chapter also considers the value of the current onshore project area and surroundings for each species, in terms of the number of individuals using it and the nature and level of use. For example, if one or more pairs of birds included on Schedule 1 of the Wildlife & Countryside Act 1981 (as amended) was found to be breeding within a proposed development site, the species would likely be assigned a medium or higher importance level (depending on population status and trends). However, if a single Schedule 1 bird flew across a proposed development site on one or two occasions only, and little or no suitable breeding habitat was present, it would likely be assessed as being of low importance.

Table 23-152: Criteria for evaluation of importance level of bird species recorded during the terrestrial ornithology surveys

Importance level	Criteria	Examples
Very High	Birds that are part of an internationally important population.	• A species listed as a qualifying feature of a site of international importance designated for its avian interest, i.e. SPAs and RAMSAR sites. • A species present in internationally important numbers.
High	Birds that are part of a nationally important population.	• A species listed as a qualifying feature of a site of national importance designated for its avian interest, i.e. SSSIs and NNRs. • A nationally important population/assemblage of a Schedule 1 or Annex I species. • A species present in nationally important numbers.
Medium	Birds that are part of a regionally important population.	• A regionally important (e.g. within a Natural Heritage Zone [NHZ]) population/ assemblage of a Schedule 1 or Annex I species. • A regionally important population of a species included on

Importance level	Criteria	Examples
		the Scottish Biodiversity List (SBL). • A regionally important population/assemblage of a species included on the UK BoCC Red or Amber list.
Low	Birds that are part of a locally important population.	• A species listed as an important feature of a Site of Importance for Nature Conservation (SINC) or equivalent site selected on local authority criteria. • A species listed as an important feature of a Local Nature Reserve (LNR). • A locally important population of a species included on the SBL. • A locally important population/assemblage of a species included on the UK BoCC Red or Amber list. • All populations/assemblages of Schedule 1 species that have not been captured in higher categories above. • Assemblages of other species that are of importance in the context of the local authority area (e.g. LBAP priority species). • Other species that are, in the opinion of the assessor, of note and for which mitigation measures could be recommended as a good practice measure.
Negligible	Common and widespread species that are of little or no intrinsic nature conservation value.	• All other species that are widespread and common and which are not present in locally, regionally, nationally or internationally important numbers.

Identification and characterisation of potential effects

23.46 In line with CIEEM guidance (CIEEM, 2016), reference is made to the following characteristics when describing ecological effects:

- **Nature of effect**: whether it is positive (beneficial), to birds e.g. by increasing species diversity or extending habitat, or negative (detrimental) to birds e.g. by destruction of, or displacement from, suitable habitat;
- **Extent**: the spatial or geographical area over which the effect may occur;
- **Magnitude**: refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of suitable habitat lost or percentage decline in a species population.
- **Duration**: this should be defined in relation to ecological characteristics (such as a species' lifecycle) as well as human timeframes. It should also be noted that the duration of an activity may differ from the duration of the resulting effect, e.g. if short-term construction activities cause disturbance to birds during their breeding period, there may be long-term implications from failure to reproduce that season.
- **Reversibility**: an irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it.

A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.

- **Frequency**: the number of times an activity occurs may influence the resulting effect.
- **Timing**: this may result in an effect on an ecological feature if it coincides with critical life-stages or seasons e.g. the bird nesting season.

Terrestrial ornithology design envelope

23.47 The project description is set out in Chapter 4: Project Description. Specific assumptions relevant to the assessment of terrestrial ornithology presented in this technical chapter are:

- Onshore cable corridor route, footprint and duration;
- Landfall method, footprint and duration;
- Substation/switchgear location and duration; and
- Requirement for upgrading and extension of existing access tracks.

23.48 Installation of the onshore cable corridor will require a trench 20 m in width and up to 800 m in length; the precise route of the onshore cable corridor has yet to be confirmed. However, to assist the assessment of terrestrial ornithology interests, two potential onshore cable corridor routes have been defined to allow a consideration of likely effects on birds resulting from different routes. Note that these routes are indicative only, and the final onshore cable corridor route selected may be located elsewhere within the current onshore project area. The two indicative export cable route corridors are shown in Figure 23-3. Onshore trenching is expected to take 1-2 months, subject to weather conditions.

23.49 There are two options for the landfall method: HDD or pinning.

- Indicative onshore cable corridor route 1 would require an HDD compound of up to 1000 m^2 (0.1 ha), set back approximately 150 m from the edge of the cliffs. The potential location of this compound is included in Figure 23-3, but is indicative only and an HDD compound, if required, may be located elsewhere within the current onshore project area.
- Indicative onshore cable corridor route 2 would require pinning of the cable to the existing cooling water intake channel for the Dounreay Nuclear power station.

23.50 Both landfall options are expected to take 1-2 months to construct, subject to weather conditions.

23.51 The substation or switchgear footprint is likely to be an area of approximately 50 m x 50 m (0.25 hectares). The location of the substation or switchgear has yet to be determined, but the area within which it is likely to be located is shown in Figure 23-3, along with two possible substation/switchgear locations within this area. Note that these locations are indicative only and have been defined to assist in determining potential effects on terrestrial ornithology interests; the substation /switchgear may be located elsewhere within the area shown in Figure 23-3. The construction period for the switchgear or substation is expected to be 12 - 18 months.

23.52 The Project will make use of an existing access track from the A836, which may require upgrading, and would also utilise an existing area of hardstanding for storage, welfare facilities and laydown.

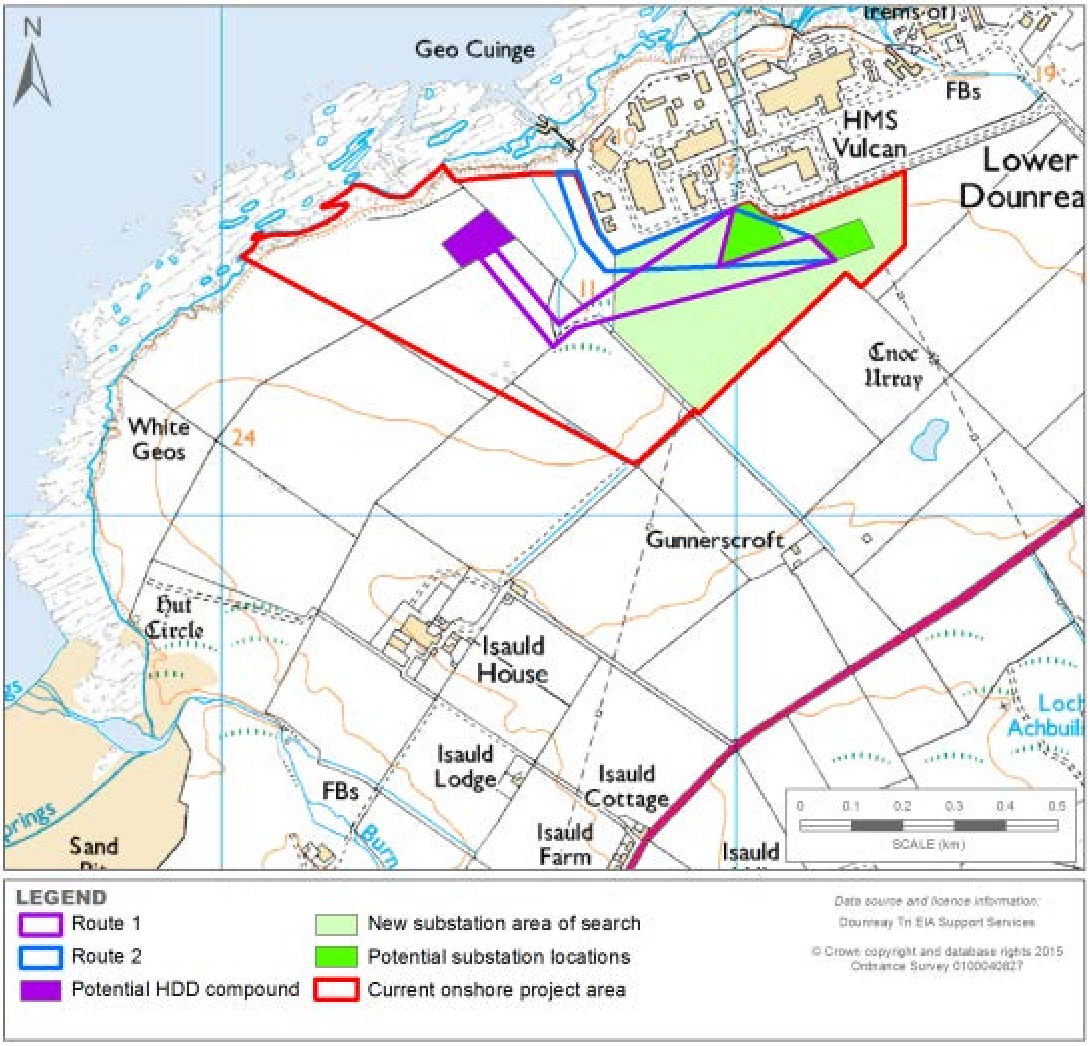

Figure 23-3: Indicative locations of onshore infrastructure and cable corridor routes

23.53 To ensure that the assessment adequately covers all potential variations in the design, as far as possible, the 'worst case scenario' is assessed, which ensures that all other variations within that maximum parameter are assessed by proxy.

23.54 In the case of terrestrial ornithology, it is considered that indicative onshore cable corridor route 1 and the HDD landfall option have the potential to cause greater disturbance to breeding birds than indicative onshore cable corridor route 2 combined with the pinning landfall option. This is due to the higher level of potential disturbance associated with HDD, and the closer proximity of the onshore cable corridor route 1 to breeding waders and seabirds. It is considered that the two potential substation/switchgear locations would have similar potential effects on terrestrial ornithology.

Geographic context

23.55 Impacts on terrestrial ornithology are assessed in a local and, if necessary, a regional context as appropriate. For the purposes of the assessment, a local population refers to the population within Caithness. If a potentially significant impact on a local population is identified, then the assessment is extended to consider potential impacts on the wider, regional population. However, if no significant effect on the local population is identified, consideration of the wider geographical area is not considered necessary (because considering a wider population will likely result in potential effects that are of the same or lower level).

23.56 SNH has defined NHZs within Scotland (SNH, 2002), which they consider to be appropriate biogeographical spatial units against which regional impacts of proposed developments on birds can be assessed (SNH, 2006). NHZ classifications represent areas with a high level of bio-geographic coherence, and are unrelated to administrative boundaries.

23.57 The proposed onshore project area lies within NHZ 2: Orkney and North Caithness and, where an assessment of a regional population is necessary, effects are assessed within this NHZ as far as possible. At this stage, however, there are limited data on bird populations available at the NHZ level, a notable exception being the recent publication by Wilson *et al*. (2015), which provides NHZ population estimates for 24 species of breeding birds and a further four species of wintering wildfowl, considered by the Scottish Windfarm Bird Steering Group (SWBSG) to feature frequently in EIAs.

Duration of effects

23.58 The following definitions have been applied with regard to timescales:

- **Immediate**: within approximately 12 months;
- **Short-term**: within approximately 1 to 5 years;
- **Medium-term**: within approximately 6 to 15 years; and
- **Long-term**: more than 15 years.

23.59 In addition, effects may be described as temporary or permanent.

Determining the level of effects

23.60 For the purposes of this assessment, potential effects are assigned to different levels to assist the assessment process. The level of effect is defined using the criteria in Table 23-6. Note that these effects relate to negative effects; where positive effects are predicted, these are not assigned different levels.

Table 23-153: Criteria for determining the level of effects on terrestrial ornithology

Severity level	Criteria
Very High	Total or almost complete loss of a bird population, likely to result in a permanent effect on its long-term ecological integrity and affect its conservation status.
High	Large-scale, permanent changes to a bird population, and likely to change its ecological integrity and affect its conservation status.
Medium	Moderate-scale, long-term changes to a bird population, or larger-scale temporary changes, but its long-term ecological integrity is unlikely to be affected, and any changes in conservation status are reversible.
Low	Small-scale, temporary effects on a bird population that do not affect ecological integrity or conservation status.
Negligible	Little or no detectable effect on a bird population.

Behavioural sensitivity of birds

23.61 Potential effects on bird populations are also assessed with consideration of their behavioural sensitivity and ability to recover from or adapt to disturbance. Behavioural sensitivity is determined subjectively based on the species' ecology and behaviour, and taking into account available information regarding disturbance distances and the responses of birds to various stimuli (e.g. noise and disturbance by humans, or presence of predators).

23.62 For example, birds present in areas with high human populations and activity levels are likely to have a greater tolerance to disturbance than those that occupy habitats remote from human activities. It should be noted that behavioural sensitivity can differ between similar species and between different populations of the same species, as well as between individual birds of the same species (e.g. between nesting goshawk [*Accipiter gentilis*] pairs; Petty, 1996).

23.63 Behavioural sensitivity also depends on the activity of the bird, for example, a species is likely to be less tolerant of disturbance whilst breeding than at other times. It may also differ across a single breeding season, with birds exhibiting higher levels of sensitivity at particular stages of breeding.

23.64 Thus the behavioural responses of birds are likely to vary with the nature and context of the stimulus timing, and the experience of the individual bird.

Assessment of significance

23.65 For terrestrial ornithology, potential ***effects*** are identified and significance of ***impact*** is assessed for each stage of the project lifecycle, and significance attributed relative to the background conditions.

23.66 The latest CIEEM guidance on EcIA (CIEEM, 2016) avoids and discourages use of the matrix approach to determining significance, and describes only two categories: 'significant' or 'not significant'.

23.67 According to the CIEEM guidance, for the purpose of EcIA, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for important ecological features or for biodiversity in general. Effects can be considered significant at a wide range of scales from international to local.

23.68 The guidance further states that "In broad terms, significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)".

23.69 In line with this guidance, rather than using a matrix to determine significance, the approach used in this technical chapter is to consider the importance and sensitivity of the bird population and the characteristics (extent, magnitude, duration, timing etc.) and severity of the effect, and applying professional judgement as to whether the ecological integrity of a bird population will be affected.

23.70 The term "ecological integrity" refers to the maintenance of the conservation status of a population of a species at a specific location or geographical scale, and is used here in accordance with the definition adopted by the ODPM Circular 06/2005, whereby designated site integrity refers to "*…the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*".

23.71 Effects are more likely to be significant where they affect bird populations of higher levels of importance, or where the severity of the effect is high. Effects not considered to be significant would be those that do not threaten the integrity of a population (i.e. where the severity of an effect is low), or where the bird population affected is considered to be of low importance.

23.72 For the purposes of the assessment of terrestrial ornithology, an effect that threatens the integrity of a bird population is considered to be significant. Effects that do not threaten the integrity of a bird population are considered to be not significant.

23.73 Where appropriate, mitigation measures are identified in order to avoid and reduce potentially significant effects. It is also good practice to propose mitigation measures to reduce negative effects that are not significant.

23.74 The significance of residual effects on bird populations following implementation of mitigation is then determined, along with any monitoring requirements (in line with SNH guidance; SNH, 2009).

Assessment of cumulative effects

23.75 Cumulative effects would not be detected when considering the Project in isolation, but become significant in combination with other effects.

23.76 The need to consider cumulative effects is a requirement of the EIA process, as specified by The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000. Specific guidance has also been provided for assessment of cumulative impacts of onshore wind farms on bird populations (SNH, 2012).

23.77 Projects to be incorporated in such an assessment must include existing and consented developments, as well as those at the application stage.

23.78 As different projects often employ differing baseline and impact assessment methods, data often cannot be directly compared, and so quantitative assessment of cumulative effects is often not possible. Furthermore, as there is no compulsion for developers to share commercial data with other companies, it is often impossible to acquire a full dataset. Therefore a comprehensive and quantitative cumulative impact assessment is rarely possible. However, every effort has been made to provide a qualitative assessment that is as robust as the available data allows.

23.79 The context in which cumulative effects are considered depends upon the ecology of the species in question. For example, it may be appropriate to consider cumulative effects to geese associated with an SPA within the context of their wider foraging range. For other species, such as breeding waders, it may be appropriate to consider the effects on the local population in the context of any planned developments in the immediate vicinity which have the potential to cause additional displacement.

23.80 For the purposes of the terrestrial ornithology assessment presented in this technical chapter, the main potential cumulative effects are considered to be disturbance/ displacement of wader species that were breeding within the current onshore project area and 500 m buffer. For all other species, the effects of the onshore element of the Project are considered to be so small as to make it extremely unlikely that significant cumulative impacts would occur.

23.81 The Highland Council planning portal[64] was searched for Section 36 planning applications located within 10 km of the current onshore project area. Wader species tend to have a

[64] http://wam.highland.gov.uk/wam/ (last accessed 25/01/2016)

limited range during the breeding season (e.g. Pendlebury *et al*., 2011), therefore this search area is considered to be appropriate for assessing cumulative effects on local breeding wader populations. Given the relatively small scale of the onshore element of the Project, it is considered unlikely that it would contribute to cumulative effects on breeding waders at a regional scale.

23.6 Desk study results

Existing records

23.82 Information relating to terrestrial ornithology that was received in response to data requests is summarised in Table 23-7, and relevant data are included in the baseline accounts presented in section 23.10. Further details of the records received are provided in Technical Appendix 23.1.

Table 23-154: Summary of terrestrial ornithology records obtained through data requests

Organisation	Description of information provided
SNH	Information about statutory sites of ecological importance, and records of notable habitats and species.
RSPB	Returned records of 28 bird species within 2 km of the initial project area; the majority of records were of species of moderate or high conservation concern[1].
HRSG	Did not hold any records of breeding eagles within 6 km of the initial onshore project area, or of other Schedule 1 raptors/owls within 2 km.
BTO	Held WeBS Core Count data for Sandside Bay from between winter 2009/10 and winter 2013/14. However, due to the remote location only a single visit was made each year, in either January or February, and not the monthly visits between September and March as required by the standard survey method (Gilbert *et al*., 1998). Returned records of 133 bird species (not including domestic birds or hybrid species) from the NC96 Bird Atlas hectad (10 km grid squares). This included a number of common and widespread species of little or no conservation concern.
WWT	Stated that they held feeding distribution data for pink-footed geese and greylag geese in Caithness, which was published in a report by Mitchell (2012). Also held limited (unpublished) data for whooper swans.
GWFGS	Stated that there were no records of Greenland white-fronted geese from within the initial onshore project area, with the nearest sightings from pasture around Balmore, which is located approximately 2 km to the north-east of the current onshore project area. Further stated that SPA birds feed mainly in the valley of the Forss Water to the east of the current onshore project area and tend to roost either on the north end of Loch Calder or the RSPB reserve at Broubster Leans. Only during periods of prolonged freezing, do birds sometimes resort to areas closer to the sea, where there may be less snow or milder temperatures than further inland.
[1]Defined as birds included on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), Annex I of the Birds Directive, species included in the UK BoCC Red or Amber lists (Eaton *et al*., 2015) and SBL priority species.	

Statory sites

23.83 Three sites with international designations for ornithological features are located within 20 km of the current onshore project area, and two sites with national designations are located within 5 km. Details of these sites are summarised in Table 23-8 and locations are shown in Figures 23-4 (sites with international designations) and 23-5 (sites with national designations).

Table 23-155: Statutory sites designated for ornithological features, listed in order of proximity to the current onshore project area

Designation(s)	Site name	Distance (km)	Qualifying ornithological feature
SPA	North Caithness Cliffs	0.0 km (adjacent to current onshore project area)	• Breeding peregrine population of international importance; • Migratory guillemot population of international importance; and • Internationally important breeding seabird assemblage, which includes nationally important populations of fulmar (*Fulmarus glacialis*), kittiwake, razorbill, guillemot and puffin (*Fratercula arctica*).
SSSI	Red Point Coast	1.4 km to NW	• Nationally important breeding guillemot population.
SPA and RAMSAR	Caithness and Sutherland Peatlands	4.0 km to SW	Designated features of the SPA are internationally important breeding populations of: • Wigeon (*Anas penelope*); • Common scoter (*Melanitta nigra*); • Red-throated diver (*Gavia stellata*); • Black-throated diver (*Gavia arctica*); • Hen harrier (*Circus cyaneus*); • Golden eagle (*Aquila chrysaetos*); • Golden plover; • Dunlin (*Calidris alpina*); • Greenshank (*Tringa nebularia*); • Wood sandpiper (*Tringa glareola*); • Short-eared owl (*Asio flammeus*); and • Merlin (*Falco columbarius*). Designated features of the RAMSAR site: • Breeding populations of greylag goose and dunlin; and • Breeding bird assemblage.
SSSI	East Halladale	4.0 km to SW	• Nationally important populations of breeding golden plover and dunlin; and • Nationally important breeding bird assemblage.
SPA and RAMSAR	Caithness Lochs	6.6 km to SE	• Internationally important populations of wintering Greenland white-fronted goose, greylag goose and

Designation(s)	Site name	Distance (km)	Qualifying ornithological feature
			whooper swan.

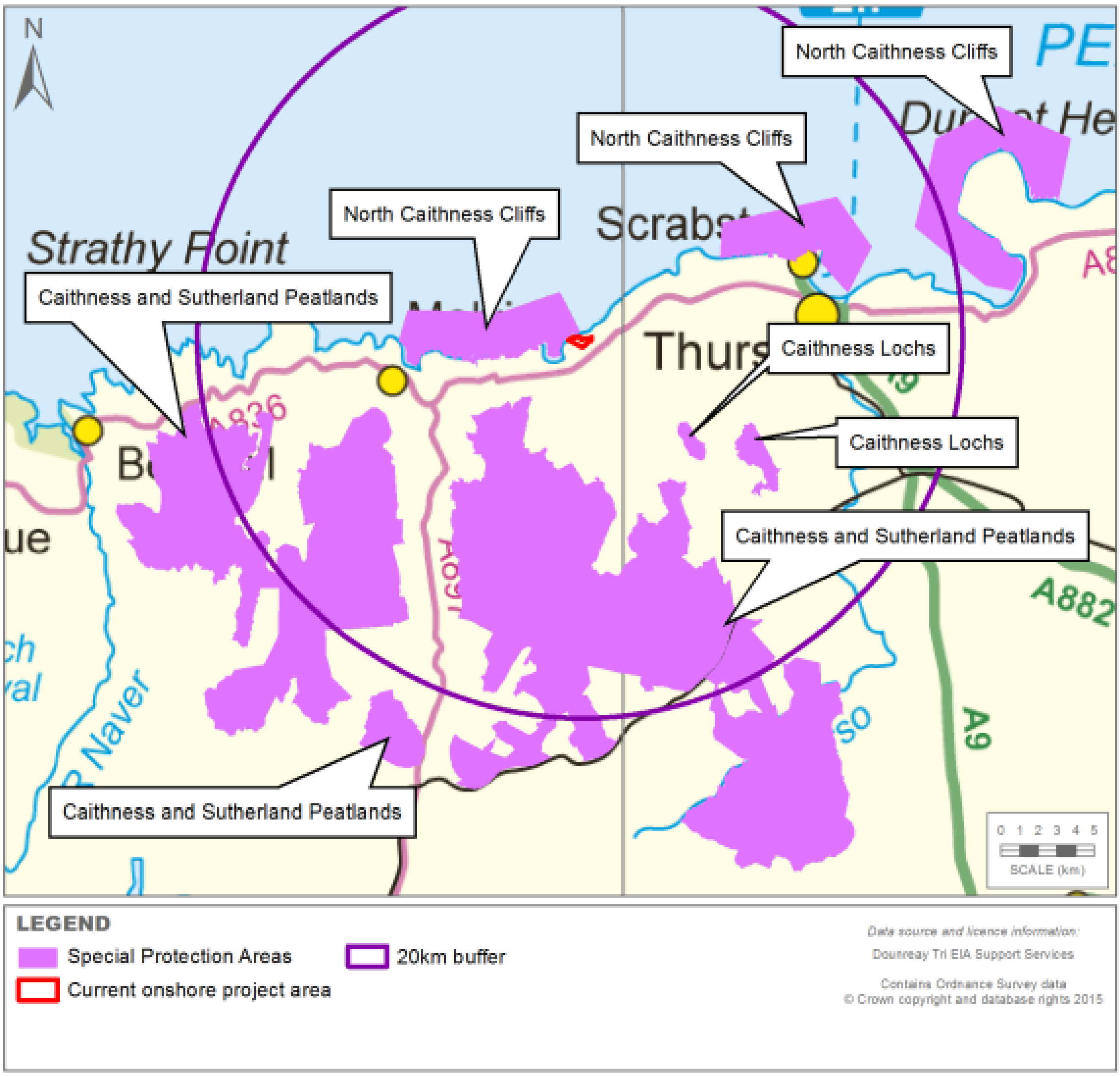

Figure 23-4: Sites with international designations for ornithological features located within 20 km of the current onshore project area

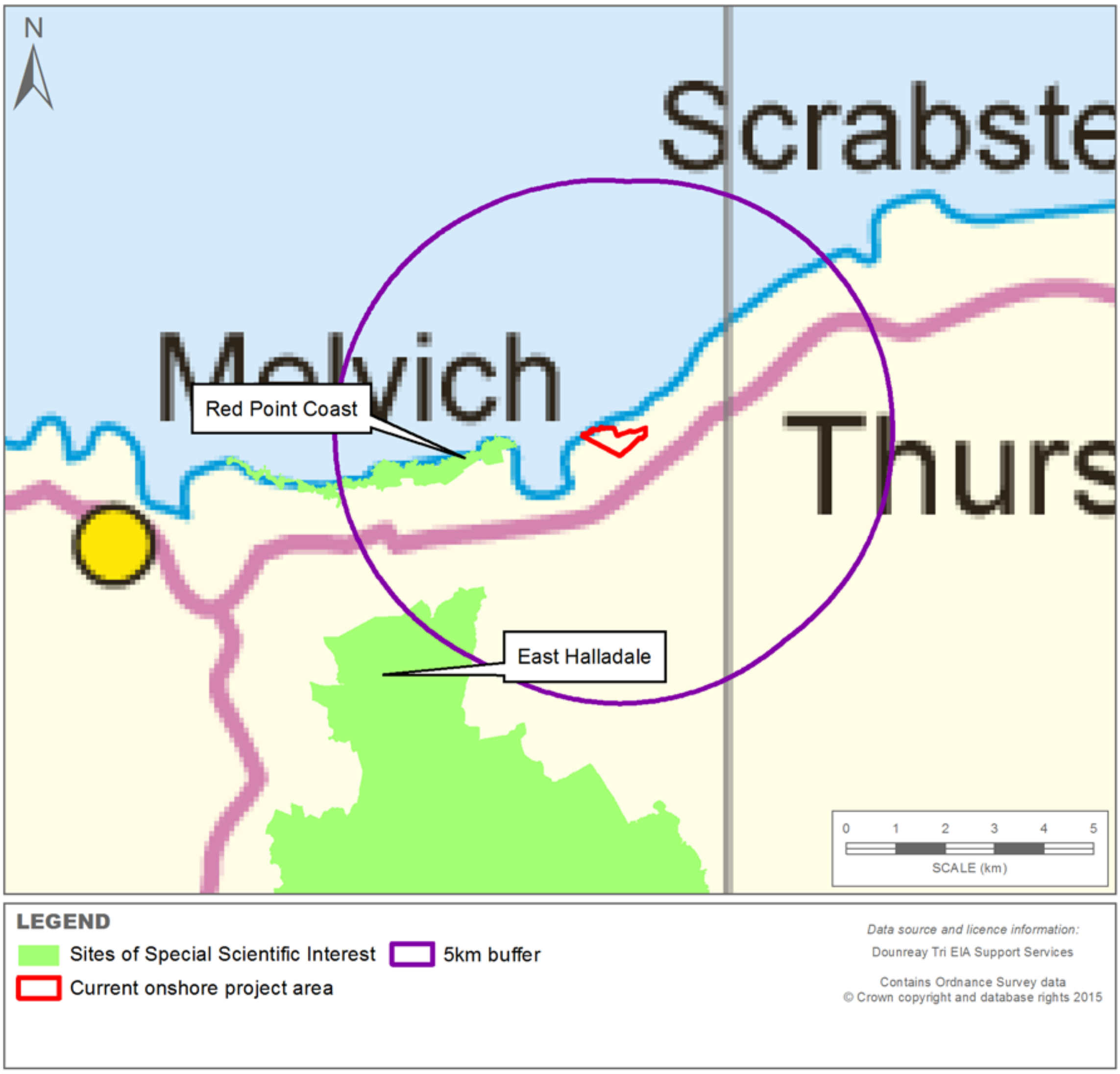

Figure 23-5: Sites with national designations for ornithological features located within 5 km of the current onshore project area

23.7 Field survey results

Breeding bird survey

23.84 A total of 60 species were recorded during the 2015 breeding bird survey. Of these, four wader and five passerine species were considered to be breeding within the survey area. Numbers of territories and conservation status of each of the nine breeding species is provided in Table 23-9 and locations of territories are shown in Figures 23-6 (waders) and 23-7 (passerines). A list of all bird species recorded during the 2015 breeding bird survey is provided in Technical Appendix 23.1.

Table 23-156: Numbers of territories and conservation status of breeding wader and passerine species recorded during the 2015 breeding bird survey

Species		No. of territories			Legislation/ conservation status
Common name	Scientific name	In current onshore project area	Additional records within 500 m of current onshore project area	Total in survey area	
Oystercatcher	*Haematopus ostralegus*	1	3	6	Amber-listed
Curlew	*Numenius arquata*	1	0	4	Red-listed; SBL
Lapwing	*Vanellus vanellus*	0	3	8	Red-listed; SBL
Redshank	*Tringa totanus*	0	1	1	Amber-listed
Skylark	*Alauda arvensis*	6	7	23	Red-listed; SBL Caithness LBAP; Highland LBAP
Willow warbler	*Phylloscopus trochilus*	0	0	1	Amber-listed
Sedge warbler	*Acrocephalus schoenobaenus*	0	0	1	
Wren	*Troglodytes troglodytes*	0	0	8	
Meadow pipit	*Anthus pratensis*			139*	Amber-listed
*As meadow pipit territory densities are often too high for accurate recording and mapping, numbers of birds were tallied within each 500 m x 500 m quadrat; the number presented here represents the maximum value recorded across the survey area					

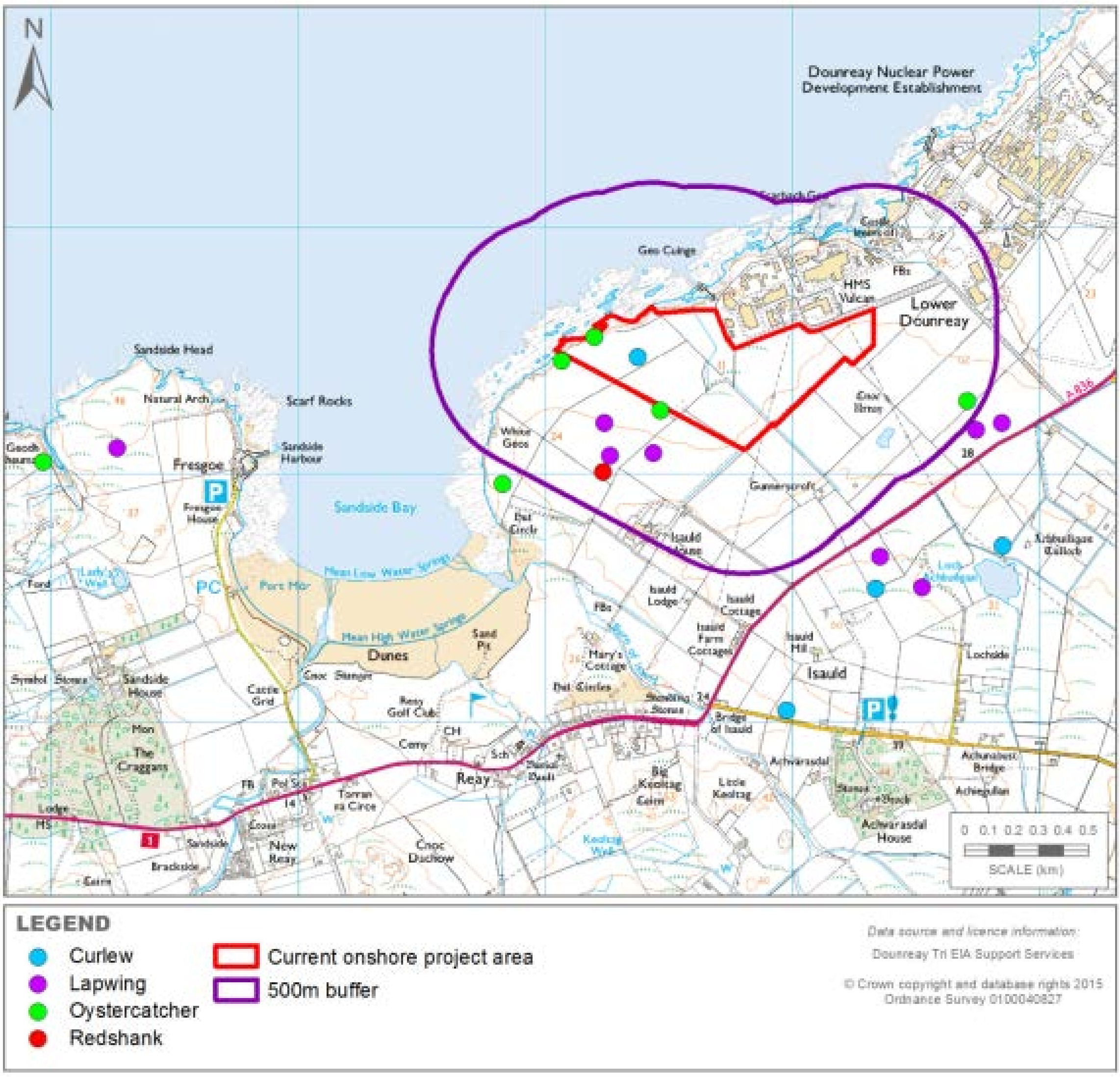

Figure 23-6: Wader territories recorded during the 2015 breeding bird survey

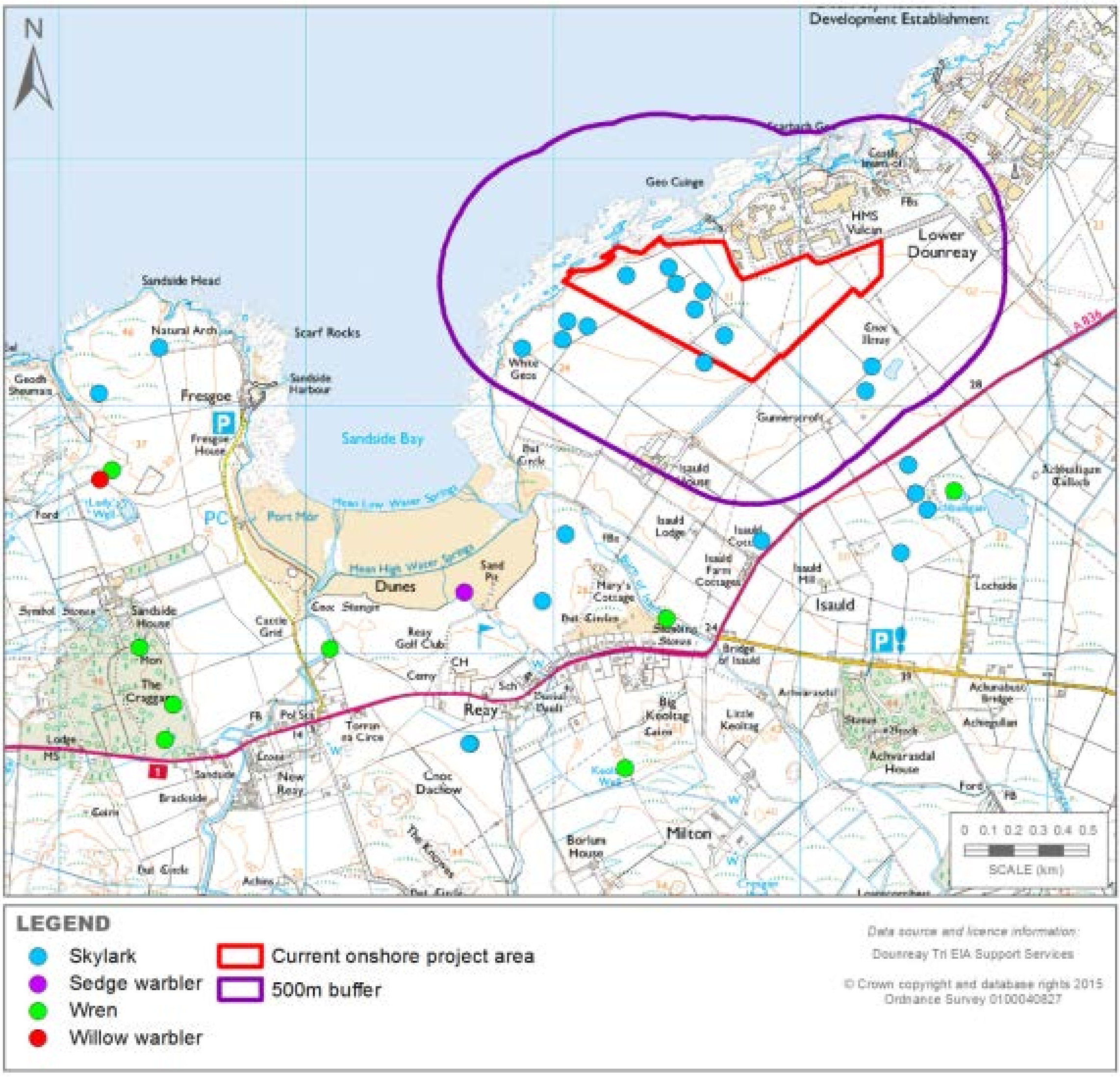

Figure 23-7: Passerine territories recorded during the 2015 breeding bird survey

Breeding raptor and seabird survey

Seabird species

23.85 A total of 20 seabird species were recorded during the 2015 breeding seabird survey. Of these, eight species were considered to be breeding within the survey area. Numbers of territories/ nests/individuals and conservation status of each of the eight breeding species is provided in Table 23-10, and locations of territories are shown in Figures 23-8 to 23-12.

23.86 Other protected seabird species that were recorded during the breeding bird survey, but for which there was no evidence of breeding were: puffin, red-throated diver (*Gavia stellata*), great northern diver (*Gavia immer*), common tern (*Sterna hirundo*) and Arctic tern (*Sterna paradisaea*).

23.87 In addition, several non-passerine species of moderate or high conservation concern were recorded within the survey area, but did not show any evidence of breeding: shelduck (*Tadorna tadorna*), eider (*Somateria mollissima*), gannet (*Morus bassanus*), Arctic skua

(*Stercorarius parasiticus*), great skua (*Stercorarius skua*) and black-headed gull (*Chroicocephalus ridibundus*).

23.88 Cormorant (*Phalacrocorax carbo*) was also recorded within the survey area but did not show any evidence of breeding; this species is not considered to be of conservation concern.

Table 23-157: Numbers of territories and conservation status of breeding seabird species recorded during the 2015 survey; species which are a feature of the North Caithness Cliffs SPA are shaded

Species		Peak counts in survey area*	Conservation status
Common name	Common name		
Fulmar	*Fulmarus glacialis*	150 nests	Amber-listed
Shag	*Phalacrocorax aristotelis*	11 nests	Red-listed
Black guillemot	*Cepphus grylle*	Single bird exhibiting breeding behaviour	Amber-listed
Razorbill	*Alca torda*	300 individuals	Amber-listed
Guillemot	*Uria aalge*	1,050 individuals	Amber-listed
Kittiwake	*Rissa tridactyla*	890 individuals	Red-listed
Herring gull	*Larus argentatus*	10 nests	Red-listed; SBL
Great black-backed gull	*Larus marinus*	2 nests	Amber-listed

Raptor species

23.89 Peregrine and barn owl were the only specially protected raptor species recorded during the breeding raptor survey. A single barn owl breeding territory was identified within the survey area; details are provided in a Confidential Annex. A single peregrine was recorded flying over the survey area, but no evidence of breeding behaviour was observed.

23.90 Small numbers of sparrowhawk (*Accipiter nisus*), buzzard (*Buteo buteo*) and kestrel (*Falco tinnunculus*) flights of were also recorded within the survey area, and a single buzzard territory was recorded (to the south-east of the current onshore project area).

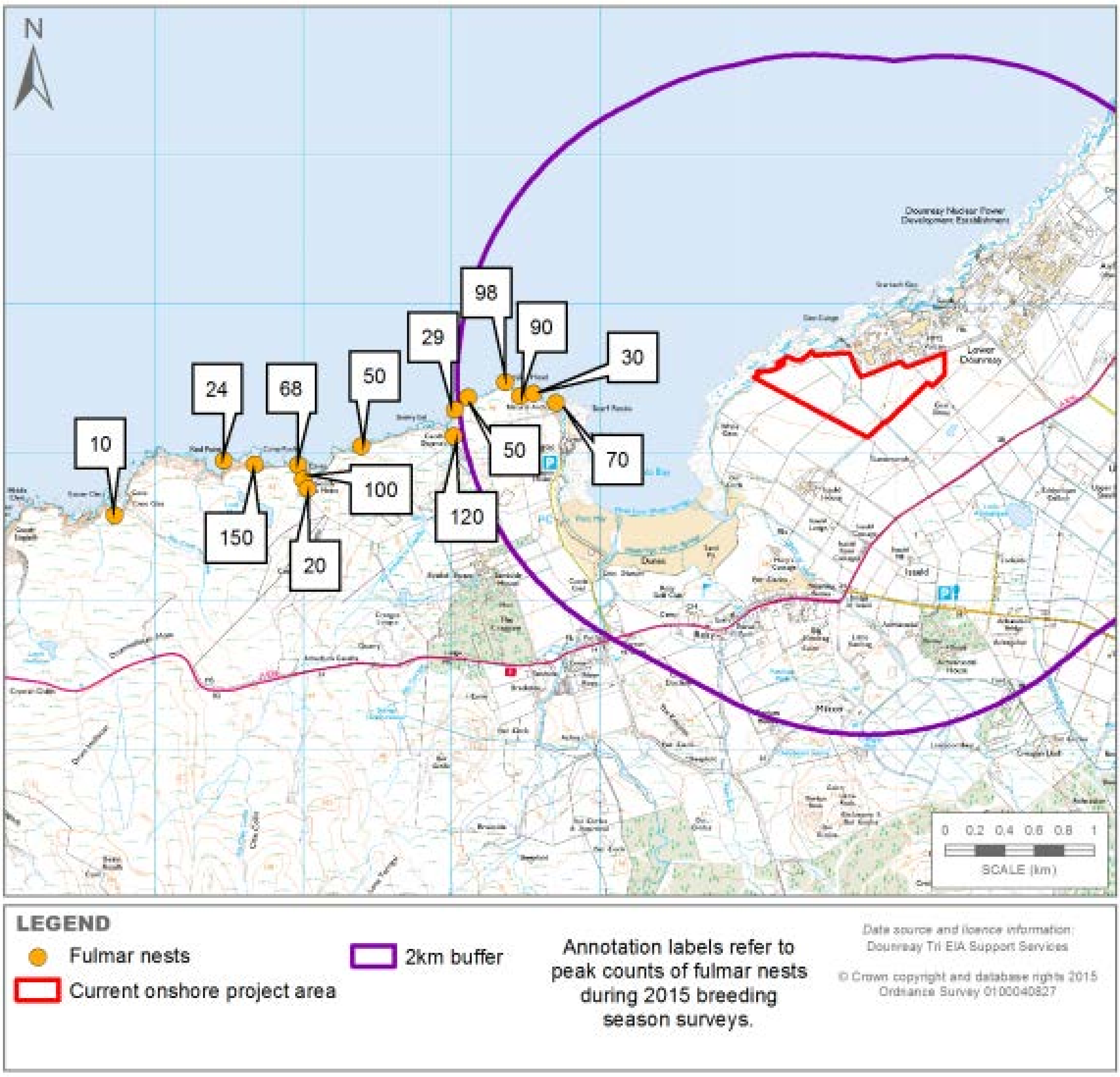

Figure 23-8: Fulmar nests recorded during the 2015 breeding seabird survey

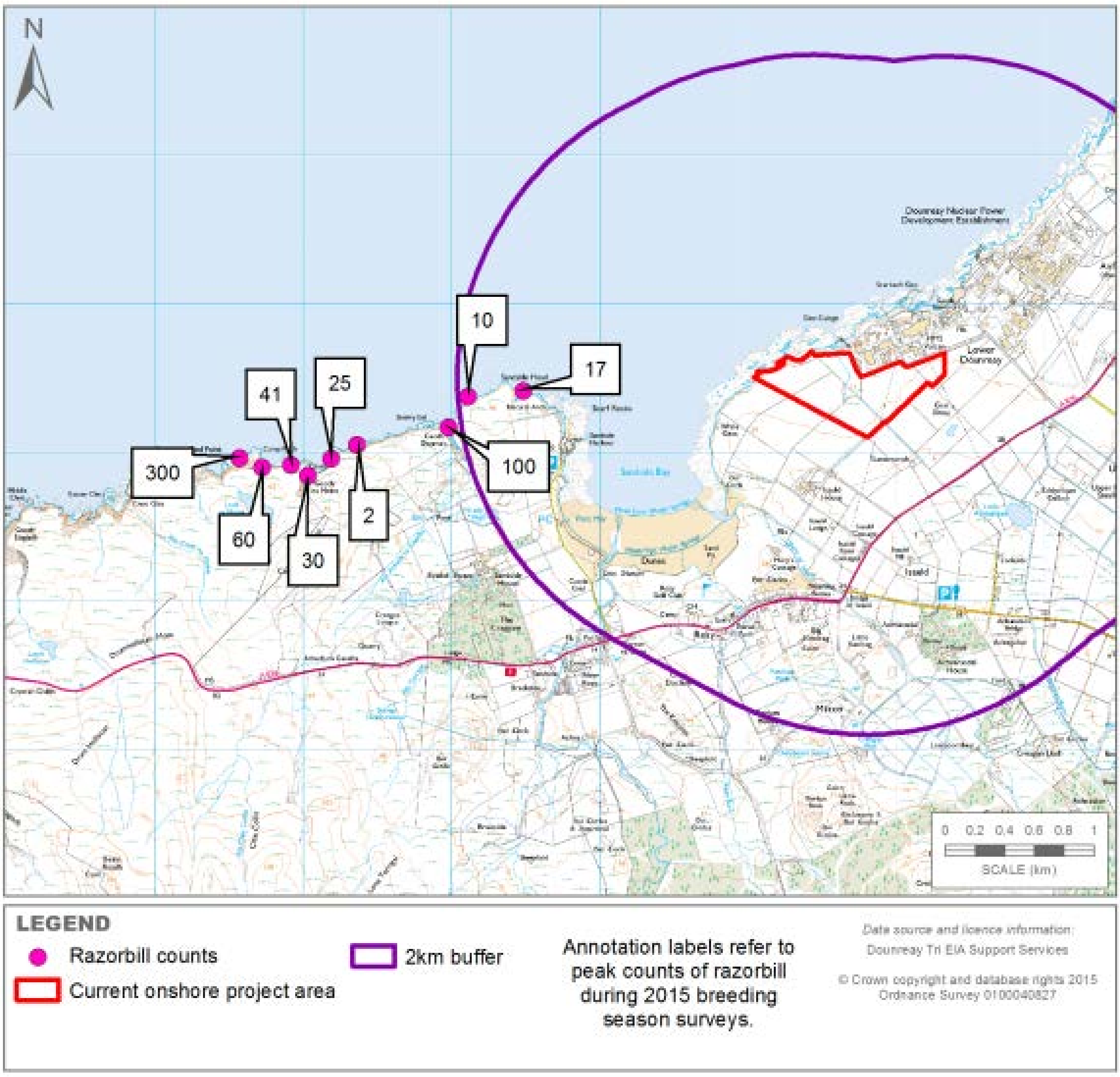

Figure 23-9: Razorbill counts recorded during the 2015 breeding seabird survey

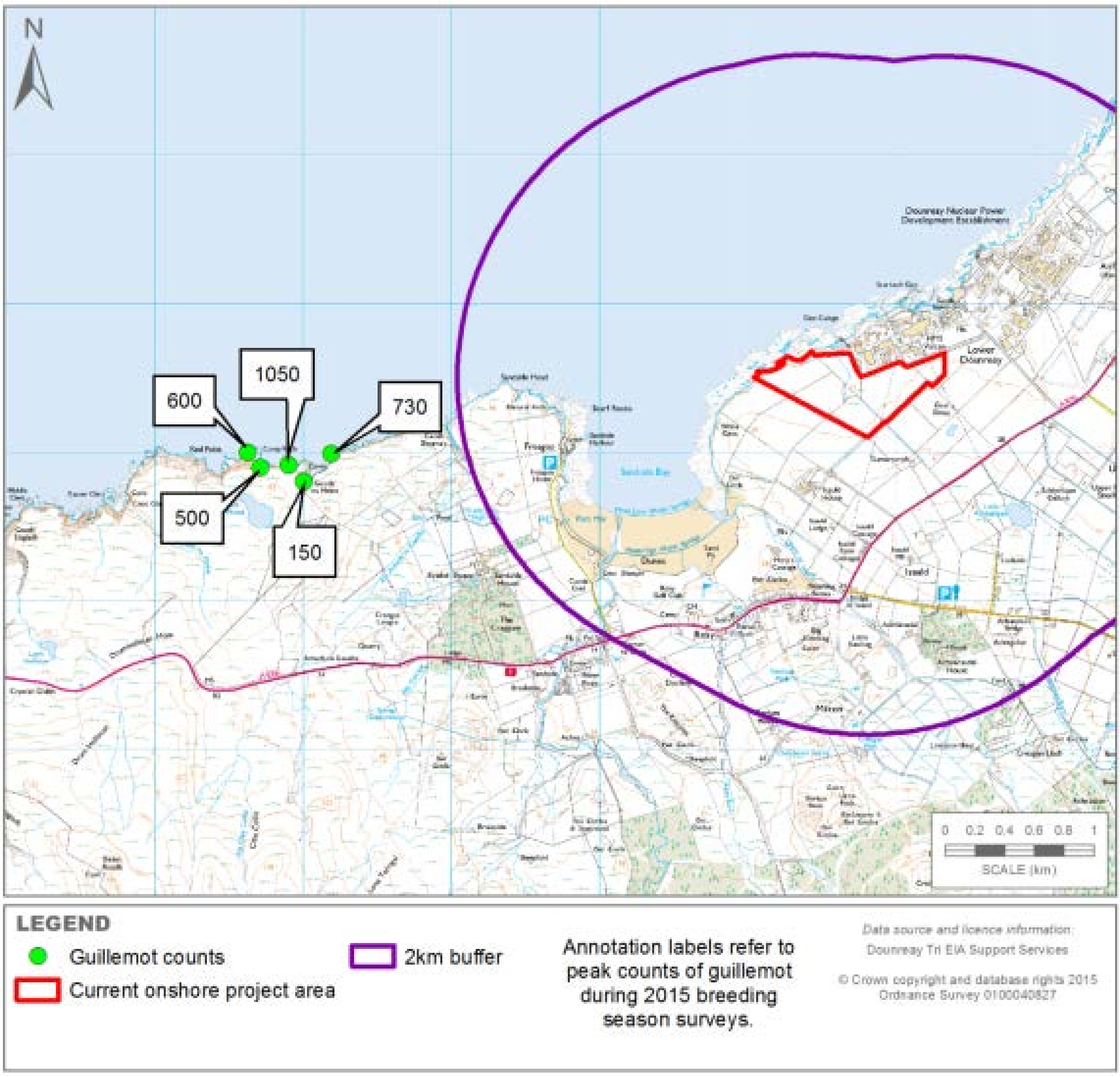

Figure 23-10: Guillemot counts recorded during the 2015 breeding seabird survey

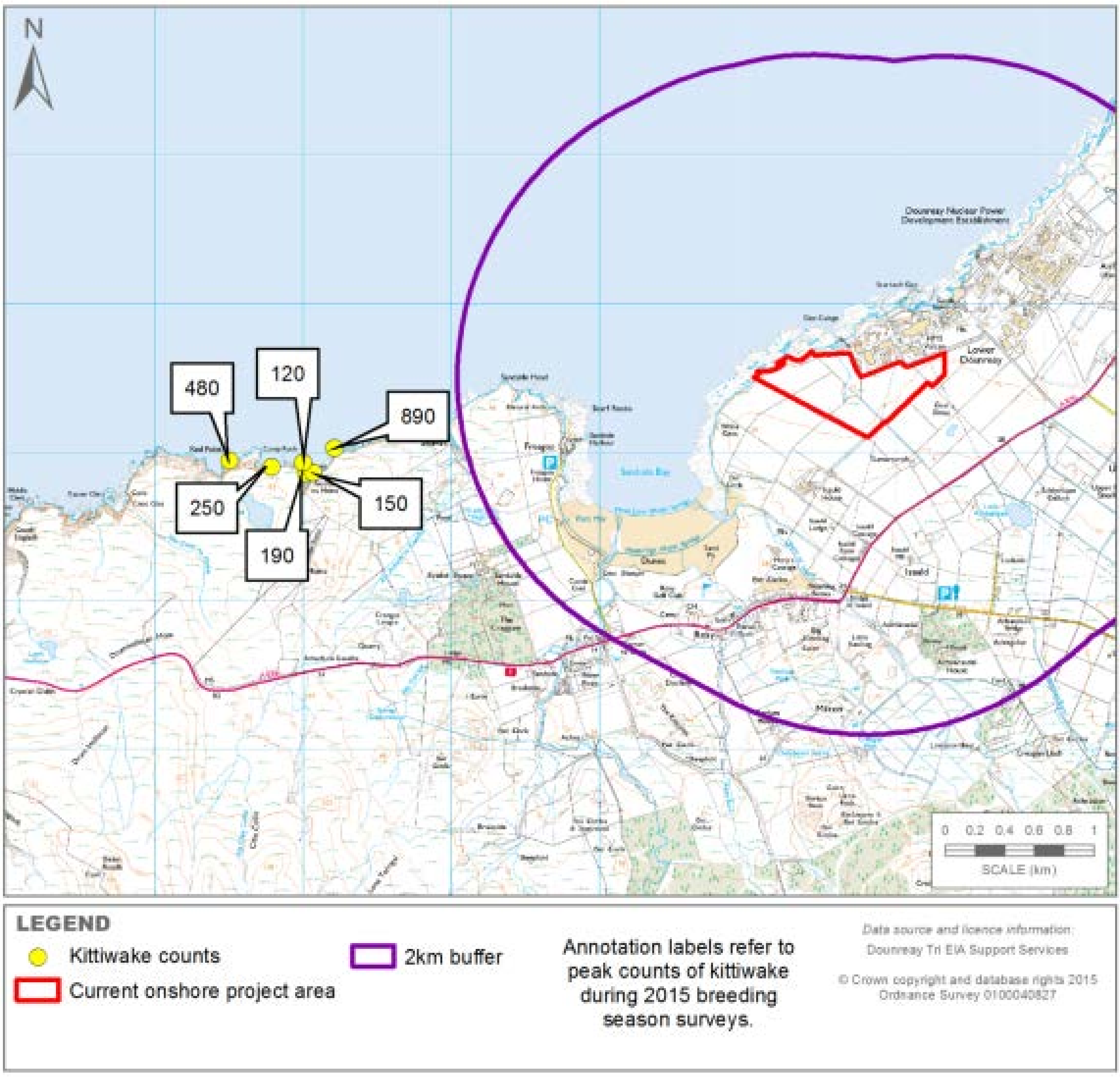

Figure 23-11: Kittiwake counts recorded during the 2015 breeding seabird survey

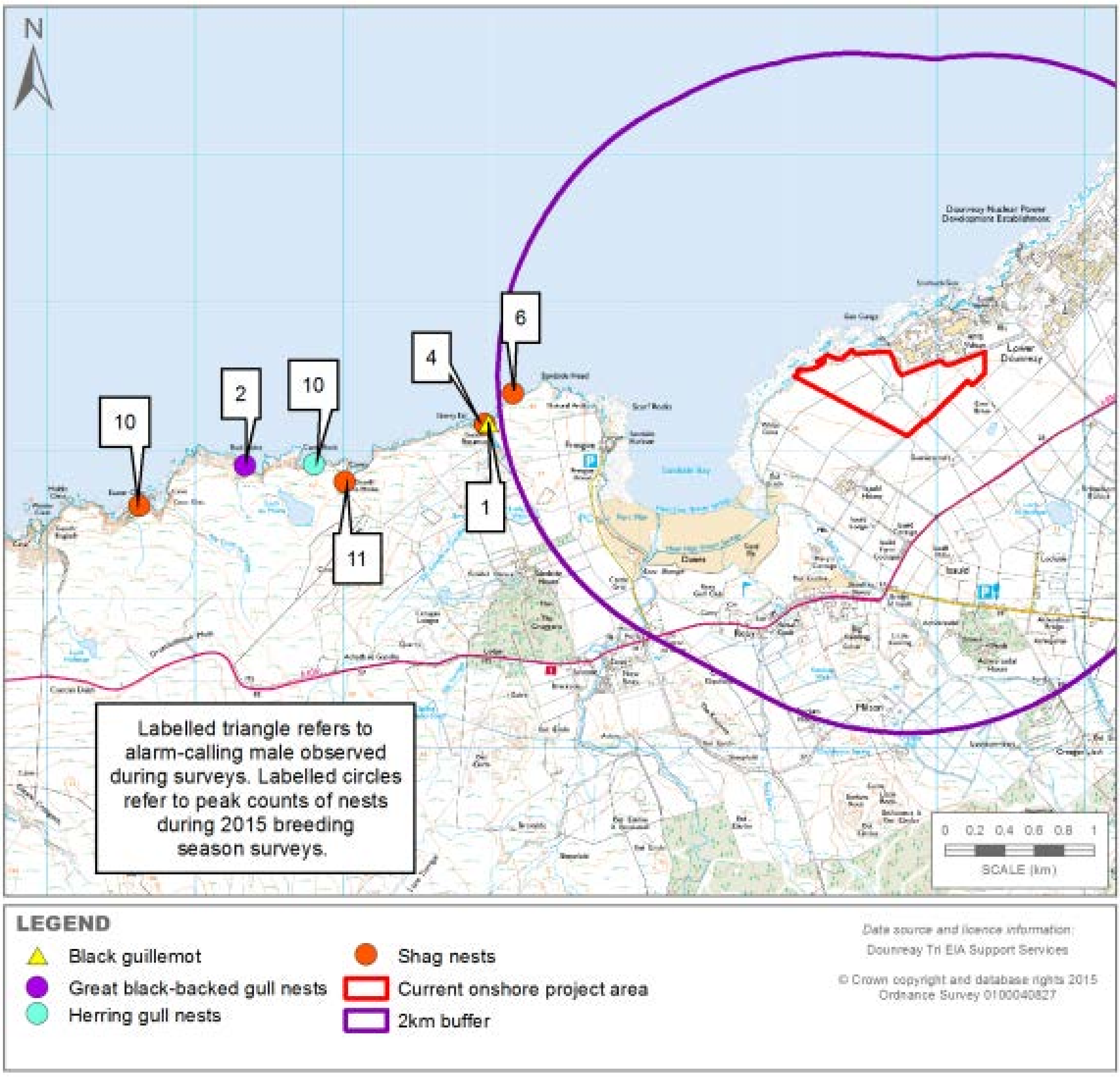

Figure 23-12: Other breeding seabirds recorded during the 2015 breeding seabird survey

Winter bird surveys

23.91 A total of 68 bird species were recorded during the 2015 winter walkover surveys, and a total of 22 species during the 2015 WeBS. These totals included several wildfowl, wader and seabird species of moderate or high conservation concern (i.e. those included on the UK BoCC Red or Amber list, and/or the SBL). In addition, several passerine species of relatively high conservation concern (i.e. those included on the UK BoCC Red list, and/or the SBL) were recorded during the winter walkover survey.

23.92 Full lists of bird species recorded during the 2015 winter bird surveys are presented in Technical Appendix 23.1, along with Figures showing distributions of each species. Maximum counts and conservation status of those species considered to be of moderate or high conservation concern (i.e. those included on Schedule 1, Annex I, the UK BoCC Red or Amber lists and/or the SBL) are summarised in Table 23-11.

Table 23-158: Maximum counts of bird species of moderate or high conservation concern recorded during the 2015 winter bird survey visits

Species		Max. no. recorded during a single survey visit		Legislation/ conservation status
Common name	Scientific name	WWO	WeBS	
Wildfowl (including seaducks)				
Whooper swan	*Cygnus cygnus*	5	3	Annex I; Schedule 1; Amber-listed; SBL
Greylag goose	*Anser anser*	75		Amber-listed
Wigeon	*Anas penelope*	80	48	Amber-listed
Teal	*Anas crecca*	78	8	Amber-listed
Mallard	*Anas platyrhynchos*	55	41	Amber-listed
Eider	*Somateria mollissima*	12	11	Amber-listed
Waders				
Oystercatcher	*Haematopus ostralegus*	34	129	Amber-listed
Golden plover	*Pluvialis apricaria*	100		Annex I; SBL
Lapwing	*Vanellus vanellus*	457		Red-listed; SBL
Ringed plover	*Charadrius hiaticula*	110	67	Red-listed
Whimbrel	*Numenius phaeopus*	1		Schedule 1; Red-listed
Curlew	*Numenius arquata*	86	30	Red-listed; SBL
Turnstone	*Arenaria interpres*	63	5	Amber-listed
Knot	*Calidris canutus*		8	Amber-listed
Sanderling	*Calidris alba*	8	10	Amber-listed
Dunlin	*Calidris alpina*	26	6	Annex I; Amber-listed; SBL
Purple sandpiper	*Calidris maritima*		10	Schedule 1; Amber-listed; SBL
Redshank	*Tringa totanus*	40	39	Amber-listed
Snipe	*Gallinago gallinago*	1		Amber-listed
Seabirds (including gulls)				
Gannet	*Morus bassanus*	1		Amber-listed
Shag	*Phalacrocorax aristotelis*	10		Red-listed
Black guillemot	*Cepphus grylle*	4		Amber-listed
Black-headed gull	*Chroicocephalus ridibundus*	2	8	Amber-listed; SBL

Species		Max. no. recorded during a single survey visit		Legislation/ conservation status
Common name	Scientific name	WWO	WeBS	
Common gull	*Larus canus*	147	155	Amber-listed
Lesser black-backed gull	*Larus fuscus*	1		Amber-listed
Herring gull	*Larus argentatus*	15	5	Red-listed; SBL
Great black-backed gull	*Larus marinus*	22	20	Amber-listed
Passerines of moderate or high conservation concern				
Skylark	*Alauda arvensis*	50		Red-listed; SBL; Caithness LBAP; Highland LBAP
Starling	*Sturnus vulgaris*	1,833		Red-listed; SBL; Highland LBAP
Fieldfare	*Turdus pilaris*	10		Schedule 1; Red-listed
Song thrush	*Turdus philomelos*	4		Red-listed; SBL; Caithness LBAP; Highland LBAP
Redwing	*Turdus iliacus*	10		Schedule 1; Red-listed
Mistle thrush	*Turdus viscivorus*	5		Red-listed; SBL
Dunnock	*Prunella modularis*	7		Amber-listed; SBL; Highland LBAP
House sparrow	*Passer domesticus*	18		Red-listed; SBL; Highland LBAP
Grey wagtail	*Motacilla cinerea*	1		Red-listed
Meadow pipit	*Anthus pratensis*	37		Amber-listed
Bullfinch	*Pyrrhula pyrrhula*	1		Amber-listed; SBL; Caithness LBAP; Highland LBAP
Linnet	*Linaria cannabina*	128		Red-listed; SBL; Caithness LBAP; Highland LBAP
Twite	*Linaria flavirostris*	15		Red-listed; SBL; Highland LBAP
Snow bunting	*Plectrophenax nivalis*	1		Schedule 1; Amber-listed; SBL
Yellowhammer	*Emberiza citrinella*	2		Red-listed; SBL; Highland LBAP

Foraging goose survey

23.93 Three wildfowl species were recorded during the 2015 foraging goose survey: whooper swan, pink-footed goose and greylag goose. Of these, greylag goose was recorded most frequently and in the greatest numbers, while whooper swan was only recorded on a single occasion. The majority of records were to the west of the current onshore project area.

23.94 A summary of all wildfowl observations is presented in Table 23-12 and locations are shown on Figures 23-13 (whooper swan and greylag goose, which are both designated features of Caithness Lochs SPA) and 23-14 (pink-footed goose).

Table 23-159: Summary of wildfowl flocks observed during the 2015 foraging goose surveys

Species		No. of observations			Flock size range	Details
Common name	Scientific name	Within current onshore project area	Additional records within 3 km of current onshore project area	Total within survey area		
Whooper swan	*Cygnus cygnus*	0	1	1	4	Single flock recorded in west of survey area during an October visit.
Pink-footed goose	*Anser brachyrhynchus*	0	3	4	2-60	Four flocks, all west of current onshore project area. Closest was a flock of 60 birds during an October visit. Two small flocks (2 and 25 birds) recorded to west of Sandside Bay during an April visit, and a flock of 50 birds beyond survey buffer during an October visit ().
Greylag goose	*Anser anser*	0	7	12	3-290	Twelve flocks, all outside current onshore project area, most to west of Sandside Bay. Closest was a flock of 140 birds to west during October visit. A further six flocks (numbering 3-290 birds) recorded in survey buffer, and five flocks beyond the survey area.

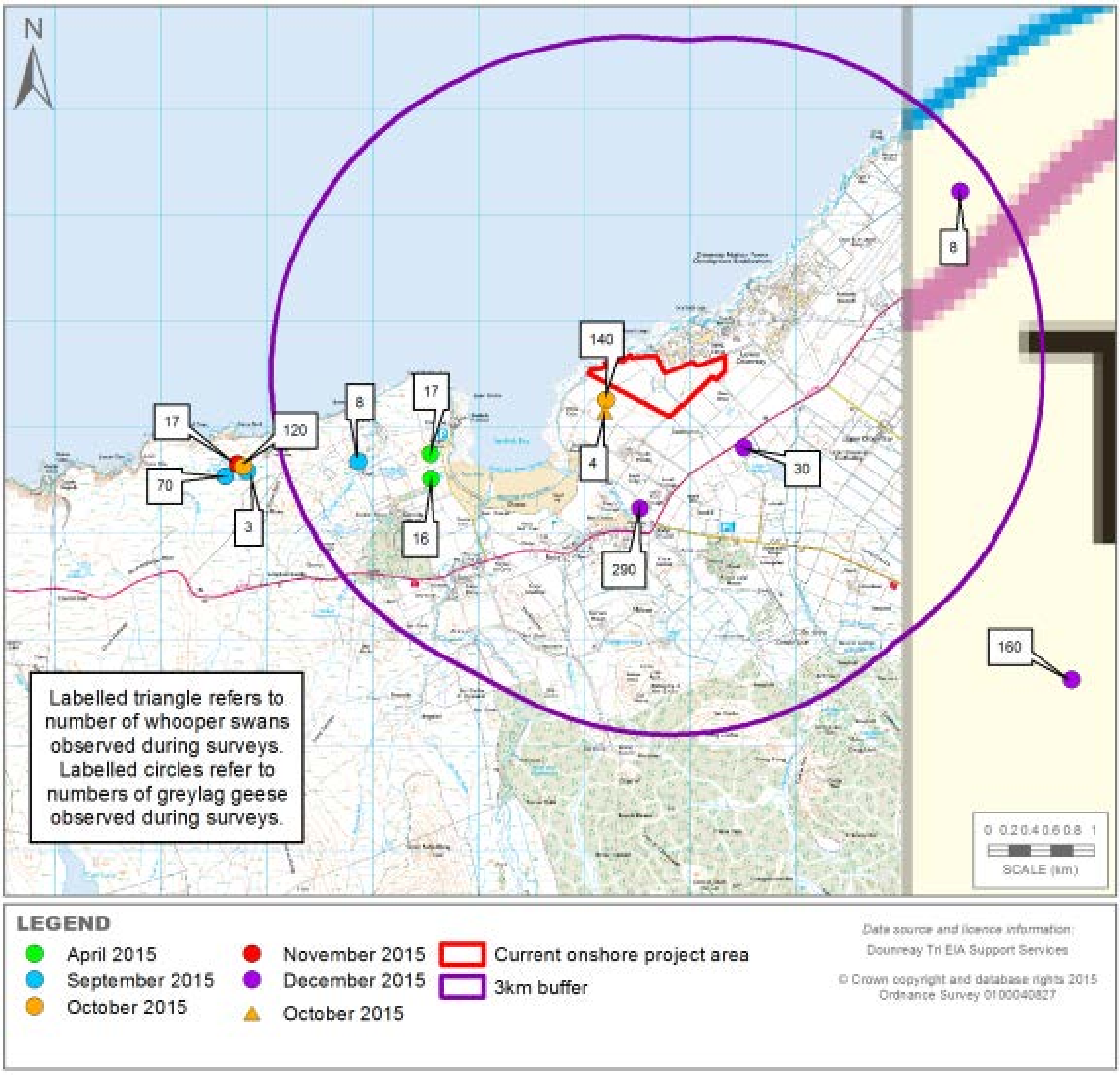

Figure 23-13: Whooper swans and greylag geese recorded during the 2015 foraging goose survey

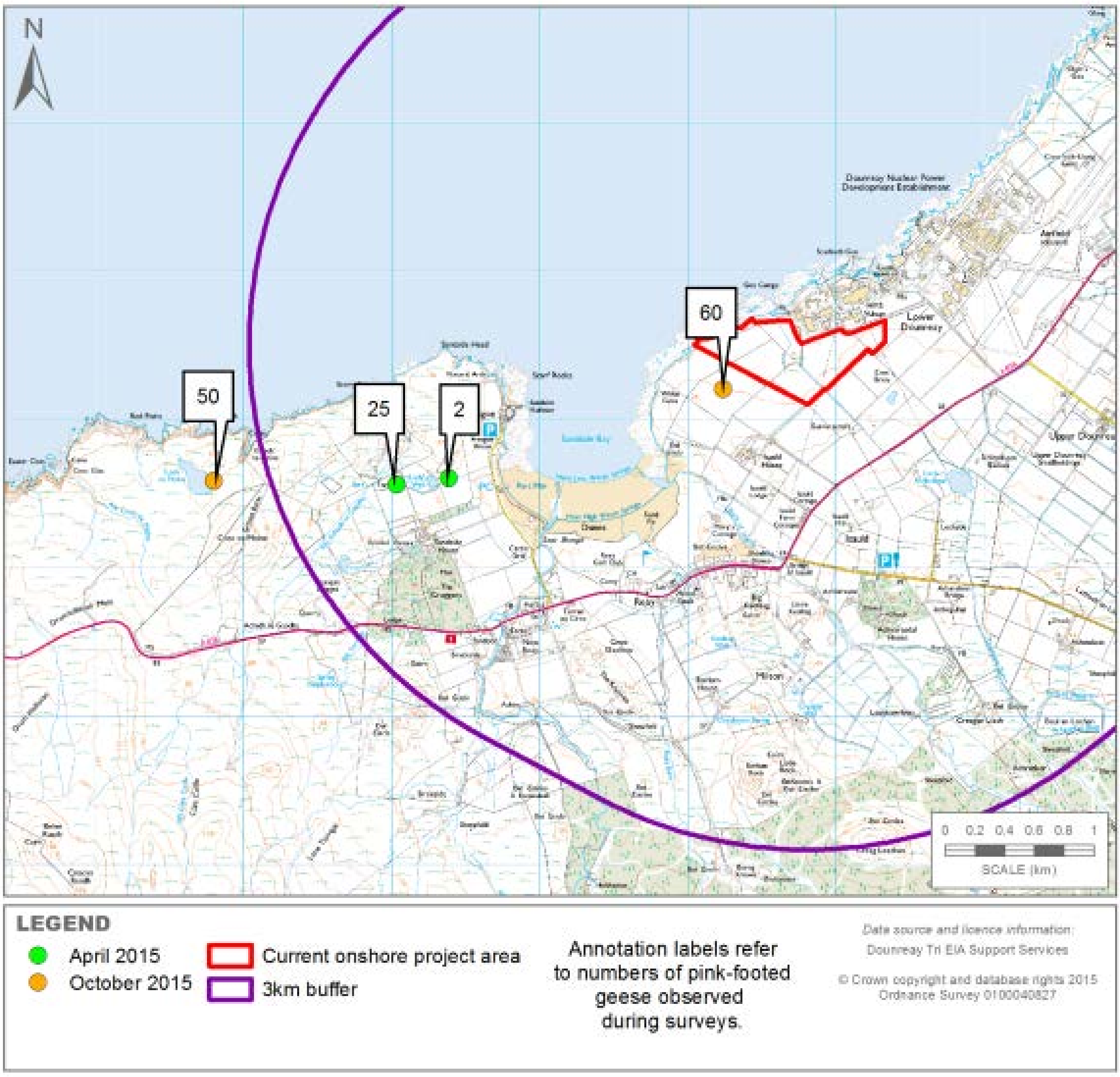

Figure 23-14: Pink-footed geese recorded during the 2015 foraging goose survey

23.8 Potential effects

23.95 The main potential effects on birds arising from the onshore element of the Project are likely to be:

- Direct habitat loss due to land-take;
- Disturbance or displacement; and
- Destruction or damage to nests, eggs and chicks.

23.96 In addition to potential effects that are directly related to the Project, effects may arise as a result of the cumulative effects of multiple developments within the local or regional area.

23.97 These potential effects are discussed in turn below for each phase of the proposed development (construction, operation and decommissioning).

Potential effects during construction

23.98 Potential construction effects on birds are identified below. These are likely to be temporary with the overall programme of onshore works likely be 12-18 months, as the onshore cable landfall (1-2 months duration), trenching (1-2 months duration), and substation/switchgear construction (12-18 months duration) occurring in parallel.

Direct habitat loss

23.99 The onshore construction works will involve construction of the onshore cable corridor and substation/switchgear, as well as hardstanding, and potentially an HDD compound and upgrading and/or extension of the existing access track, all of which would result in direct habitat loss.

23.100 As stated in section 23.5 (under 'Terrestrial ornithology design envelope'), the location of the onshore infrastructure has yet to be determined. However, based on the indicative infrastructure footprint shown in Figure 23-3, indicative onshore cable corridor route 1 with the HDD landfall option would result in a total habitat loss of 10.29 ha (including construction of the substation/switchgear, hardstanding and upgrading of the access track), while indicative onshore cable corridor route 2 with the pinning landfall option would result in a total habitat loss of 8.70 ha. Details of the habitat loss estimates are presented in Chapter 24: Terrestrial Ecology.

23.101 Note that all of these values are estimates only; the area of total habitat loss will vary according to the finalised design, but is likely to be similar to the estimated values. However, these estimates indicate that the total area that will be lost is relatively small. Furthermore, once the onshore cable corridor has been installed, the habitat within which the trench is located will be restored.

23.102 As no trees, scrub, walls or buildings will be removed as part of the onshore construction works, the effects of direct habitat loss on nesting birds will likely be limited to small numbers of ground-nesting species. It is understood that no hard cliff habitat will be permanently lost during construction of the onshore cable corridor. Foraging birds may also be disturbed or displaced during both the breeding and non-breeding seasons (depending on the timing of the onshore construction works).

Disturbance and displacement

23.103 The onshore construction works have the potential to cause temporary disturbance to bird species for the duration of this phase, as a direct result of increased human activity, including the use of construction vehicles and machinery. Disturbance may affect breeding success or foraging behaviour. It may also deter birds from entering the area; resulting in birds becoming displaced, which is effectively a form of indirect habitat loss.

23.104 The level of effect often depends on the timing and extent of potentially disturbing activities; effects are likely to be greatest during the breeding season.

23.105 Although the level of disturbance experienced by birds is difficult to quantify, there is a tendency for larger bird species, those higher up the food chain, and those that feed in flocks in the open, to be more vulnerable to disturbance than small bird species living in structurally complex or 'closed' habitats such as woodland (Hill *et al*., 1997).

23.106 Behavioural sensitivity to disturbance also varies between species living within the same habitats. For example, a recent study by Pearce-Higgins *et al*. (2012) found that red grouse

(*Lagopus lagopus*), snipe and curlew densities all declined on onshore wind farms during construction, while those of skylark and stonechat (*Saxicola torquata*) increased. Red grouse numbers had recovered by the first year post-construction, but those of snipe and curlew had not.

23.107 The potential effects associated with construction activities can generally be avoided or mitigated by siting works away from sensitive areas, and timing construction activities outside sensitive periods, such as the breeding season.

Destruction or damage to nests, eggs and chicks

23.108 It is important to note that all birds, their nests and eggs are protected under the Wildlife and Countryside Act 1981 (as amended). Under this Act it is an offence to destroy or damage nests, eggs and/or chicks. Birds (both adults and young) listed on Schedule 1 of this Act are also protected from disturbance during the breeding season.

23.109 Adoption of good practice during site clearance and construction works is therefore required to avoid committing an offence; this is discussed in section 23.12.

Potential effects during operation

23.110 Potential operational effects on terrestrial ornithology interests are identified below. These are likely to be associated with maintenance works and will therefore be infrequent and of temporary duration.

Disturbance and displacement

23.111 Human activities related to maintenance of onshore infrastructure have the potential to cause temporary and localised disturbance effects on birds. Due to the unpredictable nature of the requirement for maintenance works, it is difficult to determine precise effects on birds. However, it is likely that routine maintenance activities would be infrequent and small scale, and would not cause a higher level of disturbance than human activities in the area associated with current land use, such as farming and golfing. It is therefore expected that disturbance effects during operation will be of a lower magnitude than those during construction.

Potential effects during decommissioning

23.112 Onshore works associated with decommissioning may cause disturbance to birds breeding, foraging or roosting within the current onshore project area and surroundings. The level of effect will depend on the bird species present at the time of decommissioning; although this cannot be reliably predicted at this stage, it is likely that the habitats will be similar and will thus support a similar suite of species.

23.113 As decommissioning works are likely to be of a similar nature and duration as construction activities, it is considered that the potential effects resulting from decommissioning are likely to be similar to those resulting from construction, with the exception that habitat will be restored and any displaced birds will be able to return to abandoned territories.

Evaluation of importance

23.114 A summary of the evaluation of the importance of bird species recorded within the terrestrial ornithology survey areas during the 2015 baseline surveys is provided in Table 23-13.

Table 23-160: Evaluation of the level of importance of bird species recorded within the terrestrial ornithology survey areas during the 2015 baseline surveys

Importance	Species	Justification
Very High	Whooper swan Greylag goose	Non-breeding populations of these wildfowl species are designated features of the Caithness Lochs SPA and RAMSAR, and were recorded within the survey area.
	Fulmar Razorbill Guillemot Kittiwake	Breeding populations of these seabirds are designated features of the North Caithness Cliffs SPA, and were breeding within the survey area.
High	Barn owl	Schedule 1 species breeding within the survey area. Given the small size of the local breeding population, this is an important record for the area.
Medium	Peregrine	Breeding peregrine is a designated feature of the North Caithness Cliffs SPA. It is also a Schedule 1 species and is a designated feature of the and East Halladale SSSI. There was a single record of this species but no evidence that it was breeding within the survey area. However, suitable breeding habitat is present within close proximity to the current onshore project area and it is therefore possible that peregrine could breed there in future.
	Puffin Common tern Arctic tern	Seabird species that are either designated features of the North Caithness Cliffs SPA (puffin), or afforded special protection (Arctic and common terns), which were recorded in relatively low numbers during the breeding season. Although there was no evidence of breeding, a limited amount of potentially suitable breeding habitat is present within close proximity to the current onshore project area.
	Shag Black guillemot Herring gull Great black-backed gull Oystercatcher Lapwing Curlew Redshank	Seabird and wader species of moderate or high conservation concern that were breeding within the survey area, but which are not specially protected or a designated feature of any statutory sites within 10 km of the current onshore project area.

Importance	Species	Justification
Low	Wigeon Red-throated diver Great northern diver Golden plover Whimbrel Dunlin Purple sandpiper	Non-passerine species that are afforded special protection, and/or are a designated (breeding) feature of a statutory sites within 10 km of the current onshore project area, but which were recorded in relatively low numbers, with no evidence of breeding and no suitable breeding habitat present within 500 m of the current onshore project area.
	Pink-footed goose Teal Mallard Shelduck Eider Red grouse Gannet Ringed plover Turnstone Knot Sanderling Arctic skua Great skua Black-headed gull Common gull Lesser black-backed gull Kestrel	Non-passerine species of moderate or high conservation concern, but not specially protected or a designated feature of statutory sites within 10 km of the current onshore project area, and which were not identified as breeding within the survey area, and were not recorded in particularly high numbers at any time.
	Skylark Willow warbler Meadow pipit	Passerine species of moderate or high conservation concern, but not specially protected or a designated feature of statutory sites within 10 km of the current onshore project area, which were breeding within the survey area.
	Starling Song thrush Mistle thrush Dunnock House sparrow Grey wagtail Bullfinch Linnet Twite	Passerine species of moderate or high conservation concern, but not specially protected or a designated feature of statutory sites within 10 km of the current onshore project area, which were not recorded during the breeding season, but for which suitable breeding habitat is present within 500 m of the current onshore project area.
	Fieldfare Redwing Snow bunting	Passerine species which are of moderate or high conservation concern, and are specially protected during the breeding season, but are not a designated feature of

Importance	Species	Justification
		statutory sites within 10 km of the current onshore project area. These species have very restricted breeding ranges in Scotland and are unlikely to be breeding within 500 m of the current onshore project area.
Negligible	All other bird species (including buzzard, sparrowhawk, waterbirds such as cormorant, grey heron [*Ardea cinerea*] and little grebe [*Tachybaptus ruficollis*], pigeons and doves, and passerines such as corvids, blackbird [*Turdus merula*], wren and robin [*Erithacus rubecula*])	Common and widespread species of low conservation concern (i.e. species on the UK BoCC Green list that are not SBL or LBAP priority species) that are not afforded any special protection or a designated feature of any statutory sites within 10 km of the current onshore project area.

Species not taken forward to the assessment phase

23.115 Species of negligible importance are not considered further in this assessment; these species are generally common and widespread and none were recorded in exceptionally high numbers within the survey area.

Species taken forward to the assessment phase

23.116 Results from the desk study and field surveys have been compiled to produce baseline descriptions for each bird species of a low or higher level of importance recorded within the survey area. Species are described in order of importance level, with species of greatest importance considered first.

23.117 To avoid repetition, where potential effects on species of the same level of importance are likely to be similar due to similarities in the species ecology, they are assessed as a group (e.g. breeding seabirds that are designated features of the North Caithness Cliffs SPA) rather than individually.

23.118 Species assessed as being of low importance are assessed in groups within a summary table. Although no significant impacts on species of low importance are likely, these species are nevertheless considered because they are of local conservation importance, and mitigation measures could be recommended for such species as a good practice measure.

23.119 Where relevant, potential effects on notified features of statutory sites are included in section 23.10, while overall effects on the sites themselves (in terms of effects on integrity and conservation objectives) are considered separately in section 23.11.

23.9 Assessment of terrestrial ornithology

Species evaluated as being of very high importance

Designated features of the Caithness Lochs SPA and RAMSAR

23.120 Two species that are designated features of the Caithness Lochs SPA and RAMSAR were recorded within the survey area: whooper swan and greylag goose.

23.121 Whooper swan is protected under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) and Annex I of the Birds Directive. It is also an SBL priority species. Whooper swan is included on the UK BoCC Amber list due to the rarity of the breeding population, and localisation in winter (Eaton *et al*., 2015). The species is a common winter visitor in Scotland, where the population is estimated to be 4,142 birds (Forrester *et al*., 2007). Peak abundance of the Orkney and North Caithness NHZ whooper swan population has been estimated at 706 birds (Wilson *et al*., 2015). Caithness is an important wintering and staging area for whooper swans, although mid-winter (December/January) flocks rarely exceed 100 birds (Davey *et al*., 2015).

23.122 Greylag goose is included on the UK BoCC Amber list due to the localisation of the wintering population (Eaton *et al*., 2015). The species is a common resident in Scotland with a native population in the north and west (20,000 birds post-breeding) and a naturalised population in the south and east (5,000 birds post-breeding; at least 700 pairs). After the breeding season, these birds are joined by 85,000+ immigrants from Iceland that winter in lowland areas (Forrester *et al*., 2007). Caithness constitutes a major staging/wintering area for greylag geese with the total aggregation of flocks surpassing 10,000 individuals (Davey *et al*., 2015).

Baseline

23.123 Small flocks of whooper swans were recorded during the winter bird surveys:

- Five birds flying near Loch Achbuiligan to the south of the current onshore project area recorded during the September winter walkover survey;
- Three birds during the November and December 2015 WeBS visits; and
- A flock of four birds in a semi-improved agricultural bordering the current onshore project area to the west during a foraging goose survey visit in October 2015 (Figure 23-13).

23.124 Data provided by the BTO included two records of whooper swans to the south of the current onshore project area (maximum count of six birds), while the RSPB returned a single record from November 2000 of eight whooper swans roosting at Loch Achbuiligan.

23.125 A maximum count of 75 greylag geese was recorded during the winter walkover surveys, including a single registration (11 birds) within the current onshore project area.

23.126 Foraging greylag geese were also recorded during the April, September, October, November, and December 2015 foraging goose survey visits (Figure 23-13). There were 11 observations in total, numbering 8-290 birds, with the largest group observed foraging in a stubble field to the south of Isauld Lodge during the December visit. None of the foraging flocks were within the current onshore project area itself; the closest record was a flock of 140 birds observed in a semi-improved agricultural field bordering the current onshore project area to the west in October 2015 . Most activity occurred in the agricultural and grazing fields to the west of Sandside Bay and near Loch na Moine.

23.127 Both the RSPB and BTO returned several records of greylag geese foraging in fields to the east of Sandside Bay, with a peak count of 574 birds recorded during 2007–11 surveys for the BTO Atlas project.

Potential construction effects

23.128 The current onshore project area is not located within the core foraging areas found to be used by qualifying species of the Caithness Lochs SPA during the winters of 2011-12 and 2012-13 (Patterson *et al*., 2013). Although flocks of whooper swans and greylag geese were occasionally recorded in the vicinity during the 2015 non-breeding season surveys, the numbers of birds present were relatively small, with none recorded within the current onshore project area itself. This suggests that use of the current onshore project area and the fields surrounding it by whooper swans and greylag geese is limited to very occasional foraging by relatively small numbers of birds.

23.129 There is a potential for any whooper swans or greylag geese foraging within the current onshore project area and surrounding fields to be disturbed during construction. However, the number of birds that would potentially be affected is likely to be very small. The maximum counts recorded during the 2015 non-breeding season surveys were five whooper swans and 290 greylag geese (around half of greylag goose observations were of 30 or fewer birds). Moreover, disturbance during construction will be of temporary duration, and suitable alternative feeding habitat is available in the surrounding area (such as the many fields to the east of the current onshore project area that were used by SPA birds in 2011-12 and 2012-13; Patterson *et al*., 2013). Thus, it is likely that any foraging birds temporarily disturbed during construction can be supported in the surrounding area.

23.130 As such, potential disturbance effects during construction are assessed as being of temporary duration and low to negligible level, with only small numbers of foraging birds potentially affected in the short-term. **No significant impacts** on the local whooper swan and greylag goose populations are predicted during construction and specific mitigation for these species is not required.

Potential operation effects

23.131 It is possible that whooper swans or greylag geese foraging within the current onshore project area and surrounding area could be disturbed due to human activity related to maintenance works during the operational phase. Based on site use by these species, the numbers of birds that would potentially be affected is likely to be small. In addition, any works would be temporary, and likely to affect a relatively small area (given the small size of the current onshore project area). It is unlikely that the level of human disturbance associated with such small-scale works would be any higher than already exists due to current land-use practices (farming and golfing).

23.132 As such, potential disturbance effects during operation are assessed as being of temporary duration and low to negligible level, with only small numbers of foraging birds potentially affected in the short-term. **No significant impacts** on the local whooper swan and greylag goose populations are predicted during operation and specific mitigation for these species is not required.

Potential decommissioning effects

23.133 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the local whooper swan and greylag goose populations are predicted during decommissioning and specific mitigation for these species is not required.

Breeding seabird species listed as designated features of the North Caithness Cliffs SPA

23.134 Four seabird species that are designated features of the North Caithness Cliffs SPA were found to be breeding within the survey area to the west of the current onshore project area: fulmar, razorbill, guillemot and kittiwake.

23.135 Kittiwake was recently moved from the UK BoCC Amber list to the Red list (Eaton *et al*., 2015), due to serious declines in the breeding population. The other three species are included on the UK BoCC Amber list due to localisation of the species breeding populations, and in the case of razorbill and guillemot (but not fulmar), due to the international importance of the UK breeding populations (Eaton *et al*., 2015).

23.136 Fulmar is a common cliff-nesting species throughout coastal areas of Scotland, with a few inland colonies. The Scottish breeding population is estimated at 486,000 apparently occupied nest sites (Forrester *et al*., 2007). Fulmar is a common breeding bird around the Caithness coastline. The main colonies are at Dunnet Head, Duncansby Head and on the east Caithness cliffs between Wick and the Ord, but the species also nests in smaller geos and cliffs all along the coast (Davey *et al*., 2015). Numbers of breeding fulmars in Caithness have shown an increase in recent decades, from 25,922 apparently occupied sites recorded during the first national census in 1969 to 1970 ('Operation Seafarer'; Cramp *et al*., 1974); 32,131 during the subsequent census in 1983-85 (the 'Seabird Colony Register [SCR] Census'; Lloyd *et al*., 1991); and 29,957 during the most recent census in 1998-2002 ('Seabird 2000 Census'; Mitchell *et al*., 2004).

23.137 With an estimated Scottish breeding population of 93,300 pairs, breeding razorbills are widely distributed at a number of coastal colonies around the country (Forrester *et al*., 2007). In the summer, razorbills are present around the entire Caithness coast, breeding in scattered colonies on stacks and broken cliff faces; the largest concentrations coincide with large guillemot colonies (Davey *et al*., 2015). Numbers in the region have fluctuated between national censuses, with 26,138 breeding birds recorded during the first national census in 1969-70; 17,376 during the subsequent census in 1983-85; and 20,333 during the most recent census in 1998-2002 (Mitchell *et al*., 2004).

23.138 Guillemot is common along Scottish coasts, except where there are no mainland cliffs or offshore islands. The Scottish breeding population is estimated at 780,000 pairs, with the main breeding concentrations in the north and west of the country (Forrester *et al*., 2007). Guillemots breed on the Caithness coast in huge numbers, with one of the largest densities in the British Isles present between Latheron and the Ord in south-west Caithness (Davey *et al*., 2015). Numbers in the region have increased between national censuses, from 63,096 breeding birds recorded during the first national census in 1969-70; 146,753 during the subsequent census in 1983-85; and 226,254 during the latest census in 1998-2002. This represents an increase of 54% between the two most recent censuses (Mitchell *et al*., 2004).

23.139 Kittiwake is a common and widespread breeding bird that nests on suitable cliff habitat on exposed, rocky coastline throughout Scotland. The Scottish breeding population is estimated at 282,200 adults on nests (Forrester et al., 2007). In Caithness, the species remains a regular breeding bird with large concentrations west of Sandside Head (part of the North Caithness Cliffs SPA) and on the cliffs south of Wick (Davey *et al*., 2015). Numbers in the region have fluctuated between national censuses, with 54,771 breeding birds recorded during the first national census in 1969-70; 46,560 during the subsequent census in 1983-85; and 49,533 during the most recent census in 1998-2002 (Mitchell *et al*., 2004).

Baseline

23.140 Peak counts of up to 150 nesting fulmar pairs, 1,050 individual guillemots, 890 individual kittiwakes and 300 individual razorbills were recorded within the survey area during the 2015 breeding seabird survey.

23.141 There are also historic breeding records of all four species within the local area.

Potential construction effects

23.142 As no construction works are likely to take place in the hard cliff habitat bordering the current onshore project area to the north, it is not expected that any cliff-nesting habitat will be lost during the onshore construction works.

23.143 In terms of disturbance effects, a review of the impact of public access on the breeding success of ground-nesting and cliff- nesting birds (Showler *et al*., 2010) found little quantitative evidence to draw any firm conclusions regarding cliff-nesting species, but the few studies that existed suggested a negative impact on breeding success. Similarly, there is limited information regarding disturbance distances for cliff-nesting seabirds, and no clear guidance on acceptable buffer zones to minimise effects. A study by Beale & Monaghan (2004) of nesting success in kittiwakes and guillemots suggested that perceived predation risk is a good predictor of the effects of disturbance. The findings showed that this risk, and therefore disturbance effects, varied both with distance from humans and the number of humans present.

23.144 All nesting seabird colonies recorded during the 2015 breeding seabird survey were located to the west of Sandside Bay. This area is more suitable for breeding birds than the coastline adjacent to the current onshore project area, which is dominated by slabbing rocks, rather than steep cliffs/stacks (see Figure 4-8, Chapter 4: Project Description). Notwithstanding the lack of clear guidance on disturbance distances in cliff-nesting seabirds, most or all of the nesting colonies are likely to be separated from onshore construction works by several hundred metres. In addition, the construction works will be of temporary duration.

23.145 As such, potential effects during construction are assessed as being negligible, and **no significant impacts** on breeding populations of seabird species that are designated features of the North Caithness Cliffs are predicted.

23.146 Although it is not considered that specific mitigation measures for seabirds are required, good practice measures are outlined in section 23.12 to ensure compliance with the relevant legislation protecting breeding birds. Potential operation effects

23.147 Based on the distance between nesting birds and the current onshore project area, the potential for birds to be affected during the operational phase, due to human activity related to routine maintenance works, is minimal. In addition, any works would be temporary, and likely to affect a relatively small area (given the small size of the current onshore project area). It is unlikely that the level of human disturbance associated with such small-scale works would be any higher than already exists due to current land-use practices (farming and golfing).

23.148 As such, potential disturbance effects during operation of the Project are assessed as being of a negligible level, and **no significant impacts** on breeding populations of seabird species that designated features of the North Caithness Cliffs are predicted.

23.149 However, should any significant maintenance works be required during the breeding season, it is advised that the good practice measures described in section 23.12 are applied during the period that the works are undertaken, to ensure compliance with the relevant legislation protecting breeding birds.

Potential decommissioning effects

23.150 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on any seabird populations belonging to the North Caithness Cliffs SPA are predicted during decommissioning.

23.151 However, as a precaution, relevant good practice measures described in section 23.12 should be applied during decommissioning to ensure compliance with the relevant legislation protecting breeding birds.

Species evaluated as being of high importance

Barn owl

23.152 Barn owl is protected under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended), and is also an SBL priority species. With an estimated population of 500-1,000 breeding pairs and 1,000-2,000 wintering individuals barn owl is a resident breeding species in Scotland. The species range is limited by its susceptibility to hard winters, particularly during extended periods of snow cover, and the highest numbers are present in the south and west of the country (Forrester *et al*., 2007). The barn owl has naturally extended its range throughout Caithness with single records in 1994-1996 and the first successful breeding attempt in 1999. Since then, numbers gradually increased over several years. Severe winters in 2009-10 and 2010-11 had a noticeably detrimental impact on the species, although from 2014 many previously occupied territories were again in use (Davey *et al*., 2015).

Baseline

23.153 A barn owl nest was recorded during the breeding raptor survey, more than 100 m from the current onshore project area; full details of the location are provided in a Confidential Annex to Technical Appendix 23.1. Given the small size of the local breeding population, this is an important record for the area.

23.154 Anecdotal evidence suggests that barn owls have nested at this location for several years. Historic records of barn owls within the search area were also provided by the BTO and RSPB.

Potential construction effects

23.155 No structures suitable for nesting barn owls will be affected during construction; therefore there is no potential for nesting habitat to be lost. Furthermore, none of the proposed onshore construction works will be within 100 m of the existing nest, which is the recommended exclusion zone to avoid disturbance to breeding barn owls (Ruddock & Whitfield, 2007; Whitfield *et al*., 2008).

23.156 It is possible that a small amount of habitat will be temporarily unavailable to hunting birds during the construction works. However, more suitable hunting habitat is available in the surrounding area, particularly to the south of the current onshore project area.

23.157 As such, potential disturbance effects to breeding and foraging birds during construction are assessed as being of a negligible level. Therefore, **no significant impacts** on the local barn owl population are predicted during construction and specific mitigation is not required. Good practice measures to ensure compliance with the relevant legislation protecting all breeding birds are outlined in section 23.12.

Potential operation effects

23.158 As the barn owl nest location is more than 100 m away from onshore infrastructure, including the access track, breeding birds would not be disturbed due to human activity associated with maintenance works during the operational phase. As barn owls hunt at night and any routine maintenance required is likely to be undertaken during the day, it is unlikely that any hunting birds would be disturbed. Furthermore, any works would be temporary, and likely to affect a relatively small area of foraging habitat.

23.159 As such, potential disturbance effects to breeding barn owls during operation are assessed as being of a negligible level. Therefore, **no significant impacts** on the local barn owl population are predicted during operation and specific mitigation is not required.

23.160 However, should any significant maintenance works be required during the breeding season, it is advised that good practice measures described in section 23.12 should be applied during the period that the works are undertaken, to ensure compliance with the relevant legislation protecting all breeding birds.

Potential decommissioning effects

23.161 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the local barn owl population are predicted during decommissioning and specific mitigation is not required. However, as a precaution, relevant good practice measures described in section 23.12 should be applied during decommissioning to ensure compliance with the relevant legislation protecting all breeding birds. Species evaluated as being of medium importance

Peregrine

23.162 Peregrine is protected under Schedule 1 of the Wildlife and Countryside Act 1981 (as amended) and Annex I of the Birds Directive. It is also an SBL priority species, and breeding peregrine is a designated feature of the North Caithness Cliffs SPA. Numbers, distribution and breeding performance of the UK peregrine population have all largely recovered from a historical population decline in the 1950s and 1960s caused by the effects of organochlorine pesticides (Newton, 2013). The Scottish peregrine population is estimated at around 600 breeding pairs and 2,000-2,500 individuals during the winter (Forrester *et al*., 2007). Preliminary analyses published on the BTO website[65] have shown that, although the overall number of breeding peregrine pairs in the UK have remained relatively stable between national censuses in 2002 and 2014, there has been a small decline of 11% in Scotland, and a major distributional shift away from the uplands (North East Scotland Raptor Study Group, 2015) and towards lowland regions and the coast.

23.163 The Orkney and North Caithness NHZ breeding peregrine population has been estimated at 22 pairs (based directly on the 2014 national survey dataset; Wilson *et al*., 2015). In Caithness, peregrines still breed on sea cliffs and at some inland sites. They remain faithful to regular breeding sites and the main stronghold in the area is the high sea cliffs of the north and east coasts. There is some indication of a decline in numbers of breeding birds in the region between 1988-91 and 2007-12 and the species presence is considered to be precarious, with some traditional and more accessible sites having been abandoned (Davey *et al*., 2015). In 2014, raptor workers in Caithness identified just three home ranges occupied by peregrine pairs (Challis *et al*., 2015).

Baseline

23.164 A single peregrine flight recorded just to the south of the current onshore project area was the only record of this species during terrestrial ornithology surveys, and there was no evidence that the species was breeding within 2 km. This indicates that use of the current onshore

[65] http://www.bto.org/volunteer-surveys/peregrine-survey/results (last accessed 14/01/2016)

project area is limited to occasional foraging flights. However, suitable habitat is present within the wider survey area and it is possible that the species could breed there in future.

23.165 The HRSG did not return any records of breeding peregrines within 2 km of the current onshore project area. Historic records of peregrine within the local area were provided by the BTO. The majority of these records related to the non-breeding season; however, there was a single 'probable breeding' record of peregrine within the NC96 hectad.

Potential construction effects

23.166 No peregrine nest sites were identified within 2 km of the current onshore project area. Moreover, as the adjacent stretch of coastline is dominated by slabbing rocks, rather than steep cliffs/stacks, there are unlikely to be any suitable nesting sites for peregrines in the vicinity of the current onshore project area. More suitable nesting habitat is available in the wider area, particularly to the west.

23.167 It is possible that a very small amount of habitat will be temporarily unavailable to hunting peregrines. However, the number of birds potentially affected is likely to be small, and suitable alternative hunting habitat is available in the surrounding area.

23.168 As such, potential disturbance effects to breeding and foraging birds during construction are assessed as being of negligible level, and, **no significant impacts** on the local peregrine population are predicted.

23.169 Although it is not considered that specific mitigation measures for peregrine are required, good practice measures to ensure compliance with the relevant legislation protecting all breeding birds are outlined in section 23.12.

Potential operation effects

23.170 As no peregrine nests were identified within 2 km of the current onshore project area, breeding birds would not be disturbed due to human activity related to routine maintenance works during the operational phase. Although it is possible that birds may nest within this area in future, the coastline adjacent to the current onshore project area is unlikely to be suitable for nesting peregrine. Moreover, any works would be temporary, and likely to affect a relatively small area (given the small size of the current onshore project area). In addition, it is unlikely that the level of human disturbance associated with such small-scale works would be any higher than already exists due to current land-use (farming and golfing). Furthermore, peregrines appear to be relatively tolerant to disturbance (although this varies according to factors such as accessibility of the nest site). There is also evidence that the species is able to habituate to at least some forms of human disturbance, as witnessed by its occupation of disturbed nest sites such as working quarries and urban centres (Ruddock & Whitfield, 2007).

23.171 The potential for hunting birds to be affected by routine maintenance works is minimal because peregrines do not appear to make regular use of the site for hunting.

23.172 As such, potential disturbance effects during operation are assessed as being of negligible level and, **no significant impacts** on the local peregrine population are predicted.

23.173 However, should any significant maintenance works be required during the breeding season, it is advised that good practice measures described in section 23.12 be applied during the period that the works are undertaken, to ensure compliance with the relevant legislation protecting all breeding birds.

Potential decommissioning effects

23.174 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the local peregrine population are predicted during decommissioning.

23.175 However, as a precaution, relevant good practice measures described in section 23.12 should be applied during decommissioning to ensure compliance with the relevant legislation protecting all breeding birds.

23.176 **Protected and SPA-designated seabird species that could potentially breed within close proximity to the current onshore project area in future**

23.177 Puffin, common tern and Arctic tern were recorded in the survey area during the breeding season. Breeding puffin is a designated feature of the Caithness Cliffs SPA, while common tern and Arctic tern are afforded special protection under Annex I of the Birds Directive.

23.178 Puffin was recently moved from the UK BoCC Amber list to the Red list (Eaton *et al*., 2015), due to its status as 'Globally Threatened' under International Union for Conservation of Nature (IUCN) guidelines[66], as assessed by BirdLife International[67] (BirdLife International, 2015). Arctic tern is included on the UK BoCC Amber list due to moderate decline in breeding population range and numbers, while common tern is Amber-listed due to localisation of the breeding population (Eaton *et al*., 2015).

23.179 Puffins are rarely seen inshore, except during the breeding season, when it is highly colonial, typically nesting in burrows on islands free from ground predators. The Scottish breeding population is estimated at 493,000 pairs (Forrester *et al*., 2007). In Caithness the species usually breeds in well-established colonies (Drumhollistan, Dunnet Head, Duncansby Stacks and Noss Head) and in smaller, more scattered numbers among other auk species elsewhere along coastal cliffs. Results of national census work show that there has been a dramatic decline in puffin numbers breeding on the Caithness coast over the last forty years, with 28,100 apparently occupied burrows recorded during the first seabird census in 1969-70, 2,675 birds during the 1985-88 census, and just 1,278 during the most recent census in 1998-2002. This represents an overall decline of 95% (Mitchell *et al*., 2004). However, Davey *et al*. (2015) note that, following several years of poor productivity, 2015 saw a noticeable improvement with many juveniles recorded off the east coast of Stroma, and many birds on cliffs and sea.

23.180 Arctic tern is a summer visitor to Scotland, nesting discontinuously around the coasts of the mainland (but with strongholds in Orkney and Shetland). The Scottish breeding population is estimated at 47,300 adults on nests (Forrester *et al*., 2007). Although the distribution of Arctic terns in Caithness has remained fairly constant across recent decades (Davey *et al*., 2015), numbers of breeding pairs have declined from 2,073 pairs during the first seabird census in 1969-70 to 574 during the most recent census in 1998-2002, which represents a decline of 71% (Mitchell *et al*., 2004).

23.181 Common tern is also a summer visitor to Scotland; although it is primarily a freshwater species, almost all common terns breed at the coast or beside estuaries. The Scottish breeding population is estimated at 4,800 adults on nests (Forrester *et al*., 2007). Although numbers of

[66] The species is assessed as 'Vulnerable' on the IUCN Red List of Threatened Species (www.iucnredlist.org; last accessed 15/01/2016)

[67] The IUCN Red List Authority for birds.

common terns in Caithness have remained fairly constant between national surveys (at 44-49 pairs; Mitchell *et al*., 2004), the distribution of breeding birds has contracted across almost all of Caithness and Sutherland (Davey *et al*., 2015).

Baseline

23.182 All three species were recorded during the breeding seabird survey, although no breeding behaviour was observed. The cliffs within the survey area may offer potentially suitable nesting habitat for puffins. Similarly, small numbers of Arctic terns are known to occasionally breed on the seaward edge of unvegetated sea cliffs similar to those present within the survey area, and also rarely in pastureland (Forrester *et al*., 2007). The survey area also offers potentially suitable breeding habitat for common tern in isolated areas. However, the habitat within the current onshore project area and immediate surroundings is likely to be of limited suitability for these species, with more optimal breeding habitat present in the wider area, particularly to the west.

23.183 The BTO returned three Atlas records of nesting puffins (each numbering 3-11 birds), three records of Arctic tern (two of birds that were possibly breeding and one of birds that were confirmed to be breeding) and a single common tern record (possibly breeding) from the NC96 hectad.

Potential construction effects

23.184 No construction works are expected to take place in the hard cliff habitat bordering the current onshore project area to the north and it is not anticipated that any cliff-nesting habitat will be lost during the onshore construction works. As no puffin or tern nest sites were identified within 2 km of the current onshore project area, and the habitat within close proximity is likely to be of very limited suitability, effects on breeding birds as a result of disturbance during construction are predicted to be negligible. Therefore, **no significant impacts** on breeding puffins or terns are predicted.

23.185 Although it is not considered that specific mitigation measures for puffins or terns are required, good practice measures to ensure compliance with the relevant legislation protecting all breeding birds are proposed in section 23.12.

Potential operation effects

23.186 As no nesting puffins or terns were present within 2 km of the current onshore project area, breeding birds would not be disturbed due to human activity related to routine maintenance works during the operational phase.

23.187 It is possible that small numbers of birds may breed within the current onshore project area or nearby coastal habitat in future. However, any works would be temporary, and likely to affect a relatively small area (given the small size of the current onshore project area). Furthermore, it is unlikely that the level of human disturbance associated with such small-scale works would be any higher than already exists due to current land-use (farming and golfing).

23.188 As such, potential disturbance effects during operation are assessed as being of a negligible level. Therefore, **no significant impacts** on the local puffin and tern populations are predicted during operation.

23.189 However, should any significant maintenance works be required during the breeding season, it is advised that good practice measures described in section 23.11 should be applied to ensure compliance with the relevant legislation protecting all breeding birds.

Potential decommissioning effects

23.190 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the local puffin or tern populations are predicted during decommissioning.

23.191 However, as a precaution, relevant good practice measures described in section 23.12 should be applied during decommissioning to ensure compliance with the relevant legislation protecting all breeding birds.

Other breeding seabird species

23.192 Four other seabird species (shag, black guillemot, herring gull and great black-backed gull) that are of moderate to high conservation concern (but not specially protected or a designated feature of the North Caithness Cliffs SPA) were found to be breeding within the survey area.

23.193 Shag was recently moved from the UK BoCC Amber list to the Red list (Eaton *et al*., 2015), due to a severe decline in the breeding population. It is a common and widespread breeding species in coastal regions throughout Scotland, with the largest colonies in the north and west. The Scottish breeding population is estimated at 21,500-30,000 pairs (Forrester *et al*., 2007). In Caithness there has been a recent decline in breeding shag numbers (Davey *et al*., 2015). The most recent national census in 1998-2002 recorded 61 breeding shags on the north Caithness coast and 1,075 on the east coast, while the previous census in 1985-88 recorded 120 and 2,532 nests respectively. This represents an overall decline of 57% (Mitchell *et al*., 2004).

23.194 Black guillemot is included on the UK BoCC Amber list due to a moderate decline in the breeding population (Eaton *et al*., 2015). In Scotland, the black guillemot is a common coastal resident, with a distribution largely restricted to the north and west of the country. The Scottish breeding population is estimated at 18,750 breeding pairs (Forrester *et al*., 2007). In Caithness, black guillemot is resident along the entire coast, feeding inshore and breeding in small local colonies associated with broken cliff faces, geos and caves, often away from the large seabird cliffs. Typically birds nest in loose colonies at lower levels than other auk species (Davey *et al*., 2015). National censuses recorded 1,104 pre-breeding black guillemots in East Caithness in 1999-2001, and 1,701 in 1985, representing a decline of 35% (Mitchell *et al*., 2004).

23.195 Herring gull is included on the UK BoCC Red list due to a severe long-term decline in the breeding population (Eaton *et al*., 2015). It is also an SBL and Highland LBAP priority species. Herring gull is a common resident breeding species in Scotland, with colonies around the entire coast, and some inland colonies scattered around the country. Birds typically breed on rocky shorelines and coastal islets, but also uses coastal cliffs, sand dunes, grassy areas and shingle beds, as well as inland sites. The Scottish population numbers around 72,100 adults on nests, which is thought to represent at least 49% of the UK and Irish breeding population (Forrester *et al*., 2007). However, numbers of breeding pairs at Scottish coastal colonies have declined by 55% between the first national seabird census in 1969-70 and the most recent census in 1998-2002 (Mitchell *et al*., 2004).

23.196 The Orkney and North Caithness NHZ breeding herring gull population has been estimated at 3,455 pairs (Wilson *et al*., 2015). During the first national census in 1969-70, the Caithness cliffs supported 22,483 breeding birds, which was the second highest regional total (Cramp *et al*., 1974). Since then, numbers of nesting birds in Caithness have declined dramatically, to 10,033 during the 1985-88 census and 3,743 during the most recent census in 1992-2002, which represents an overall decline of 83% (Mitchell *et al*., 2004). More recently, an unusually high count of approximately 10,000 herring gulls was recorded in August 2012 at Seater Landfill Site near Bower in north-eastern Caithness (the birds were disturbed by a gas gun). Many of these birds were juveniles and assumed to be from the North Caithness Cliffs SPA, although a proportion may have been migrants (Davey *et al*., 2015).

23.197 Great black-backed gull is included on the UK BoCC Amber list due to moderate declines in both the breeding and wintering populations (Eaton *et al*., 2015). The Scottish great black-backed gull breeding population is estimated at 14,800 nests. The largest numbers occur in western areas, the north coast and Northern Isles. Smaller numbers breed along the east coast and inland. Birds mainly breed on small, usually uninhabited coastal islands, remote coasts and cliffs, but occasionally nest inland (Forrester *et al*., 2007).

23.198 The Orkney and North Caithness NHZ breeding great black-backed gull population has been estimated at 1,712 pairs (Wilson *et al*., 2015). In Caithness great black-backed gull breeds regularly on headlands, stacks and cliffs, but no longer inland (Davey *et al*., 2015). Like herring gull, numbers of great black-backed gulls breeding in Caithness have shown a severe decline over recent decades, with an estimated 1,048 and 1,013 birds during the 1969-70 and 1985-88 national censuses respectively, and just 211 pairs during the most recent, census in 1992-2002. This represents an overall decline of 80% (Mitchell *et al*., 2004), with much of the decline occurring between the two most recent censuses.

Baseline

23.199 Peak counts of up to 11 shag nests, a single black guillemot exhibiting breeding behaviour, ten herring gull nests and two great black-backed gull nests were recorded within the survey area during the breeding raptor and seabird survey.

23.200 Small numbers of all four species were also recorded during the winter bird surveys, with peak counts of 10 shag, four black guillemot, 15 herring gull and 22 great black-backed gull.

23.201 The BTO returned several records of all four species within the NC96 hectad, including two potential breeding records of black guillemot, and confirmed breeding records of the other three species.

Potential construction effects

23.202 No construction works are expected to take place in the hard cliff habitat bordering the current onshore project area to the north and it is not anticipated that any cliff-nesting habitat will be lost during the onshore construction works.

23.203 As stated above (paragraph 23.139) there is some evidence indicating that public access may have a negative impact on the breeding success of cliff-nesting seabirds (Showler *et al*., 2010), but limited information regarding disturbance distances, and no clear guidance on acceptable buffer zones to minimise effects.

23.204 All nesting seabirds were located to the west of Sandside Bay, which provides more optimum nesting habitat for cliff-nesting birds such as shags than the coastline adjacent to the current onshore project area, which is dominated by slabbing rocks. However, this habitat may be suitable for other nesting seabird species such as herring gulls and eider. Notwithstanding the lack of clear guidance on disturbance distances in cliff-nesting seabirds, most or all of the nesting colonies are likely to be separated from the current onshore project area by several hundred metres. The two gull species were nesting furthest away, with all nests more than 2 km from the current onshore project area. Moreover, these two species are relatively tolerant of human activity, sometimes breeding on roofs for example. In addition, the works will be of temporary duration and restricted to a relatively small area.

23.205 As such, potential disturbance effects during construction are assessed as being of short-term duration and negligible magnitude resulting in **no significant impact** on the local shag, black guillemot, herring gull and great black-backed gull populations.

23.206 However, as potentially suitable (albeit limited) nesting habitat for some seabird species is present in relatively close proximity to the current onshore project area, as a precautionary approach, good practice measurers are proposed in section 23.12 to ensure compliance with the relevant legislation protecting all breeding birds .

Potential operation effects

23.207 Based on the distance between nesting birds and the current onshore project area, the potential for birds to be affected during the operational phase, due to human activity related to routine maintenance works, is minimal. In addition, any works would be temporary, and likely to affect a relatively small area (given the small size of the current onshore project area). Furthermore, it is unlikely that the level of human disturbance associated with such small-scale works would be any higher than already exists due to current land-use (farming and golfing).

23.208 As such, potential disturbance effects during operation are assessed as being negligible, and **no significant impacts** on local breeding populations of shag, black guillemot, herring gull and great black-backed gull are predicted.

23.209 However, should any significant maintenance works be required during the breeding season, it is advised that specific mitigation described in section 23.12 should be applied during the period that the works are undertaken, to ensure compliance with the relevant legislation protecting all breeding birds.

Potential decommissioning effects

23.210 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on local breeding populations of shag, black guillemot, herring gull and great black-backed gull are predicted during decommissioning.

23.211 However, as a precautionary measure (to protect any seabirds breeding close to the current onshore project area in future), relevant mitigation described in section 23.12 should be applied during decommissioning.

Wader species breeding within the survey area

23.212 Four wader species (lapwing, curlew, oystercatcher and redshank) that are of moderate to high conservation concern (but not specially protected or a designated feature of any statutory sites within 10 km of the onshore project area) were found to be breeding within the survey area.

23.213 Oystercatcher is included on the UK BoCC Amber list due to its status as 'Vulnerable' on the European Red List of Birds (BirdLife International, 2015), localisation of the UK wintering population, and because the UK supports breeding and non-breeding populations of international importance. With a Scottish breeding population estimated at 84,500-116,500 pairs, oystercatcher is a widespread and common breeding species both on farmland and coastal areas (Forrester *et al*., 2007). However, the results of the national breeding bird survey

(BBS) organised annually by the BTO, show a significant decline in the Scottish breeding population of 29% between 1995 and 2013 (Harris *et al*., 2015). In Caithness, oystercatcher is a widespread breeding species and coastal visitor in winter, with populations during both seasons appearing to have remained relatively stable over recent decades (Davey *et al*., 2015).

23.214 Lapwing is included on the UK BoCC Red list due to severe declines in the breeding population (Eaton *et al.*, 2015). It is also an SBL and Highland LBAP priority species. Lapwing is a common and widespread resident in farmland habitats in Scotland. The Scottish breeding population is estimated at 71,500-105,600 breeding pairs (Forrester *et al.*, 2007). However, the results of the national BBS show a significant decline in the Scottish breeding population of 59% between 1995 and 2013 (Harris *et al.*, 2015). In Caithness, lapwings have undergone severe long-term declines; between national bird atlas surveys in 1988-91 (Gibbons *et al.*, 1993) and 2007-12 (Balmer *et al.*, 2013), and there has been an estimated decline in breeding productivity of approximately 90% (Davey *et al.*, 2015).

23.215 Curlew was recently moved from the UK BoCC Amber list to the Red list (Eaton *et al*., 2015) due to a severe, long-term decline in the breeding population, and it was recently suggested that curlew should be considered the highest conservation priority bird species in the UK (Brown *et al*., 2015). Curlew is also an SBL and Highland LBAP priority species. With a Scottish breeding population estimated at approximately 58,800 pairs, curlew is a widespread resident, breeding on farmland and uplands (Forrester *et al*., 2007), although recent BBS records for Scotland show a 55% decline in breeding birds between 1995 and 2013 (Harris *et al*., 2015).

23.216 The Orkney and North Caithness NHZ breeding curlew population has been estimated at 3,233 pairs in 2005 (Wilson *et al*., 2015), although the authors note that this figure should be treated with caution. In Caithness, curlews appear to be relatively abundant (compared with the rest of the UK); surveys on three farmland sites with a mix of habitats including unimproved grassland and rush (*Juncus*) species have recorded densities of 5-8 pairs/km^2, with one site supporting up to five displaying males within a 300 m radius. However, there is some indication that the Caithness population is also beginning to decline (Davey *et al*., 2015).

23.217 Redshank is included on the UK BoCC Amber list due to moderate declines in the breeding and wintering populations, moderate declines in the breeding range, and because the UK supports a non-breeding population of international importance (Eaton *et al*., 2015). Redshank is a common and widespread resident and migrant in Scotland, where birds breed mainly on farmland. The Scottish breeding population is estimated at 11,700-17,500 breeding pairs (Forrester *et al*., 2007). However, the results of the national BBS show a significant decline in the Scottish breeding population of 59% between 1995 and 2013 (Harris *et al*., 2015). Like lapwings, redshanks have undergone a dramatic decline in Caithness over recent decades (Davey *et al*., 2015). During surveys for the 1988-91 Breeding Bird Atlas (Gibbons *et al*., 1993) redshanks were confirmed to be breeding in 16 hectads; by 2012, that figure was reduced to just six hectads (Davey *et al*., 2015).

Baseline

23.218 Six oystercatcher territories, eight lapwing territories, four curlew territories and a single redshank territory were recorded within the breeding bird survey area.

23.219 All four species were also recorded during the winter bird surveys, with peak counts of 129 oystercatcher, 457 lapwing, 86 curlew and 40 redshank.

23.220 The BTO returned several records of all four wader species within the NC96 hectad, including confirmed breeding records of oystercatcher and lapwing, and potential breeding records of curlew and redshank.

Potential construction effects

23.221 Ten of the 19 wader territories recorded during the 2015 breeding bird survey were located more than 500 m from the current onshore project area.

23.222 Of the remaining nine territories, just two were located within the current onshore project area (single oystercatcher and curlew territories). Birds breeding within the current onshore project are likely to be more vulnerable to construction effects than those breeding in the buffer, as they may be affected by direct loss of nesting habitat as well as being subjected to higher levels of disturbance due to their closer proximity to construction areas.

23.223 Even under the worst case scenario, the total area of land-take during the construction works is relatively small, with preliminary estimates (based on indicative infrastructure locations) of up to 10.29 ha of habitat loss, some of which will be reinstated following construction. . As such, the loss of suitable habitat for breeding and foraging waders is relatively small, and the number of birds that would be affected is likely to be relatively low.

23.224 There is limited information available regarding distances at which human activity initiates disturbance in UK breeding wader species, and no clear guidance on acceptable buffer zones to minimise effects to nesting waders.

23.225 Studies of the effects of disturbance on breeding golden plovers in the Peak District National Park showed that birds used heavily disturbed habitat near the Pennine Way footpath at a lower rate than surrounding areas (Yalden & Yalden, 1989; 1990). In a less disturbed area of the same National Park, there was no evidence that golden plovers avoided disturbed areas (Higgins *et al*., 2007). Following resurfacing of the footpath (which resulted in fewer people straying from it; Pearce-Higgins & Yalden 1997), avoidance rates were reduced from 200 m to 50 m (Finney *et al*., 2005), and there was no detectable impact of disturbance on reproductive performance (Finney *et al*., 2005; Higgins *et al*., 2007). Dunlins showed a similar response, with levels of habitat utilisation within 200 m of the footpath showing a non-significant increase of approximately 50% following footpath resurfacing (Higgins *et al*., 2007).

23.226 These studies suggest that high levels of disturbance can affect habitat usage by upland wader species, but only in limited circumstances where visitor pressure is relatively high. In addition, effects on waders can be minimised by restricting human activities to specific areas.

23.227 Although there have been several publications in recent years that consider disturbance effects to breeding waders such as curlew and golden plover resulting from onshore wind farms (e.g. Pearce-Higgins *et al*., 2009; 2012; Whitfield *et al*., 2010, Douglas *et al*., 2011, Fielding & Haworth, 2013), much of this information relates to the operational stage. Such conditions are not considered to be comparable to the onshore element of this Project, either during operation or construction.

23.228 The study by Pearce-Higgins *et al*. (2012) does include an analysis of disturbance effects to breeding bird species (including five wader species) during the construction stage of an onshore wind farm, but this situation is likely to be very different from that of the construction of an onshore cable corridor for an offshore wind farm, in terms of magnitude, extent, duration etc. Nonetheless, the study provides useful information regarding responses of breeding waders to construction activities. Of the five wader species included in the study, curlew and snipe were identified as the species most vulnerable to disturbance effects.

Breeding numbers of both species declined (by approximately 40% and 53% respectively) within 620 m of (turbine) construction works, and neither had recovered by the first year post-construction. No significant effects of onshore wind farms were identified for the three other wader species studied (golden plover, lapwing and dunlin).

23.229 Although it has already been acknowledged that different species may show differing levels of sensitivity (paragraph 23.100), in the absence of guidance on acceptable buffer zones to minimise disturbance effects to breeding waders, effects on curlew and snipe are considered to provide a suitable proxy for effects on other, potentially less sensitive, wader species breeding within the survey area.

23.230 . Under the 'worst case scenario' that indicative onshore cable route 1 and HDD are selected, based on the findings of the study by Pearce-Higgins *et al*. (2012), if construction takes place during the breeding bird season, a loss of around half of the breeding wader territories within 500 m of the current onshore project area may be expected, i.e. two oystercatcher territories, two lapwing territories, and single curlew and redshank territories. This is likely to represent a conservative estimate because the scale and duration of the onshore element of the Project construction works will be far lower than that for a typical onshore wind farm, although it is difficult to predict perceived threat levels experienced by breeding waders in response to onshore construction works.

23.231 Although it is likely that suitable breeding habitat is available elsewhere in the survey area to support most or all birds affected by direct or indirect habitat loss (i.e. displacement due to disturbance), a worst case scenario has been used for this assessment as a precaution and it is therefore predicted that these breeding birds would be lost from the local population.

23.232 Several additional breeding wader territories were recorded within 500 m of the access track for the current onshore project area and/or the A836 road to the south-east. Construction works associated with upgrading of the access track may be required, and there will be a temporary increase in traffic volume along the access track and the A836 (due to construction traffic), which may increase disturbance effects to waders breeding nearby. The fact that several pairs of curlews and lapwings and a single pair of oystercatchers had established breeding territories in close proximity to these existing roads in 2015 suggests that they exhibit a certain degree of tolerance to disturbance from vehicles, as well as disturbance related to other types of human disturbance in the area (e.g. farming activities). However, as a worst case scenario, it might be expected that the two lapwing and single oystercatcher territories close to the proposed access track would also be temporarily lost from the local population due to disturbance from construction traffic.

23.233 It is highly unlikely that any waders breeding on Sandside Head, those breeding more than 500 m to the west of the current onshore area and those breeding to the south of the A836, would be affected by disturbance during construction due to the distance between these areas and the proposed onshore infrastructure.

23.234 As such, potential effects during construction resulting from disturbance and habitat loss are assessed as being of a medium level. As the number of breeding waders that would be potentially affected by habitat loss and/or disturbance during construction is relatively low with effects unlikely to be detectable at the local population level, **no significant impacts** are predicted.

23.235 However, good practice measures are outlined in section 23.12 to ensure compliance with the relevant legislation protecting all breeding birds.

Potential operation effects

23.236 It is possible that waders breeding within the current onshore project area and surrounding area could be disturbed due to human activity related to maintenance works during the operational phase. Any works would be temporary, and will affect a relatively small area (given the small size of the current onshore project area), and so it is likely that the numbers of birds potentially affected would be small.

23.237 As such, potential disturbance effects during operation are assessed as being of temporary duration and low level and **no significant impacts** on local breeding wader populations are predicted during operation.

23.238 However, should any significant maintenance works be required during the breeding season, it is advised that the good practice measures described in section 23.12 should be applied, to ensure compliance with the relevant legislation protecting all breeding birds.

Potential decommissioning effects

23.239 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on local breeding wader populations are predicted.

23.240 However, as a precautionary, relevant good practice measures described in section 23.12 should be applied during decommissioning to ensure compliance with the relevant legislation protecting all breeding birds.

Potential cumulative effects

23.241 Thirty-three Section 36 planning application were identified on the Highland Council planning portal website. Of these, only the proposed Limekilns Wind Farm is located within 10 km of the current onshore project area. This is a 24 turbine scheme, located approximately 2.5 km to the south of the current onshore project area. Following a Public Local Inquiry (PLI) in 2015, the scheme was refused. However, an application has recently been resubmitted.

23.242 The habitat at this site is dominated (>90%) by coniferous plantation. It is therefore of limited suitability for breeding waders. Of the four wader species breeding within the current onshore project area, only curlew was found to breeding during the surveys for Limekilns Wind Farm, with four territories recorded to the north of the development site in 2010. However, as no birds were breeding within 500 m of the Limekilns site, the species was not considered to warrant assessment.

23.243 The closest of these territories is located approximately 2.5 km to the south of the current onshore project area, and birds nesting in this area are unlikely to be affected by either development. As such, **no significant cumulative impacts** on breeding waders are predicted.

Species evaluated as being of low importance

23.244 A summary assessment of bird species recorded within the terrestrial ornithology survey areas that were assessed as being of low value is presented in Table 23-14.

Table 23-161: Assessment of species of low conservation value recorded during the 2015 terrestrial ornithology surveys

		Potential impacts			
Species	**Baseline**	**Construction**	**Operation**	**Decommissioning**	**Proposed mitigation**
Wildfowl					
Six Amber-listed species: **pink-footed goose, wigeon, teal, mallard, shelduck** and **eider** (breeding wigeon is also a designated feature of Caithness and Sutherland Peatlands SPA and RAMSAR site).	Species were recorded in relatively small numbers, the majority during the non-breeding season. An exception was eider, which was recorded in small numbers during the breeding seabird surveys, but was not found to be breeding (although limited suitable breeding habitat is present). None of the records were within the current onshore project area.	Construction works will be temporary and of a small scale, and disturbance effects are likely to be limited to temporary displacement of small numbers of wintering birds. As such, the level of construction effects on these wildfowl species is likely to be low to negligible and **no significant impacts** are predicted.	Any routine maintenance works required during the operational phase would be temporary, and it is unlikely that the level of disturbance would be any higher than already exists due to current land-use (farming and golfing). As such, the level of effects on these wildfowl species during operation is likely to be negligible and **no significant impacts** are predicted.	Potential decommissioning effects are considered likely to be of the same nature as construction effects; therefore **no significant impacts** are predicted.	Good practice measures to protect breeding birds are outlined in section 23.11; these will protect any wildfowl species (such as eider) that could potentially breed within the current onshore project area in future. No mitigation is required for non-breeding birds.
Seabirds (including gulls)					
Two Schedule 1, Annex I and SBL priority species: **red-throated diver** and **great northern diver** (breeding red-throated diver is also a	Species were recorded in relatively small numbers during the breeding season, but none were found to be breeding. The survey area does not offer suitable breeding habitat for red-throated diver, while great northern	Construction works will be temporary and of a small scale, and disturbance effects are likely to be limited to temporary displacement of small numbers of non-breeding	Any routine maintenance works required during the operational phase would be temporary, and it is unlikely that the level of disturbance would be any higher than already exists due to current land-use	Potential decommissioning effects are considered likely to be of the same nature as construction effects; therefore	Good practice measures to protect breeding birds are outlined in section 23.11; these will protect any seabird species (such as great skua) that could

		Potential impacts			
Species	**Baseline**	**Construction**	**Operation**	**Decommissioning**	**Proposed mitigation**
designated feature of Caithness and Sutherland Peatlands SPA and RAMSAR); Five Amber-listed species: **gannet, great skua, black-headed gull, common gull,** and **lesser black-backed gull**; and **Arctic skua**, which is Red-listed and an SBL and Highland LBAP priority species.	diver are only present around mainland Scotland during the breeding season as passage migrants (Forrester *et al.*, 2007). Although only limited suitable breeding habitat is present within the current onshore project area and nearby surroundings for species such as great skua and it is possible that small numbers of birds may breed therein the future.	birds. As such, the level of construction effects on these seabird species is likely to be low to negligible and **no significant impacts** are predicted.	(farming and golfing). As such, the level of effects on these seabird species during operation is likely to be negligible and **no significant impacts** are predicted.	**no significant impacts** are predicted.	potentially breed within the current onshore project area in future. No mitigation is required for non-breeding birds.
Waders					
Two Annex I and SBL priority species (breeding populations are also designated features of Caithness and Sutherland Peatlands SPA and RAMSAR and East Halladale SSSI): **golden plover** and **dunlin** (which is also Amber-listed);	Small numbers of whimbrel turnstone sanderling common sandpiper and ringed plover were recorded during the breeding bird survey, but there was no evidence that any of these species was breeding. Golden plover, dunlin, whimbrel, purple sandpiper, turnstone, knot, sanderling, snipe and ringed plover were recorded during the winter bird surveys; the majority were	Construction works will be temporary and of a small scale, and disturbance effects are likely to be limited to temporary displacement of occasional foraging birds. As such, the level of construction effects on these wader species is likely to be low to negligible and **no**	Any routine maintenance works required during the operational phase would be temporary, and it is unlikely that the level of disturbance would be any higher than already exists due to current land-use (farming and golfing). As such, the level of effects on these wader species during operation	Potential decommissioning effects are considered likely to be of the same nature as construction effects; therefore **no significant impacts** are predicted.	Good practice measures to protect breeding birds are outlined in section 23.11; these will protect any wader species (such as snipe) that could potentially breed within the current onshore project area in future.

		Potential impacts			
Species	**Baseline**	**Construction**	**Operation**	**Decommissioning**	**Proposed mitigation**
Two Schedule 1 species: **whimbrel** (which is also Red-listed) and **purple sandpiper** (which is also Amber-listed and an SBL priority species); Five Amber-listed species: **turnstone, knot, sanderling, common sandpiper** and **snipe;** and **Ringed plover**, which is Red-listed.	concentrated around Sandside Bay. The current onshore project area and immediate surroundings do not offer suitable breeding habitat for species afforded special protected (golden plover, dunlin, whimbrel and purple sandpiper). Limited suitable breeding habitat may be present for species such as snipe and it is possible that small numbers of birds may breed within the current onshore project area or nearby surroundings in the future.	**significant impacts** are predicted.	is likely to be negligible and **no significant impacts** are predicted.		No mitigation is required for non-breeding birds.
Other non-passerine species					
Two Amber-listed and SBL priority species: **red grouse** and **kestrel**.	Three kestrel flights were recorded to the west of the current onshore project area, but there was no evidence of breeding. However, it is possible that suitable breeding habitat may be present amongst the cliffs to the north of the current onshore project area.	Construction works will be temporary and of a small scale, and disturbance effects are likely to be limited to temporary displacement of occasional foraging birds. As such, the level of construction effects on	Any routine maintenance works required during the operational phase would be temporary, and it is unlikely that the level of disturbance would be any higher than already exists due to current land-use (farming and golfing).	Potential decommissioning effects are considered likely to be of the same nature as construction effects; therefore **no significant**	Good practice measures to protect breeding birds are outlined in section 23.11; these will protect any kestrels that breed within the vicinity of the current onshore project area

		Potential impacts			
Species	**Baseline**	**Construction**	**Operation**	**Decommissioning**	**Proposed mitigation**
	A single red grouse was recorded during a winter walkover survey; no suitable breeding habitat for this species is present within 500 m of the current onshore project area.	these two species is likely to be negligible and **no significant impacts** are predicted.	As such, the level of effects on these two species during operation is likely to be negligible and **no significant impacts** are predicted.	**impacts** are predicted.	in future. No mitigation is required for non-breeding birds.
Passerines					
Three Schedule 1 species: **fieldfare**, **redwing** (both of which are Red-listed; redwing is also an SBL priority species) and **snow bunting** (Amber-listed, and an SBL priority species); and 13 species of moderate or high conservation concern[1]: **skylark**, **willow warbler**, **starling**; **song thrush**, **mistle thrush**, **dunnock**, **house sparrow**, **grey wagtail**, **meadow pipit**, **bullfinch**, **linnet**, **twite**	Skylark and meadow pipit were the only species breeding within 500 m of the current onshore project area. Both species were also recorded during the non-breeding season, along with the remaining species listed. The majority were recorded in small numbers, with the exception of linnet and starling, which were occasionally recorded in large flocks.	Small numbers of ground-nesting breeding birds may be affected by habitat loss and/or temporary disturbance, although the number of birds affected is unlikely to be detectable at the local population level; foraging birds may also be disturbed during the winter. However, suitable breeding and foraging habitat is available in the surrounding area for any displaced birds. As such, the level of construction effects on these passerine species is	Any routine maintenance works required during the operational phase would be temporary, and it is unlikely that the level of disturbance would be any higher than already exists due to current land-use (farming and golfing). As such, the level of effects on these passerine species during operation is likely to be low to negligible and **no significant impacts** are predicted.	Potential decommissioning effects are considered likely to be of the same nature as construction effects; therefore **no significant impacts** are predicted.	Good practice measures to protect breeding birds are outlined in section23.11; these will protect any passerine species (such as skylark and willow warbler) that may be breeding within the current onshore project area in future. No mitigation is required for non-breeding birds.

		Potential impacts			
Species	**Baseline**	**Construction**	**Operation**	**Decommissioning**	**Proposed mitigation**
and **yellowhammer**.		likely to be low to negligible and **no significant impacts** are predicted.			
Note: [1]Full conservation designations are shown in Table 23-9 (breeding birds) and Table 23-11 (non-breeding birds)					

23.10 Potential effects on statutory sites

Sites of international importance

23.245 As detailed in section 23.6, there are three SPAs (two of which are also RAMSAR sites), located within the terrestrial ornithology search area: North Caithness Cliffs, Caithness and Sutherland Peatlands, and Caithness Lochs.

23.246 Under the Habitats Regulations, any development likely to have a significant effect on an SPA, either alone or in combination with other projects, requires an Appropriate Assessment (part of the HRA process) to be carried out by the relevant competent authority, to determine whether or not the development, would have an adverse effect on the integrity of the SPA.

23.247 In order to assist the competent authority in determining whether an Appropriate Assessment is required, potential effects on each of the SPAs is considered below, in order of proximity to the current onshore project area.

North Caithness Cliffs SPA

23.248 North Caithness Cliffs SPA is located adjacent to the current onshore project area, which is designated for breeding seabirds and breeding peregrines. Although several breeding seabird species connected with this SPA were found to be breeding within the survey area, no nests were identified within 500 m of the current onshore project area and no significant impacts on any of these populations are predicted. A single peregrine was recorded within the current onshore survey area, but there was no evidence of any nesting birds within 2 km. Furthermore, specific mitigation has been proposed in section 23.12 to ensure that all breeding birds are protected during all stages of development. As such, **no likely significant effects** on the integrity of the North Caithness Cliffs SPA are predicted.

Caithness and Sutherland Peatlands SPA and RAMSAR

23.249 Caithness and Sutherland Peatlands SPA and RAMSAR site is located approximately 4.0 km to the south-west of the current onshore project area. This site is designated for a number of breeding wildfowl, wader, diver and raptor populations. As none of these species were found to be making regular use of the current onshore project area, there is not considered to be any connectivity between the Project site and the SPA/RAMSAR site. As such, **no likely significant effects** on the integrity of the Caithness and Sutherland Peatlands SPA/RAMSAR site are predicted.

Caithness Lochs SPA and RAMSAR site

23.250 Caithness Lochs SPA and RAMSAR site is located approximately 6.6 km to the south-east of the current onshore project area. This site is designated for wintering populations of Greenland white-fronted goose, greylag goose and whooper swan.

23.251 No Greenland white-fronted geese were recorded within the survey area, and information received from the GWFGS indicates that birds from the SPA/RAMSAR site population do not forage there. An earlier study of 19 smaller wintering sites used by Greenland white-fronted geese (Francis *et al*., 2011) included two sites in Caithness. The closest site to the current onshore project area was near Westfield, where the flock has numbered 100-200 birds since the 1970s. Although these geese foraged over an extensive area, this was mainly in intensive and marginal agricultural land in the valley of the Forss Water between Loch Calder and the sea, approximately 3 km to the east of the current onshore project area at the closest point. Occasionally, during periods of prolonged freezing, birds have been reported in areas closer to the sea. For example, in February 1979, 120 Greenland white-fronted geese were recorded in snow-free fields in Balmore, approximately 1.5 km to the north-east of the current onshore project area. As Greenland white-fronted geese appear to be highly faithful to their wintering sites (e.g. Warren *et al*., 1992), it is considered unlikely that birds would shift their feeding areas to make regular use of the current onshore project area.

23.252 Although small numbers of whooper swans and greylag geese were occasionally recorded within the survey area, the majority of records were outside the current onshore project area. In addition, surveys undertaken in previous years (Patterson *et al*., 2013) did not record any SPA birds foraging within the current onshore project area.

23.253 Thus, although small numbers of foraging whooper swans and greylag geese may be temporarily displaced from the current onshore project area, it is unlikely that any effects will be evident at a population level, and **no likely significant effects** on the integrity of the Caithness Lochs SPA/RAMSAR site are predicted.

Requirement for Appropriate Assessment

23.254 Although the competent authority will determine whether an Appropriate Assessment is required, the information presented in this assessment indicates that the onshore element of the Project will not have a likely significant effect on any SPA.

Sites of national importance

23.255 As detailed in section 23.6, two SSSIs designated for ornithological features are located within 5 km of the terrestrial ecology search area: Red Point Coast and East Halladale.

Red Point Coast SSSI

23.256 Red Point Coast SSSI is located approximately 1.4 km to the north-west of the current onshore project area. This site is a component of North Caithness Cliffs SPA and is designated partly for its breeding guillemot population, which are also a feature of the SPA. Therefore, potential effects on this site are considered to be the same as for the SPA, and **no significant impacts** on the integrity of the Red Point Coast SSSI are predicted.

East Halladale SSSI

23.257 East Halladale SSSI is located approximately 4.0 km to the south-west of the current onshore project area. This site is a component of Caithness and Sutherland Peatlands SPA and is designated partly for its breeding golden plover and dunlin populations, which are also features of the SPA. Therefore, potential effects on this site are considered to be the same as for the SPA, and **no significant impacts** on the integrity of the East Halladale SSSI are predicted.

23.11 Mitigation measures

23.258 The principal mitigation measure adopted to minimise onshore elements of the Project on important terrestrial ecology features has been the use of an iterative design process, which has involved consideration of key ecological issues and constraints throughout the design process. This means that most mitigation measures are embedded within the overall design, allowing the opportunity to site onshore infrastructure away from sensitive ecological features, such as nesting seabirds.

23.259 Although no significant impacts on terrestrial ornithology interests are predicted, good practice measures are required to ensure compliance with the relevant legislation protecting all breeding birds.

23.260 It is proposed that a breeding bird protection plan is developed to protect species breeding within the current onshore project area and immediate surroundings. Although a finalised plan would need to be agreed with appropriate stakeholders, it is recommended that the measures outlined below are included.

23.261 A suitably experienced Ecological Clerk of works (ECoW) should be appointed to ensure compliance with ecological good practice measures during the construction and decommissioning phases (and during the operational phase, should any should any significant maintenance works be required).

Specific mitigation meaures

Table 23-15 Receptor specific mitigation measures

Mitigation Measures Specific to Terrestrial Ornithology		
Ref	**Title**	**Description**
Construction		
TO1	Timing of works	Where possible, construction works should take place outside the main breeding season for most bird species that may nest within the current onshore project area and nearby surroundings (March to August inclusive).
TO2	Pre-construction breeding bird survey	Where construction works are required during the breeding bird season, the area within 500 m of works should be surveyed ahead of any operations, by a suitably experienced and qualified Ecological Clerk of Works (ECoW), to check for active nests or breeding colonies.
TO3	Protection of nesting birds	If any nests or breeding bird colonies are identified, works in the area should cease immediately (or as soon as it is safe to do so) and an appropriate exclusion zone around the nest/colony should be established (with the distance appropriate to the species and agreed through consultation with SNH). No works should be permitted within exclusion zones and no personnel or vehicles should be allowed to enter or pass through until the ECoW has confirmed that the chicks have fledged or the breeding attempt has failed. Where this is not feasible, SNH would need to be contacted and further mitigation measures agreed to ensure that nesting birds are not disturbed. This could involve, for example, limiting the number of site personnel accessing the relevant area to the minimum number required to complete the works, restricting working hours, and employment of an ECoW to undertake a watching brief.

Mitigation Measures Specific to Terrestrial Ornithology		
Ref	**Title**	**Description**
TO4	Minimising disturbance from construction vehicles	Where construction works are required during the breeding bird season, in order to minimise disturbance to any birds breeding near the access track or the A836, the number of vehicles accessing the current onshore project area via these roads should be limited to the minimum number required to complete the works effectively, and the number of vehicle movements along roads should be minimised as far as possible. In addition, a maximum speed limit of 15 mph should be adhered to along the access track in order to minimise noise disturbance.
Operation		
TO5	Mitigation during operation	Routine maintenance required during operation of the Project is expected to be minimal, involving only small areas and of a temporary duration. However, should significant works be required during the operational phase, it is recommended that the mitigation outlined above for the construction phase is implemented to protect breeding birds.
Decommissioning		
TO6	Mitigation during decommissioning	As decommissioning works are likely to be of a similar nature and duration as construction activities, the mitigation outlined above for construction works should also be implemented during the decommissioning phase in order to protect nesting birds.

Residual effects

23.262 Although no significant impacts on terrestrial ornithology interests are predicted, following implementation of good practice mitigation measures proposed in section 23.12 to protect all nesting bird species, residual effects on breeding birds are likely to be reduced to a low to negligible level.

23.263 Therefore **no significant residual impacts** on terrestrial ornithology interests are predicted during the construction, operational, or decommissioning phases of the Project.

23.12 Summary

23.264 The key findings of the terrestrial ornithology assessment are as follows:

- Two species that are designated features of the Caithness Lochs SPA and RAMSAR were recorded foraging in relatively low numbers within the survey area: whooper swan and greylag goose. Potential effects on these species are assessed as being of a low to negligible level. No significant impacts on these species are predicted and no mitigation is required.

- Four seabird species that are designated features of the North Caithness Cliffs SPA were breeding within the western buffer of the survey area: fulmar, razorbill, guillemot and kittiwake. Potential effects on these species are assessed as being of a negligible level and no significant impacts on these species are predicted. However, good practice measures to protect all breeding birds are outlined to ensure compliance with the relevant legislation.
- One barn owl nest site was identified within the survey area, although this is located more than 100 m from the current onshore project area. Barn owl is afforded special protection during the breeding season. Potential effects on nesting barn owls are assessed as being of a negligible level and no significant impacts are predicted. However, good practice measures to protect all breeding birds are outlined to ensure compliance with the relevant legislation.
- A single peregrine was recorded within the survey area. Peregrine is a protected species and is a designated feature of the Caithness Cliffs SPA. Although there was no evidence that the species was breeding within 2 km of the current onshore project area, suitable breeding habitat was present and it is possible that the species could breed there in future. Potential effects on peregrine are assessed as being of a negligible level and no significant impacts are predicted. However, good practice measures to protect all breeding birds are outlined to ensure compliance with the relevant legislation..
- Puffin, common tern and Arctic tern were recorded within the survey area during the breeding season. Breeding puffin is a designated feature of the Caithness Cliffs SPA, while common tern and Arctic tern are afforded special protection. Although none of these species were found to be breeding, potentially suitable habitat was identified and it is possible that small numbers could breed there in future. Potential effects on puffins and terns are likely to be of a negligible level and no significant impacts are predicted. However, good practice measures to protect all breeding birds are outlined to ensure compliance with the relevant legislation.
- Four other seabird species of moderate to high conservation concern were breeding within the survey area: shag, black guillemot, herring gull and great black-backed gull. Potential effects on these species are assessed as being of a negligible level and no significant impacts on these species are predicted. However, good practice measures to protect all breeding birds are outlined to ensure compliance with the relevant legislation.
- Four wader species that are of moderate to high conservation concern were breeding within the survey area: lapwing, curlew, oystercatcher and redshank. Potential effects on these species are assessed as being of a medium to low level. No significant impacts on these species are predicted, and no cumulative impacts are predicted. However, good practice measures to protect all breeding birds are outlined to ensure compliance with the relevant legislation.
- Forty-two species of low conservation concern were recorded within the terrestrial ornithology survey areas, including several wildfowl, seabird and wader species, red grouse, kestrel and 16 passerine species. With the exception of two passerine species (skylark and willow warbler), none were breeding within 500 m of the current onshore project area. Potential effects on these species are assessed as being of a low to negligible level and no significant impacts on these species are predicted. However, good practice measures to protect all breeding birds are outlined to ensure compliance with the relevant legislation.

- No significant cumulative impacts on terrestrial ornithology, and no likely significant effects on SPAs or the ornithological interests of other statutory sites, are predicted during any phase of the Project.
- Following implementation of specific good practice mitigation to protect nesting birds, effects are likely to be reduced to a low to negligible level and no significant residual impacts are predicted during any phase of the Project.

24 Terrestrial Ecology

24.1 Introduction

24.1 This technical chapter describes the terrestrial (non-avian) ecology within and around the current onshore project area as defined in Chapter 4: Project Description and in Figure 1-2.

24.2 This technical chapter describes the non-avian ecology baseline conditions and impact assessment for the current onshore project area. The chapter details the methods used to establish the terrestrial ecological interest within and around the current onshore project area, and the process used to determine the importance of terrestrial habitats and species present and the level of potential effects on these ecological features. It then sets out the likely significant effects on terrestrial habitats and species during construction, operation and decommissioning, and assesses the significance of potential effects on terrestrial habitats and populations at an appropriate biogeographical scale. Means to mitigate any likely significant effects are proposed, and an assessment of residual effects is then provided. A summary of the key findings of the assessment is presented at the end of the chapter.

24.3 This technical chapter is supported by Technical Appendix 24.1: Terrestrial Ecology.

24.4 An assessment of likely significant effects on terrestrial ornithology within and around the current onshore project area is considered in Chapter 23: Terrestrial Ornithology.

Terminology

24.5 '**The Project**' is the term used to refer to the Dounreay Trì Floating Wind Demonstration Project;

24.6 The '**Project site**' is considered to be the offshore area delineated in Figure 5-1 in blue. The onshore cable corridor area of search is marked in orange on the same Figure and referred to as the '**onshore cable corridor**'.

24.7 For the purposes of this chapter, the following definitions are used to describe the core area for the terrestrial ecology desk study and surveys:

- **'Terrestrial ecology search area'**: the area of onshore land which was considered for the desk study and terrestrial ecology surveys, and which covers a larger area than the current onshore project area;
- **'Current onshore project area'**: all onshore land within the current Project site boundary; this comprises a smaller area than the initial onshore project area used for ecology surveys.

24.8 These areas are shown on Figure 24-1.

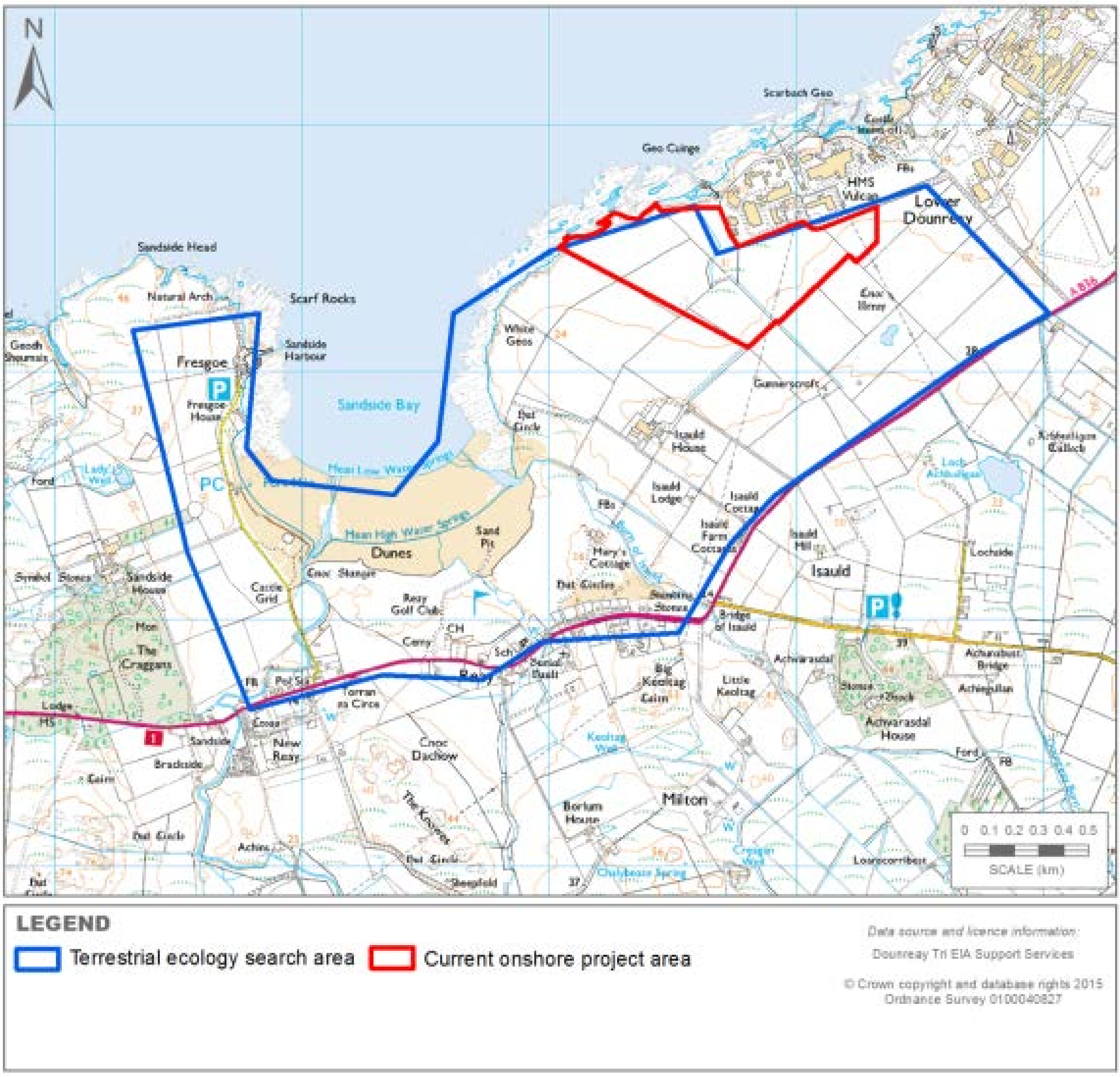

Figure 24-1: Terrestrial ecology search area and current onshore project area

24.2 Guidance and legislation

24.9 The following relevant guidance and legislation relating to terrestrial ecology was used in the preparation of this chapter:

- Council Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (*Habitats Directive*);
- The Conservation (Natural Habitats, *&c.*) Regulations 1994;
- The Conservation of Habitats and Species Regulations 2010;
- Wildlife and Countryside Act 1981 (as amended);
- Nature Conservation (Scotland) Act 2004;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- Wildlife and Natural Environment (Scotland) Act 2011;
- Electricity Works (EIA) (Scotland) Regulations 2000;

- Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000;
- Guidance on the Electricity Works (Environmental Impact Assessment) (Scotland) Amendment Regulations 2008;
- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment;
- Scottish Planning Policy 2014;
- National Planning Framework 3: A Plan for Scotland: Ambition, Opportunity, Place (Scottish Government, 2014);
- Government Circular 06/2005: Biodiversity and Geological Conservation – Statutory Obligations and their Impact within the Planning System (Office of the Deputy Prime Minister [ODPM]);
- Scotland's Biodiversity: It's In Your Hands. A strategy for the conservation and enhancement of biodiversity in Scotland (Scottish Executive, 2004);
- 2020 Challenge for Scotland's Biodiversity. A Strategy for the conservation and enhancement of biodiversity in Scotland (Scottish Government, 2013);
- The Highland Council Supplementary Guidance. Highland's Statutorily Protected Species (2011);
- Highland Biodiversity Action Plan 2015-2020;
- Caithness Biodiversity Action Plan 2003-2013;
- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (Chartered Institute of Ecology and Environmental Management [CIEEM], 2016);
- A Handbook on Environmental Impact Assessment (Scottish Natural Heritage [SNH], 2014);
- Good Practice During Wind Farm Construction (Scottish Renewables *et al*., 2015);
- Handbook for Phase 1 habitat survey - a technique for environmental audit (Joint Nature Conservation Committee [JNCC], 2010);
- British Plant Communities, Vols. 1-3 (Rodwell, 1991a; 1991b; 1992) and Vol. 5 (Rodwell, 2000);
- New Flora of the British Isles (Stace, 2010);
- Land Use Planning System SEPA Guidance Note 4: Planning Guidance on Windfarm Developments (Scottish Environment Protection Agency [SEPA], 2012);
- Land Use Planning System SEPA Guidance Note 31: Guidance on Assessing the Impacts of Development Proposals on Groundwater Abstractions and Groundwater Dependent Terrestrial Ecosystems (SEPA, 2014);
- WFD95: A Functional Wetland Typology for Scotland - Project Report (Scotland and Northern Ireland Forum for Environmental Research [SNIFFER], 2009);
- Guidance on the identification of groundwater dependent terrestrial ecosystems: Annex I – NVC plant communities and dependency on groundwater (UKTAG, 2009);
- Guidance on the identification of groundwater dependent terrestrial ecosystems (UK Technical Advisory Group on the Water Framework Directive [UKTAG], 2003);

- Animal Tracks and Signs (Bang & Dahlstrøm, 2006);
- Monitoring the Otter *Lutra lutra* (Chanin, 2003a);
- Scotland's Wildlife: Badgers and Development (SNH, 2002a); and
- Assessing the Cumulative Impact of Onshore Wind Energy Developments (SNH, 2012).

Other sources of information

24.10 As described in section 24.4 (Desk study methods), a detailed desk study was undertaken of the existing literature and data relating to terrestrial ecology and used to give an overview of the existing ecological environment within the current onshore project area and surroundings. The major data sources used in the preparation of this technical chapter are listed in Table 24-1.

Table 24-162: Summary of key information sources used in the preparation of this technical chapter

Source	Content
An Illustrated Guide to British Upland Vegetation (Averis *et al*., 2004).	Accounts of upland NVC vegetation types.
Sand dune vegetation survey of Scotland: North West. Scottish Natural Heritage Research (Dargie, 1998).	Detailed map of the sand dune and other habitat at Sandside Bay.
Primula scotica survey in Caithness and Sutherland 2007-2008. Scottish Natural Heritage Commissioned Report (Morris, 2009).	The distribution of *Primula scotica* along the North Caithness coast.
Beach Dunes: a guide to managing coastal erosion in beach/dune systems (SNH, 2000).	Approaches to protecting and restoring sand dunes.
New Flora of the British Isles (Stace, 2010).	Plant species nomenclature.
Atlas of Highland Land Mammals. Highland Biological Recording Group (Scott, 2011).	The distribution of land mammals in north Caithness.
Badger (Roper, 2010).	Information about the species ecology.
Ecology of the European Otter (Chanin, 2003b).	Information about the species ecology.

24.11 Additional data sources accessed for the preparation of this chapter are described in section 24.3 (Desk study methods).

Consultation

24.12 Consultation was undertaken with SNH, who agreed that all the major onshore natural heritage sensitivities had been identified and appropriate survey methods selected.

24.13 In addition, a formal Scoping Report was issued to statutory consultees, including SNH, in December 2015.

24.14 At the time of writing, Scoping Opinions with relevance to terrestrial ecology had been received from SNH, the Scottish Government Planning and Architecture Division and SEPA. These comments are summarised in Table 24-2.

24.15 In addition, it is assumed that comments and recommendations concerning the similar Hywind Floating Wind Farm development will be applicable to this Project and as such these comments have been included to guide the development of this technical chapter. It is further assumed that comments received for other marine development including the neighbouring Farr Point development and the large offshore wind farm developments in the Moray Firth and Firth of Forth will also be applicable. Summaries of comments that may be relevant to terrestrial ecology at the Dounreay Trì Floating Wind Demonstration Project (the Project) are included in Table 24-2.

24.16 Should further comments pertaining to this development be received prior to Gate Check, they will be included in the table below and acted upon where possible.

Table 24-163: Summary of comments from Scoping Opinions received for similar projects that may have relevance for the assessment of terrestrial ecology

Consultee	Project	Comment relative to terrestrial ecology	Relevance/Cross Reference
	Dounreay Trì Floating Wind Demonstration Project	Stated that, as the scoping report describes a number of options for the onshore infrastructure and construction methods, advice provided was generic and covered a broad range of potential impacts. Recommended ongoing dialogue between the applicant and SNH, Marine Scotland and the Highland Council, to include discussions of landfall locations and onshore infrastructure and routes, to assist in identifying environmental sensitivities/mitigation and to provide more focused advice in relation to the finalised project details. With relation to onshore works, advised that these may have implications with regard to Sites of Special Scientific Interest (SSSIs), Natura sites and European Protected Species (EPS), and provided initial comments relating to key natural heritage interests that should be scoped into the Ecological Impact Assessment (EcIA). **Sandside Bay SSSI**: noted that the terrestrial ecology search area lies within part of this SSSI, which is designated for its sand dune habitat, and that physical disruption from landfall trenching of the dynamic dune processes that underpin the coastal habitats of the SSSI is a key potential significant impact (e.g. resulting in loss of habitat and destabilisation of dunes). Further noted that potential impacts could be more extensive and longer-lasting than direct loss of habitat, and that maintenance visits may also impact the SSSI, especially where vehicle use and re-excavation is required. Advised that careful and thorough assessment of the potential impacts to the SSSI was required to ensure the proposal does not adversely affect its integrity. Further advised that, where possible, the SSSI should be avoided in order to avoid damaging the sand dune habitat, and that cable landfall outside the SSSI is a preferred option in terms of	Further details of the onshore infrastructure options and construction methods are provided in Chapter 4: Project Description, with specific assumptions relevant to the assessment of terrestrial ecology presented in section 24.6 of this technical chapter. Details of engagement with stakeholders are provided in Chapter 3: Site Selection and Engagement to Date. Since submission of the Scoping Report, the onshore infrastructure design (whilst yet to be finalised) has been refined so that cable landfall options within or adjacent to Sandside Bay SSSI are no longer being considered (see Chapter 4: Project Description and section 24.13 of this technical chapter). Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in Section 24.11, with potential effects on the sites themselves considered in section 24.12. Although the potential

Consultee	Project	Comment relative to terrestrial ecology	Relevance/Cross Reference
		minimising impacts to natural heritage. Where the SSSI cannot be avoided, impacts should be reduced to a minimal level through appropriate mitigation, the details of which should be included within the ES. Also advised that potential cumulative impacts should be scoped in. **Red Point Coast SSSI**: stated that, based on the extent of the terrestrial ecology search area, non-avian ecological features for which this SSSI is designated (maritime cliff vegetation and Scottish primrose *Primula scotica*), are unlikely to be affected by the proposal. However, if the proposal should change significantly, potential effects on these features may need to be considered. **Caithness and Sutherland Peatlands Special Area of Conservation (SAC)**: noted that designated features of this SAC include otter (*Lutra lutra*), which is an EPS, and advised that, if otters are likely to be affected by the proposal, potential impacts to the SAC population should be assessed as part of a Habitats Regulations Appraisal (HRA). **EPS**: advised that, if EPS are likely to be affected by the proposal, a Species Protection Plan (SPP) should be included within the ES.	for cumulative effects to occur was considered as part of the assessment (section 24.6), due to the relatively small scale of, the onshore works, it is considered extremely unlikely that significant cumulative effects to terrestrial ecological features would occur. As such, potential cumulative effects have been scoped out of the assessment. No otters were recorded during the terrestrial ecology surveys and the current onshore project area is of limited suitability for this species, although suitable foraging and commuting habitat is present in the terrestrial ecology search area (section 24.8). It is not considered that otters will be significantly affected by the onshore elements of the Project (section 24.11) and no impacts are predicted which could have an adverse effect on the integrity of the Caithness and Sutherland Peatlands SAC population (section 24.12).
Scottish Government Planning and Architecture Division		Stated that there is the potential for environmental impacts to terrestrial receptors and that loss of, or damage to, coastal and terrestrial habitats or species associated with onshore works and installation of cabling at landfall sites should be given appropriate consideration within the ES. Recommended that the ES should look at the proximity of the proposed onshore site works to valued or sensitive landscapes, sites with national and international environmental designations, and the potential for impacts to protected species that will not be considered within the required and supporting HRA process. Further stated that the ES should set out	Potential effects on terrestrial habitats and species are considered in section 24.11. Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in section 24.11, with potential effects on the sites themselves considered in section 24.12. Proposed mitigation

Consultee	Project	Comment relative to terrestrial ecology	Relevance/Cross Reference
		appropriate mitigation of any identified impacts.	measures are described in section 24.13.
SEPA		Advised that the development (including temporary works) should avoid impacts on watercourses and groundwater dependant terrestrial ecosystems (GWDTEs), which are types of wetland protected by the Water Framework Directive. In relation to watercourses, stated that it was understood that it is possible to make landfall in a position which negates the need for any watercourse crossings, an approach that SEPA would welcome. Further stated that the exact location of works should include a buffer of at least 10 m between the limit of any works and the top of the bank of the watercourse. In relation to GWDTEs, stated that the submission of the National Vegetation Classification (NVC) data at an early stage was welcomed by SEPA. Noted that the current onshore project area includes the NVC communities M10 (highly groundwater-dependant) and M15 and MG10 (moderately groundwater-dependant). Referred to relevant guidance (SEPA, 2014) and stated that SEPA would expect the development to avoid direct impacts on any GWDTEs (especially the highly groundwater dependant M10) and mitigate other indirect impacts. Stated that, if there are any GWDTEs near to construction works, SEPA would expect clay stoppers to be included in the cable trench to stop them acting as preferential pathways for drainage. Further stated that SEPA would welcome the opportunity to provide informal advice direct to the applicant on impacts on GWDTE when a preferred layout is determined.	Potential effects on watercourses, and NVC communities corresponding with GWDTEs are assessed in section 24.11. Reference has been made to the relevant guidance and specific mitigation measures to protect watercourses and GWDTEs are described in section 24.13.
SEPA[1]	General Advice	Recommended that advice on designated sites and European Protected Species (EPS) should be sought from SNH. Stated that Marine and transitional SACs and Special Protection Areas (SPAs) are identified as protected areas under the	Information regarding designated sites and EPS was obtained from SNH and other sources as part of the desk study (as

Consultee	Project	Comment relative to terrestrial ecology	Relevance/Cross Reference
		Water Framework Directive, and that their objectives are also river basin management plan (RBMP) objectives.	detailed in 24.4). A formal Scoping Opinion from SNH has also been requested as part of the consultation process (section 24.3).
Scottish Ministers[2, 3, 4, 5]		With regards to species, the ES should show that the applicants have taken account of the relevant wildlife legislation and guidance, including: • Natural Habitats and of Wild Flora and Fauna, and on Conservation of Wild Birds (commonly known as the Habitats and Wild Birds Directives); • Wildlife & Countryside Act 1981; • Nature Conservation (Scotland) Act 2004; • Wildlife and Natural Environment (Scotland) Act 2011; • Conservation of Habitats and Species Regulations 2010; • Scottish Government Interim Guidance on European Protected Species; and • Development Sites and the Planning System and the Scottish Biodiversity Strategy and associated Implementation Plans. In terms of the Scottish Government Interim Guidance, applicants must give serious consideration to/recognition of meeting the three fundamental licensing tests set out in this Guidance. It needs to be categorically established which species are present on and near the site, and where, before the application is considered for consent. The presence of protected species such as Schedule 1 birds or EPS must be included and considered as part of the application process, not as an issue which can be considered at a later stage. Likewise the presence of species on Schedules 5 (animals) and 8 (plants) of the Wildlife & Countryside Act 1981 should be considered where there is a potential need for a licence under Section 16 of that Act.	Relevant legislation and guidance (listed in section 24.1) has been consulted in the preparation of this technical chapter. The baseline terrestrial ecology within the current onshore project area and surroundings has been described (section 24.8), with particular attention paid to the presence of any protected species. It is not anticipated that any disturbance licences will be required.
JNCC/SNH[2]	Hywind	Provided the following comments with regard to landfall and onshore elements of the development: Noted that the scoping report identified the potential for impacts to habitats and protected species along the onshore cable route and at the onshore switching yard, and advised that there should also be consideration of impacts to habitats and protected species at the landfall site and how	Potential effects on terrestrial ecological features have been assessed, with conservation status of habitats and species considered as part of the assessment process

Consultee	Project	Comment relative to terrestrial ecology	Relevance/Cross Reference
		to mitigate any impacts. UK and LBAP habitats and species should be assessed according to advice from the Local Authority. Further noted that the ES should provide details of appropriate mitigation and state whether or not licences are likely to be required.	(assessment methods are described in section 24.6). Requirements for mitigation have been identified, and appropriate measures outlined (section 24.13).
SNH[3]	Farr Point Wave Farm	With regards to onshore infrastructure, noted that the onshore works may have implications with regard to HRA and highlighted the requirement to consider any Natura 2000 sites and SSSIs in the vicinity of the onshore works. With regard to terrestrial non-avian ecology, the location of all elements of onshore infrastructure will need to be considered in respect of potential impacts to protected mammals, reptiles and amphibians.	Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in section 24.11, with potential effects on the sites themselves considered in section 24.12.
SNH/JNCC[4]	Moray Offshore Renewables Ltd: Eastern Development Area	Noted that any HRA for Natura 2000 sites should address all elements of the development, including onshore works.	Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in section 24.11, with potential effects on the sites themselves considered in section 24.12.
JNCC[5]	Seagreen Round 3 Offshore Wind Farm	Noted that any HRA for Natura 2000 sites should address all elements of the development, including onshore works.	Potential effects on qualifying features of all Natura 2000 sites and SSSIs have been considered in section 24.11, with potential effects on the sites themselves considered in section 24.12.

Notes:

[1]SEPA Scoping Opinion provided to Marine Scotland Licensing Operations Team (MS-LOT): https://www.sepa.org.uk/media/143312/lups-gu13-sepa-standing-advice-for-marine-scotland-on-small-scale-marine-licence-consultations.pdf

[2]Scoping Opinion for the Hywind Floating Wind Farm development: http://www.gov.scot/Resource/0044/00446946.pdf

[3]Scoping Opinion for the Farr Point Wave Farm development: http://www.gov.scot/Resource/0046/00465046.pdf

[4]Scoping Opinion for the Moray Offshore Renewables Ltd: Eastern Development Area development:

Consultee	Project	Comment relative to terrestrial ecology	Relevance/Cross Reference
http://www.gov.scot/Resource/Doc/295194/0114563.pdf [5]Scoping Opinion for the Seagreen Round 3 Offshore Wind Farm development: http://www.gov.scot/Resource/0046/00460525.pdf			

24.3 Desk study methods

24.17 A desk study was undertaken to collate relevant data and literature relating to terrestrial non-avian ecology within the current onshore project area and surrounding area, in order to provide information on sensitive habitats and non-avian species, and statutory sites designated for their ecological interest. Key sources of information identified during the desk study are listed in section 24.2 (Table 24-1).

24.18 The information obtained via the desk study, combined with baseline survey results, was utilised to put habitats and non-avian populations recorded at the current onshore project area into context in terms of their ecological importance.

Existing records

24.19 As part of the desk study, requests for existing ecological data recorded within 2 km of the terrestrial ecology search area were made to several organisations on 19/04/2015. Details are provided in Table 24-3.

Table 24-164: Summary of requests for existing terrestrial ecological data recorded within 2 km of the terrestrial ecology search area

Organisation	Information requested
SNH	Information about statutory sites of ecological importance, and records of notable habitats and species.
Scottish Badgers (SB)	Records of badgers (*Meles meles*).
Highland Biological Recording Group (HBRG)	Records of all species of conservation concern.
North Highland Bat Network (NHBN)	Records of bat species.
Amphibian and Reptile Conservation Trust (ARC)	Records of protected amphibian and reptile species.
Botanical Society of the British Isles (BSBI)	Records of habitats and plant species of conservation concern.
Caithness Biodiversity Group (CBG)	Records of all species of conservation concern.

Statutory sites

24.20 A search was also made for the following statutory sites designated for non-avian ecological interests:

- Sites of international importance (SACs) within 20 km of the current onshore project area; and
- Sites of national importance (SSSIs and National Nature Reserves [NNRs]) within 5 km of the current onshore project area.

24.21 The following sources were accessed to obtain information on designated sites:

- The JNCC website (http://www.jncc.gov.uk; last accessed 08/01/2016); and
- The SNH Sitelink website (http://gateway.snh.gov.uk/sitelink/index.jsp; last accessed 11/01/2016).

24.4 Field survey methods

24.22 A summary of the terrestrial ecology survey methods is provided below; further details of methods is provided in Technical Appendix 24.1.

24.23 All surveys were based on the terrestrial ecology search area, and therefore covered a slightly larger area than required for robust consideration of effects within the current onshore project area.

Extended Phase 1 habitat survey

24.24 An Extended Phase 1 habitat survey was undertaken in suitable weather conditions between 01-03/07/2015. Phase 1 habitat surveys are a standardised method of characterising and recording habitat types and vegetation, as set out in the JNCC survey handbook (JNCC, 2010). Using this approach, all Phase 1 habitats within the terrestrial ecology search area were identified and mapped.

24.25 'Target notes' describing characteristic habitats, features of ecological interest, or any features which may require ecologically sensitive design or mitigation, were recorded.

Protected mammals survey

24.26 The Phase 1 survey method was 'extended' by additionally searching for signs indicating the presence of protected species, or other species of nature conservation importance, within 250 m of the terrestrial ecology search area, and features such as buildings and trees within 50 m with the potential to support roosting bats were also identified. These survey areas are shown in Figure 24-2.

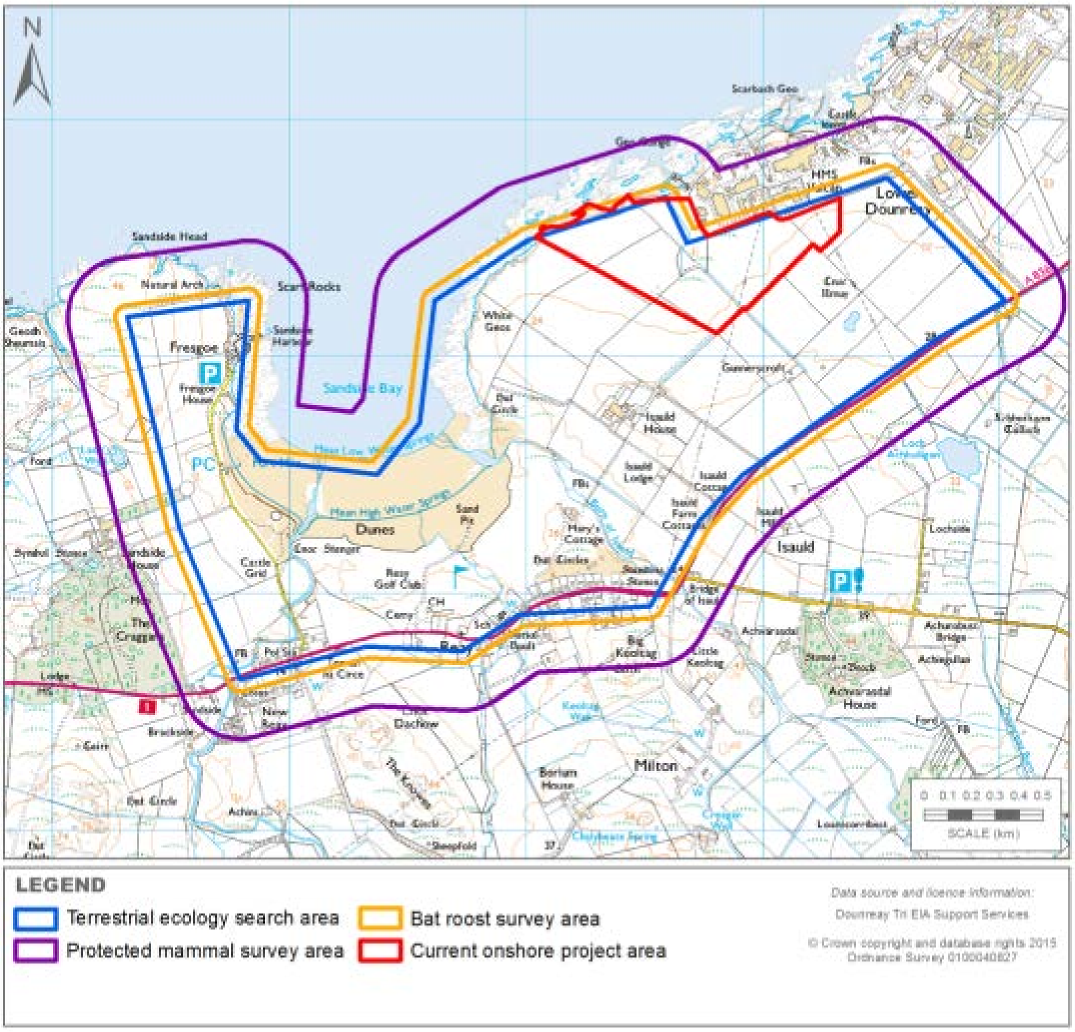

Figure 24-2: Protected mammal survey areas

National Vegetation Classification survey

24.27 A full National Vegetation Classification (NVC) survey of the terrestrial ecology search area was completed between 29/06/2015 and 03/07/2015 in order to identify any areas of sensitive habitat (i.e. those included in Annex I of the Habitats Directive). The NVC survey was completed following the methods described in Rodwell (2006). Observed vegetation communities were compared with the published descriptions given in Rodwell (1991a; 1991b; 1992; 2000).

24.28 As part of the NVC survey, any wetland habitats identified during the extended Phase 1 habitat survey were evaluated in accordance with the Wetland Typology developed by SNIFFER (2009) in terms of their potential to be GWDTEs. Any potential GWDTEs were identified in accordance with standard guidance (SEPA, 2014; SEPA, 2012; UKTAG, 2003; 2009).

Scottish primrose survey

24.29 A survey for Scottish primrose (*Primula scotica*) was undertaken in conjunction with the NVC survey. This involved the surveyor walking the terrestrial ecology search area and mapping locations of populations of Scottish primrose plants using a handheld GPS.

24.30 All locations where Scottish primrose plants were recorded in 2007 (Morris, 2009) were revisited, and other potentially suitable habitat (coastal grassland and heathland, including areas between 5 m and 10 m of sea cliffs) within the terrestrial ecology search area was surveyed in order to detect any new or unrecorded populations.

Survey limitations

24.31 The habitat present on steep slopes on and immediately above the low cliffs running north and north-east from Sandside Bay was not approached directly due to its precarious position. However, it was still possible to identify the NVC community present in this area from a safe distance. Furthermore, considering the relatively small scale and temporary duration of the onshore works, which will also avoid the cliffs, this constraint is not considered to represent a significant limitation.

24.32 It was not possible to access Dounreay Nuclear Power Development Establishment and HMS Vulcan, although these areas were surveyed at a distance using magnification. However, given the small scale and temporary duration of the onshore works, this is unlikely to represent a significant data gap.

24.33 All other parts of the terrestrial ecology search area and protected mammal survey buffer were accessible, and surveys were undertaken at the optimal time of year. As such, no other survey limitations were identified.

24.5 Assessment method

24.34 The overarching approach to assessment is described in Chapter 5: Environmental Impact Assessment Methodology. To support this, the following is a description of the specific criteria which are used to evaluate the impacts on terrestrial ecology.

24.35 The approach adopted for the assessment of impacts on terrestrial ecology involves the following stages:

- Determination of the importance of ecological features, through desk study and surveys;
- Identification and characterisation of potential effects to determine level of impact;
- Assessment of likely significant impacts;
- Identification of requirement for measures to avoid and mitigate (reduce) these impacts; and
- Assessment of the significance of any residual impacts after mitigation.

24.36 This is in line with recently published guidance for EcIA produced by CIEEM (CIEEM, 2016).

Determining importance

24.37 According to the CIEEM guidance (CIEEM, 2016), determining which ecological features are important and should be subject to detailed assessment is one of the key challenges in the EcIA process. Ecological features can be important for a variety of reasons, and may relate, for example, to the quality or extent of designated sites or habitats, to habitat/species rarity, to the extent to which they are threatened throughout their range, or to their rate of decline. The rationale used to determine importance should be explained to demonstrate a robust selection process.

24.38 The level of importance of all habitats and species recorded during the terrestrial ecology surveys has been determined using the criteria defined in Table 24-4. In line with the CIEEM guidance, these criteria have been determined with regard to statutory requirements and policy objectives for biodiversity.

24.39 In addition, where relevant and where information is available, use is made of contextual information about distribution of habitats and species, and species abundance, including trends based on historical records.

24.40 As available quantitative data on a particular habitat or species may be limited, particularly below the international and national level, the evaluation of importance may also involve an element of professional judgement.

24.41 Evaluations are based upon a combination of information gathered via the desk study and field study results, along with professional experience, including knowledge of the current onshore project area and surroundings.

24.42 In addition to the importance of a habitat or species per se, the assessment of terrestrial ecology presented in this technical chapter also considers the value of the current onshore project area and surroundings for each ecological feature, in terms of the amount of habitat present, or the number of individuals using it and the nature and level of use. For example, if a noctule bat (*Nyctalus noctula*) roost was identified within a proposed development site, the species would likely be assigned a medium or higher importance level. However, if single noctule bats were recorded flying across the site on one or two occasions only, and little or no suitable roosting, foraging or commuting habitat was present, the population may be assessed as being of low importance.

Table 24-165: Criteria for evaluation of importance level of habitats and species recorded during the 2015 terrestrial ecology surveys

Importance level	Criteria	Examples
Very High	Internationally important habitats, or species that are part of an internationally important population	• An internationally designated site, candidate site, or an area meeting the criteria for an international designation, i.e. an SAC. • Large areas of priority habitat listed under Annex I of the Habitats Directive, and smaller areas of such a habitat that are essential to maintain the viability of that ecological resource. • A regularly occurring, nationally significant population of any internationally important species, listed under Annex II or Annex IV of the Habitats Directive.
High	Nationally important habitats, or species that are part of a nationally important population	• A nationally designated site, or area meeting criteria for national level designations, i.e. a SSSI or NNR. • Significant extents of a Scottish Biodiversity List (SBL) priority habitat, or smaller areas which are essential to maintain the viability of that ecological resource. • A regularly occurring, regionally significant population of any nationally important SBL priority species, or species listed under Schedule 5 of the Wildlife and Countryside Act or Annex II or Annex IV of the Habitats Directive.
Medium	Regionally important habitats or species that are part of a regionally important population	• Viable areas of key semi-natural SBL priority habitat. • A regularly occurring, locally significant population of any nationally important SBL priority species, or species listed under Schedule 5 of the Wildlife and Countryside Act or Annex II or Annex IV of the Habitats Directive. • Sites which exceed local authority-level designations but fall

Importance level	Criteria	Examples
		short of SSSI selection guidelines, including areas of semi-natural woodland exceeding 0.25 ha.
Low	Habitats or species that are part of a locally important population.	• Areas of semi-natural ancient woodland smaller than 0.25 ha. • Sites of Importance for Nature Conservation (SINCs) or equivalent sites selected on local authority criteria. • Local Nature Reserves (LNRs). • Other species of conservation concern, including species listed under the Local BAP (LBAP). • Areas of habitat or species considered to appreciably enrich the ecological resource within the local context e.g. species-rich flushes or hedgerows
Negligible	Common and widespread habitat or species of little or no intrinsic nature conservation value.	• All other species and habitats that are widespread and common and which are not present in locally, regionally or nationally important numbers or habitats which are considered to be of poor ecological value (e.g. commercial forestry).

Identification and characterisation of potential effects

24.43 In line with CIEEM guidance (CIEEM, 2016), reference is made to the following characteristics when describing ecological effects:

- **Nature of impact**: whether it is positive (beneficial), to habitats e.g. by improving habitat structure or to species e.g. by increasing species diversity or extending habitat, or negative (detrimental) to habitats e.g. by direct habitat destruction or to non-avian species by loss of, or displacement from, suitable habitat;
- **Extent**: the spatial or geographical area over which the effect may occur;
- **Magnitude:** refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of protected habitat lost or percentage decline in a species population.
- **Duration:** this should be defined in relation to ecological characteristics (such as a species' lifecycle) as well as human timeframes. It should also be noted that the duration of an activity may differ from the duration of the resulting effect, e.g. if short-term construction activities cause disturbance to badger (*Meles meles*) during their breeding period, there may be long-term implications from failure to reproduce that season.
- **Reversibility**: an irreversible effect is one from which recovery is not possible within a reasonable timescale or there is no reasonable chance of action being taken to reverse it. A reversible effect is one from which spontaneous recovery is possible or which may be counteracted by mitigation.
- **Frequency:** the number of times an activity occurs may influence the resulting effect.
- **Timing:** this may result in an effect on an ecological feature if it coincides with critical life-stages or seasons e.g. the badger breeding season.

Terrestrial ecology design envelope

24.44 The project description is set out in Chapter 4. Specific assumptions relevant to the assessment in this technical chapter are:

- Onshore cable corridor route and footprint;
- Landfall method and footprint of onshore cable corridor;
- Substation/switchgear location;
- Requirement for upgrading and extension of existing access tracks; and
- No requirement for watercourse crossings.

24.45 Installation of the onshore cable corridor will require a trench 20 m in width and up to 800 m in length; the precise route of the onshore cable corridor has yet to be confirmed. However, to assist the assessment of terrestrial ecology interests, two potential onshore cable corridor routes have been defined to allow a consideration of likely effects on ecological features resulting from different routes. Note that these routes are indicative only, and the final onshore cable corridor route selected may be located elsewhere within the current onshore project area. The two indicative export cable route corridors are shown in Figure 24-3.

24.46 There are two options for the landfall method: HDD or pinning.

24.47 Indicative onshore cable corridor route 1 would require an HDD compound of up to 1000 m^2 (0.1 ha), set back approximately 150 m from the edge of the cliffs. The potential location of this compound is included in Figure 24-3, but is indicative only and an HDD compound, if required, may be located elsewhere within the current onshore project area.

24.48 Indicative onshore cable corridor route 2 would require pinning of the cable to the existing cooling water intake channel for the Dounreay Nuclear power station.

24.49 The substation or switchgear footprint is likely to be an area of approximately 50 m x 50 m (0.25 hectares). The location of the substation or switchgear has yet to be determined, but the area within which it is likely to be located is shown in Figure 24-3, along with two possible substation/switchgear locations within this area. Note that these locations are indicative only and have been defined to assist in determining potential effects on terrestrial ecology interests; the substation/switchgear may be located elsewhere within the area shown in Figure 24-3.

24.50 The Project will make use of an existing access track from the A836, which may require upgrading, and would also utilise an existing area of hardstanding for storage, welfare facilities and laydown.

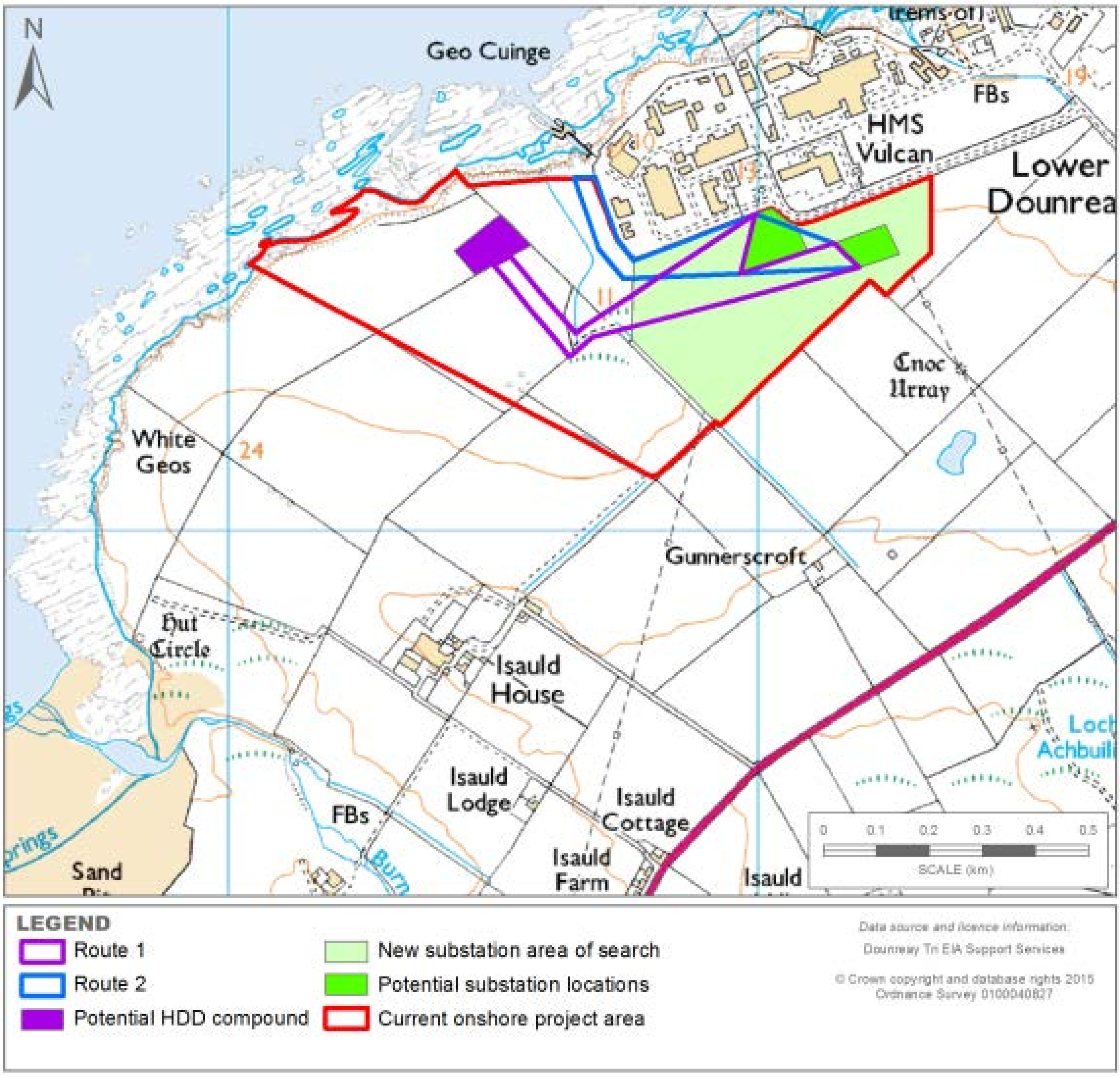

Figure 24-3: Indicative locations of onshore infrastructure and onshore cable corridor routes

24.51 It is understood that there will not be any requirement for watercourse crossings. The assessment of potential effects on watercourses has been undertaken on the basis of this assumption.

24.52 To ensure that the assessment adequately covers all potential variations in the design, as far as possible, the 'worst case scenario' is assessed, which ensures that all other variations within that maximum parameter are assessed by proxy.

24.53 In the case of terrestrial non-avian ecology, it is considered that indicative onshore cable corridor route 1 and the HDD landfall option represents the 'worst case scenario' for terrestrial ecology, because this is likely to result in greater total habitat loss than indicative onshore cable corridor route 2 combined with the pinning landfall option, and could potentially result in the loss or disturbance of very small areas of sensitive habitat. Both landfall options are expected to take 1-2 months to construct, subject to weather conditions. The construction period for the switchgear or substation is expected to be 12 - 18 months.

Geographic context

24.54 Impacts on terrestrial ecology are assessed in a local and, if necessary, a regional context as appropriate. For the purposes of the assessment, a local population refers to the population within Caithness. If a potentially significant impact on a local population or habitat extent is identified, then the assessment is extended to consider potential impacts on the wider, regional population or habitat extent. However, if no significant effect on the local population or habitat extent is identified, consideration of the wider geographical area is not considered necessary (because considering a wider population or habitat extent will likely result in potential effects that are of the same or lower level).

24.55 SNH has defined Natural Heritage Zones (NHZs) within Scotland (SNH, 2002b), which they consider to be appropriate biogeographical spatial units against which regional effects of proposed developments can be assessed. NHZ classifications represent areas with a high level of bio-geographic coherence, and are unrelated to administrative boundaries. The proposed onshore project area lies within NHZ 2: Orkney and North Caithness and, where an assessment of a regional ecological feature is necessary, effects are assessed within this NHZ as far as possible. At this stage, however, there are limited data on habitats and populations of non-avian species available at the NHZ level.

Duration of effects

24.56 The following definitions have been applied with regard to timescales:

- **Immediate**: within approximately 12 months;
- **Short-term**: within approximately 1 to 5 years;
- **Medium-term**:- within approximately 6 to 15 years; and
- **Long-term**: more than 15 years.

24.57 In addition, effects may be described as temporary or permanent.

Determining the level of effects

24.58 For the purposes of this assessment, the potential effects are assigned to different levels to assist the assessment process. The level of effects is defined using the criteria in Table 24-5. Note that these effects relate to negative effects; where positive effects are predicted, these are not assigned different levels.

Table 24-166: Criteria for determining the level of effects on terrestrial ecology

Effect level	Criteria
Very High	Total or almost complete loss of an ecological feature (habitat or population), likely to result in a permanent effect on its long-term ecological integrity and affect its conservation status.
High	Large-scale, permanent changes to an ecological feature, and likely to change its ecological integrity and affect its conservation status.
Medium	Moderate-scale, long-term changes to an ecological feature, or larger-scale temporary changes, but its long-term ecological integrity is unlikely to be affected, and any changes in conservation status are reversible.
Low	Small-scale, temporary effects on an ecological feature that do not affect ecological integrity or conservation status.
Negligible	Little or no detectable effect on an ecological feature

Assessment of significance

24.59 For terrestrial ecology, potential ***effects*** are identified and significance of ***impact*** is assessed for each stage of the project lifecycle, and significance attributed relative to the background conditions.

24.60 The latest CIEEM guidance on EcIA (CIEEM, 2016) avoids and discourages use of the matrix approach to determining significance, and describes only two categories: 'significant' or 'not significant'.

24.61 According to the CIEEM guidance, for the purpose of EcIA, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for important ecological features or for biodiversity in general. Effects can be considered significant at a wide range of scales from international to local.

24.62 The guidance further states that "In broad terms, significant effects encompass impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)".

24.63 In line with this guidance, rather than using a matrix to determine significance, the approach used in this technical chapter is to consider the importance and sensitivity of the habitats and populations and the characteristics (extent, magnitude, duration, timing etc.) and severity of the effect, and applying professional judgement as to whether the ecological integrity of a habitat or population will be affected.

24.64 The term "ecological integrity" refers to the maintenance of the conservation status of a habitat or population of a species at a specific location or geographical scale, and is used here in accordance with the definition adopted by the ODPM Circular 06/2005 on Biodiversity and Geological Conservation, whereby designated site integrity refers to "*…the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and/or the levels of populations of the species for which it was classified*".

24.65 Effects are more likely to be significant where they affect a habitat or species of higher levels of importance, or where the severity of the effect is high. Effects not considered to be significant would be those that do not threaten the integrity of an ecological feature (i.e. where the severity of an effect is low), or where the habitat or population affected is considered to be of low importance.

24.66 In this assessment, an effect that threatens the integrity of a habitat or species population is considered to be significant. Effects that do not threaten the integrity of a habitat or population are considered to be not significant.

24.67 Where appropriate, mitigation measures are identified in order to avoid and reduce potentially significant effects. It is also good practice to propose mitigation measures to reduce negative effects that are not significant.

24.68 The significance of residual effects on habitats and populations following implementation of mitigation is then determined, along with any monitoring requirements.

Assessment of cumulative effects

24.69 Cumulative effects would not be detected when considering the Project in isolation, but become significant in combination with other effects.

24.70 The need to consider cumulative effects is a requirement of the EIA process, as specified by The Electricity Works (Environmental Impact Assessment) (Scotland) Regulations 2000. Guidance has also been provided for assessment of cumulative impacts of onshore wind farms

(SNH, 2012), although this does not include specific guidance for assessing effects on non-avian ecological features.

24.71 Projects to be incorporated in such an assessment must include those existing and consented developments, as well as those at the application stage.

24.72 As different projects often employ differing baseline and impact assessment methods, data often cannot be directly compared, and so quantitative assessment of cumulative effects is often not possible. Furthermore, as there is no compulsion for developers to share commercial data with other companies, it is often impossible to acquire a full dataset. Therefore a comprehensive and quantitative cumulative impact assessment is rarely possible. However, every effort has been made to provide a qualitative assessment that is as robust as the available data allows.

24.73 The context in which cumulative effects are considered depends upon the ecology of the habitat or species in question. For example, it may be appropriate to consider cumulative effects to otters associated with an SAC within the context of their wider foraging range. For other ecological features, such as a scarce plant species, it may be appropriate to consider the effects on the local population in the context of any planned wind farms in the immediate vicinity which have the potential to cause additional effects on the plant, e.g. through loss of habitat.

24.74 As the onshore works are relatively small scale and restricted to a very small area, potential effects on statutory sites, sensitive habitats and protected species, are considered to be so small as to make it extremely unlikely that cumulative effects would occur. As such, potential cumulative effects have been scoped out of the assessment.

24.6 Desk study results

Existing records

24.75 Information relating to terrestrial ecology that was received in response to data requests is summarised in Table 24-6, and relevant data are included in the baseline accounts presented in section 24.11. Further details of the records received are provided in Technical Appendix 24.1.

Table 24-167: Summary of terrestrial ecology records obtained through data requests

Organisation	Description of information provided
SNH	Provided information relating to statutory sites, but did not hold any relevant records of notable species.
SB	Did not hold any records of badgers within 2 km of the terrestrial ecology search area. However, the area is considered to be under-recorded and as the terrestrial ecology search area includes similar habitat to that where badgers have been recorded in the wider area, a specific badger survey was advised.
HBRG	Returned records of several fungi and invertebrate species, single records of heath navel lichen (*Lichenomphalia umbellifera*) and slow-worm (*Anguis fragilis*), and nine mammal species including historic records of brown long-eared bat (*Plecotus auritus*), common pipistrelle (*Pipistrellus pipistrellus*) and pine marten (*Martes martes*).
NHBN	Advised that their records were available on the National Biodiversity Network Gateway, and gave permission for their use if relevant.
ARC	Did not hold any records that could be shared, but confirmed that adders (*Vipera berus*) were present within 2 km of the terrestrial ecology search area.

BSBI	No information received to date.
CBG	No information received to date.

Statutory sites

24.76 Four sites with international designations for ecological features are located within 20 km of the current onshore project area, and three sites with national designations are located within 5 km (in addition, two of the sites in the wider search area with international designations are also SSSIs). Details of these sites are summarised in Table 24-7 and locations are shown in Figures 24-4 (sites with international designations) and 24-5 (sites with national designations).

Table 24-168: Statutory sites designated for ecological features, listed in order of proximity to the current onshore project area

Designation(s)	Site name	Distance (km)	Qualifying non-avian ecological feature
SSSI	Sandside Bay	0.4 km to W	• Sand dunes and associated foreshore, dune slacks and the banks of the Burn of Isauld.
SSSI	Red Point Coast	1.4 km to NW	• Maritime cliff vegetation; and • Scottish primrose.
SAC	Caithness and Sutherland Peatlands	4.0 km to SW	• Clear-water lochs with aquatic vegetation and poor to moderate nutrient levels; • Acid peat-stained lakes and ponds; • Blanket bog; • Wet heathland with (cross-leaved heath (*Erica tetralix*); • Transition mires and quaking bogs; • Depressions on peat substrates ; • Otter; and • Marsh saxifrage (*Saxifraga hirculus*).
SSSI	East Halladale	4.0 km to SW	• Blanket bog.
SAC (and SSSI)	Broubster Leans	6.6 km to SE	• Transition mires and quaking bogs.
SAC (and SSSI)	River Thurso	12.6 km to E	Designated features of the SAC: • Atlantic salmon (*Salmo salar*). Designated features of the SSSI: • Flood-plain fen; and • Vascular plant assemblage.
SAC	Strathy Point	13.7 km to W	• Vegetated sea cliff.

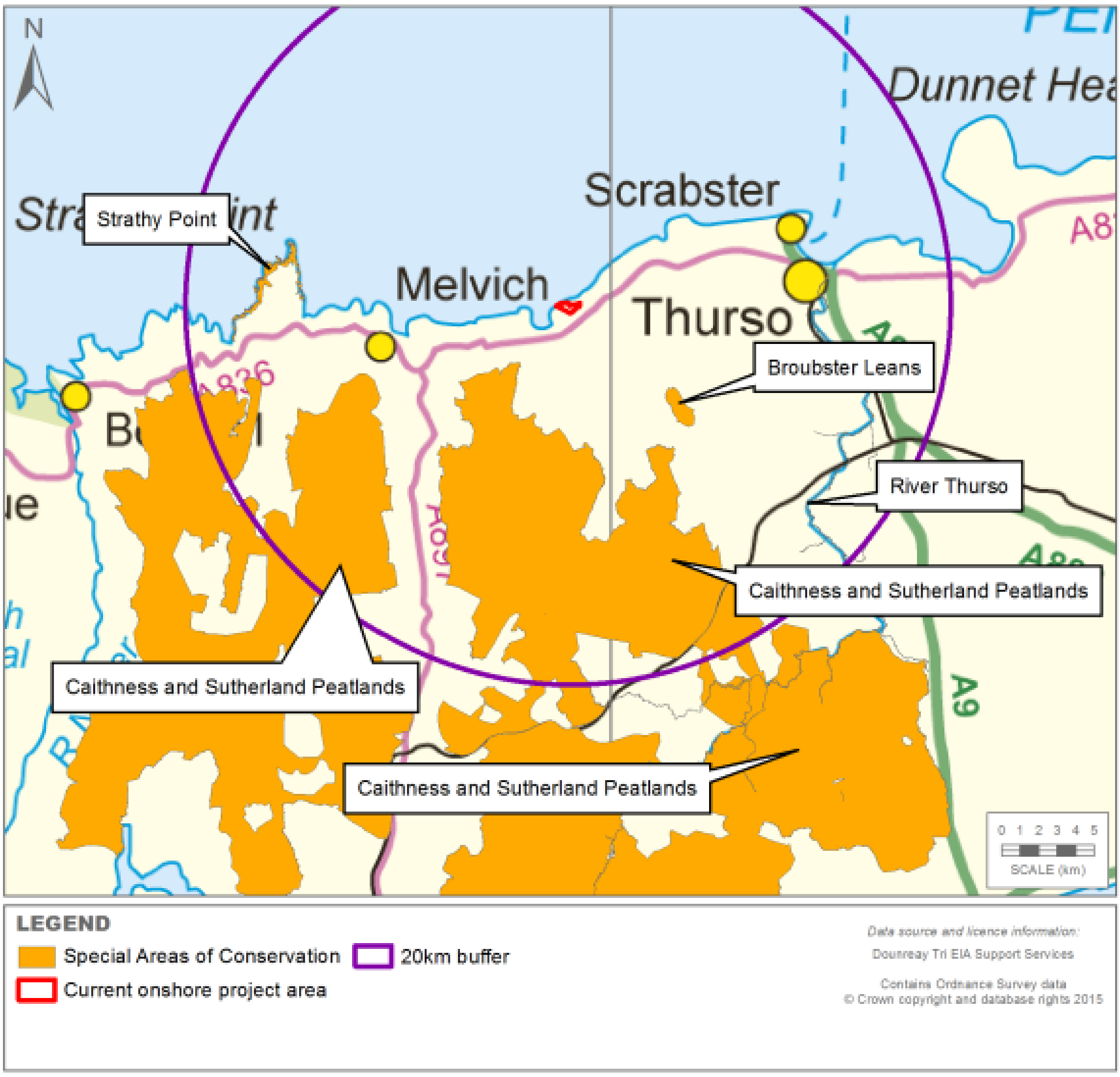

Figure 24-4: Sites with international designations for non-avian ecological features located within 20 km of the current onshore project area

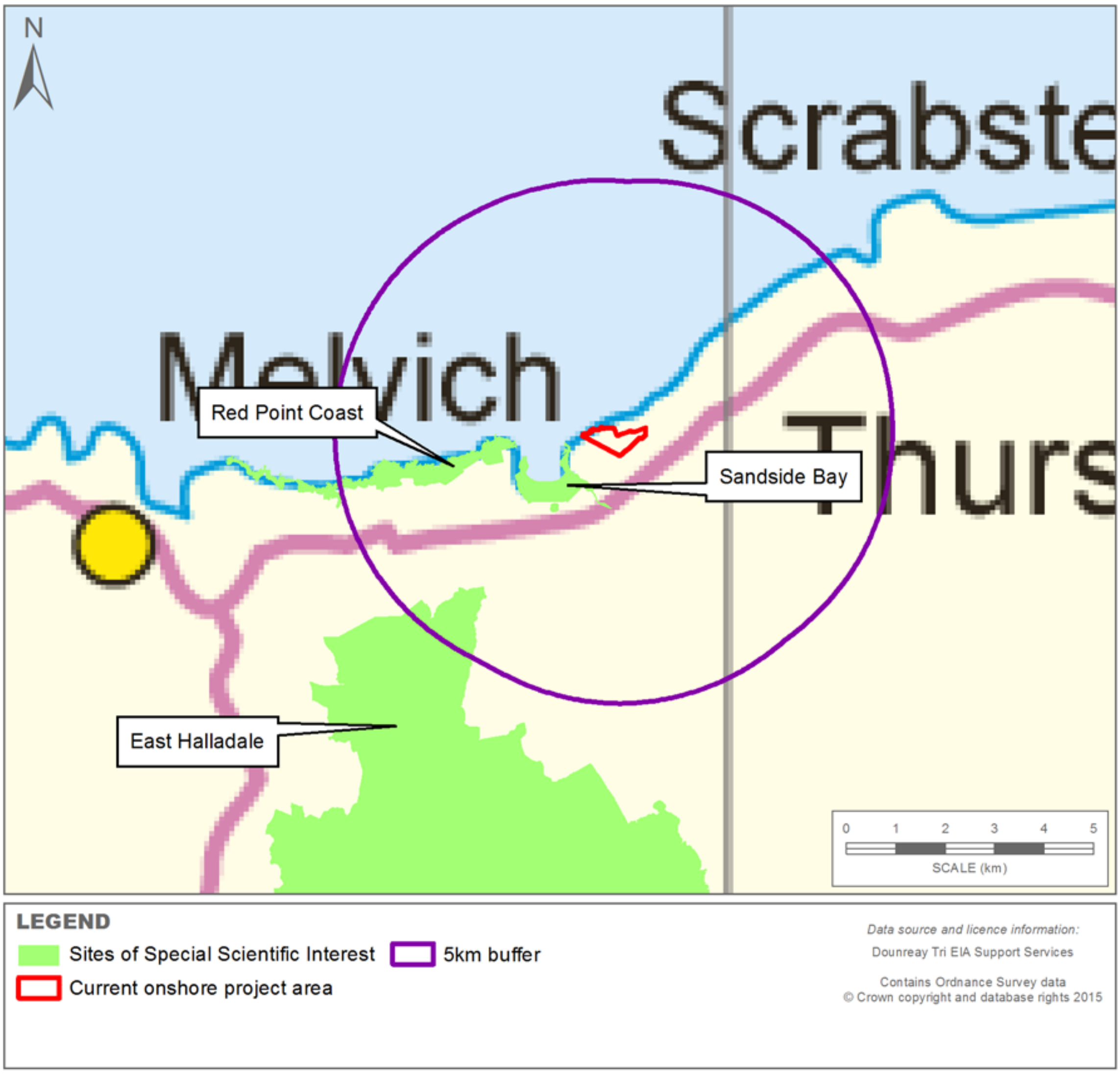

Figure 24-5: Sites with national designations for non-avian ecological features located within 5 km of the current onshore project area

1.3 Field survey results

24.77 Botanical nomenclature in this technical chapter follows Stace (2010).

Extended Phase 1 survey

Habitats

24.78 Eighteen vegetated Phase 1 habitats were identified within the terrestrial ecology search area, as well as bare ground. Of these, only five vegetated Phase 1 habitats (arable and four grassland habitats) were present within the current onshore project area, as well as a small patch of bare ground. A summary of the results is provided in Table 24-8.

24.79 The Phase 1 habitats are shown in Figure 24-6, along with man-made structural features (such as fences, buildings, tracks and roads).

Table 24-169: Summary of Phase 1 habitats recorded within the terrestrial ecology search area

Phase 1 code	Phase 1 habitat type	Description	Conservation status	Extent within current onshore project area (ha)
A1.1.1	Broadleaved semi-natural woodland	A small area of broadleaved semi-natural woodland occurs to the north of the police station in New Reay with a cover including *Fraxinus excelsior* (ash), *Acer pseudoplatanus* (sycamore), *Alnus glutinosa* (alder) and *Ulmus glabra* (wych elm).	Unlikely to include any plant communities that correspond to Annex I habitats. Some native broad-leaved woodlands are SBL priority habitats.	None
A1.2.2	Coniferous plantation	A small plantation of *Picea sitchensis* (Sitka spruce) was recorded at the southern end of the Burn of Isauld.	An introduced species monoculture of negative biodiversity value.	None
B2.2	Semi-improved neutral grassland	Several fields of semi-improved grassland occur around Sandside Bay. These are composed of a variety of grasses suited to neutral soils, including *Poa* (meadow-grass) species, *Lolium perenne* (perennial rye-grass), *Dactylis glomerata* (cock's-foot), *Holcus lanatus* (Yorkshire fog) and *Agrostis* (bent) species. The fields are primarily used for the grazing of cattle and sheep. The burns and field boundaries are also colonised by semi-improved grassland. In these areas the tall grasses are mixed with umbellifers such as *Heracleum sphondylium* (hogweed) and *Anthriscus sylvestris* (cow parsley), as well as the garden escapee *Hesperis matronalis* (dame's-violet).	Unlikely to include any plant communities that correspond to Annex I habitats, and of limited biodiversity value.	8.23
B4	Improved grassland	The majority of enclosed fields around Sandside Bay consist of improved grassland, dominated by a monotonous sward of *Lolium perenne*, with *Cynosurus cristatus* (crested dog's-tail) and *Holcus lanatus*.	Unlikely to include any plant communities that correspond to Annex I habitats, and of limited biodiversity value.	7.62
B5	Marshy grassland	Small areas of marshy grassland dominated by *Juncus effusus* (soft-rush) are present in grazed fields.	Unlikely to include any plant communities that correspond to Annex I habitats, and of limited	4.35

Phase 1 code	Phase 1 habitat type	Description	Conservation status	Extent within current onshore project area (ha)
			biodiversity value.	
B6	Poor semi-improved grassland	The remainder of the enclosed pasture fields consist of poor semi-improved grassland dominated by *Lolium perenne*.	Unlikely to include any plant communities that correspond to Annex I habitats, and of limited biodiversity value.	None
D1	Wet dwarf shrub heath - acid	A small area of wet heath occurs at the western extremity of the terrestrial ecology search area. This habitat is dominated by *Calluna vulgaris* (heather) with *Erica tetralix, Potentilla erecta* (tormentil) and *Eriophorum angustifolium* (common cottongrass) prominent.	Will include plant communities that correspond to Annex I habitats. Both lowland and upland heathland are SBL priority habitats.	None
D2	Dry dwarf shrub heath	Small areas of heather-dominated dry heath occur within the coastal grassland running north and north-east of Sandside Bay with abundant *Potentilla erecta*, *Scilla verna* (spring squill) and *Pedicularis sylvatica* (lousewort).	Will include plant communities that correspond to Annex I habitats. Both lowland and upland heathland are SBL priority habitats.	None
G1	Standing water	A small pond was located within an area of marshy grassland in one of the improved fields in the east of the terrestrial ecology search area.	Ponds are an SBL priority habitat.	None
G2	Running water	Three burns run across the western part of the terrestrial ecology search area into Sandside Bay: Sandside Burn, Reay Burn, and Burn of Isauld, which is called Achvarasdal Burn upstream of Reay.	Sandside Burn and Achvarasdal Burn are associated with the Caithness and Sutherland Peatlands SAC.	None
H1.1	Intertidal mud/sand	The intertidal areas and beach front at Sandside Bay consists of bare sand.	No plant communities present.	None
H1.2	Intertidal shingle/cobbles	A small area of intertidal shingle occurs at the north end of Sandside beach.	No plant communities present.	None
H6.4	Dune slack	A small number of hollows have formed in the larger dune slacks with *Filipendula ulmaria* (meadowsweet) and *Luzula sylvatica* (great wood-rush)	Will include plant communities that correspond to Annex I habitats.	None

Phase 1 code	Phase 1 habitat type	Description	Conservation status	Extent within current onshore project area (ha)
		prominent.		
H6.5	Dune grassland	Part of Sandside Bay golf course consists of dune grasslands with a high cover of *Festuca rubra* (red fescue) as well as plants including *Galium verum* (lady's bedstraw), *Thymus polytrichus* (wild thyme) and *Lotus corniculatus* (common bird's-foot trefoil*)*. Patches of dune with *Ammophila arenaria* (marram) also occur throughout the golf course. The fairways and even greens of the golf course are also made up of dune grassland, although they are used in the same manner as amenity grassland.	Will include plant communities that correspond to Annex I habitats. Coastal sand dunes are an SBL priority habitat and a notified feature of Sandside Bay SSSI.	None
H6.8	Open dune	The large dunes fronting Sandside Bay golf course are colonised by a variety of plant species dominated by *Ammophila arenaria*, with *Festuca rubra*, *Veronica chamaedrys* (germander speedwell) and *Vicia cracca* (tufted vetch) commonly occurring.	Will include plant communities that correspond to Annex I habitats. Coastal sand dunes are an SBL priority habitat and a notified feature of Sandside Bay SSSI.	None
H8.1	Maritime hard cliff	The coast running between Sandside Bay and HMS Vulcan has a series of low, maritime hard cliffs.	Unlikely to include any plant communities that correspond to Annex I habitats. Maritime cliff and slopes are an SBL priority habitat.	None
H8.4	Coastal grassland	A strip of coastal grassland runs above the low cliffs north of Sandside Bay. It is dominated by *Festuca rubra*, with commonly occurring *Plantago lanceolata* (ribwort plantain), *P. maritima* (sea plantain), *Anthyllis vulneraria* (kidney vetch), *Lotus corniculatus* and *Scilla verna*.	Unlikely to include any plant communities that correspond to Annex I habitats.	5.43
J1.1	Arable	A number of enclosed fields around Fresgoe and Isauld House are arable.	Unlikely to include any plant communities that correspond to Annex I habitats, and of limited biodiversity value.	11.78

Phase 1 code	Phase 1 habitat type	Description	Conservation status	Extent within current onshore project area (ha)
J4	Bare ground	A small area of bare ground was present in the north-east of the survey area (corresponding with an area of hardstanding used during the construction of the Dounreay substation in 2013).	No plant communities present.	0.40

24.80 Three target notes describing notable features were recorded during the extended Phase 1 habitat survey; these are summarised in Table 24-9 and the locations are shown on Figure 24-6.

Table 24-170: Target notes recorded during the 2015 extended Phase 1 habitat survey

Target Note	Grid reference	Description
1	NG 96705 65398	Patch of species rich grassland on sandy substrate including *Plantago lanceolata*, *Ammophila arenaria*, *Dactylis glomerata*, *Filipendula ulmaria* and *Vicia cracca*.
2	NG 95700 66100	*Calluna vulgaris*, *Erica tetralix*, *Potentilla erecta* and *Eriophorum angustifolium* prominent in area of wet heath.
3	c. NG 965 650	Golf course fairways contain dune plant species including *Festuca rubra*, *Galium verum* and *Lotus corniculatus*.

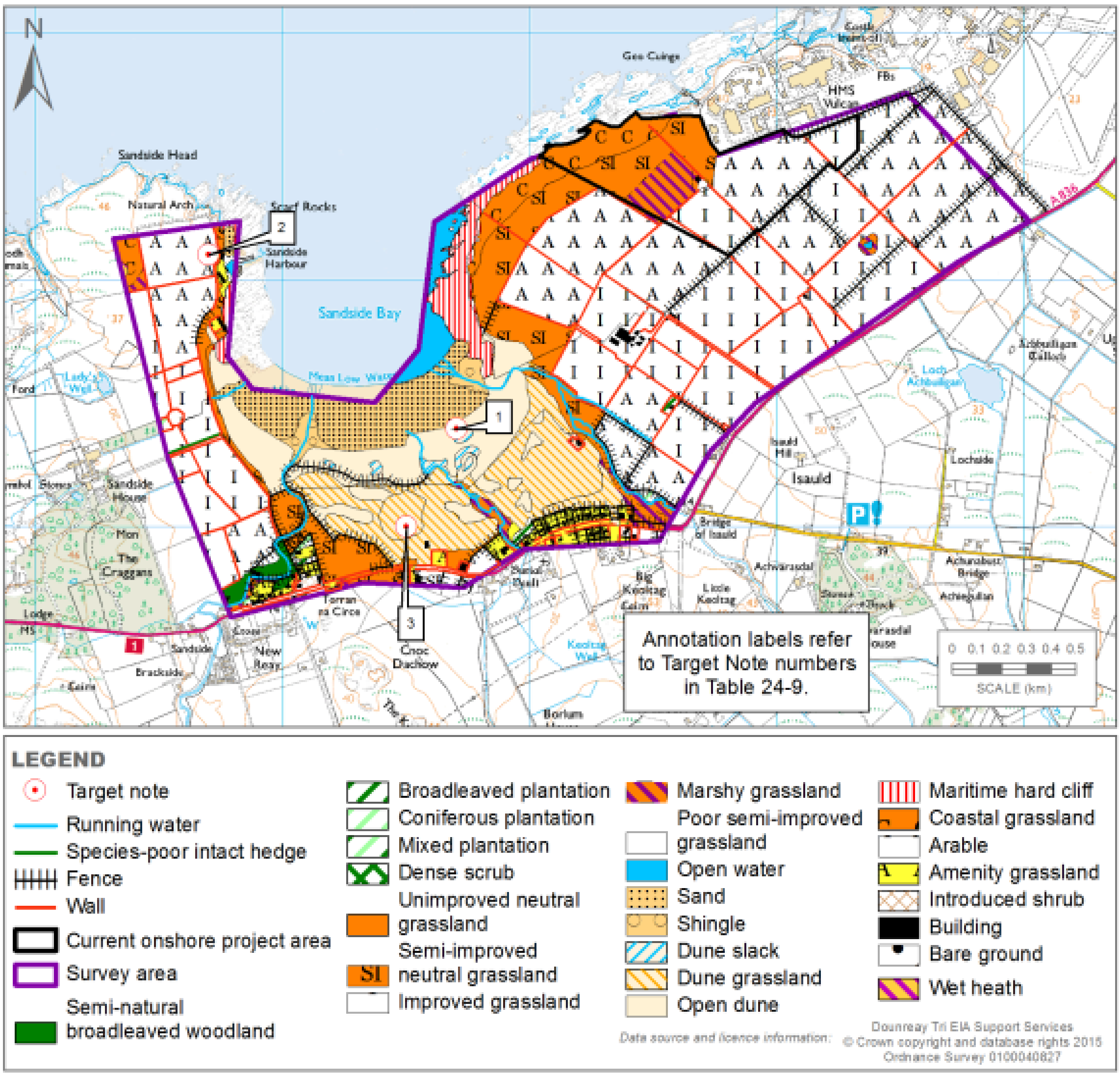

Figure 24-6: Phase 1 habitats and target notes recorded within the terrestrial ecology search area

Protected species

24.81 No signs of any protected mammal species were recorded during the extended Phase 1 habitat survey. Suitable habitat for foraging and/or commuting otters, pine martens and badgers is present within the terrestrial ecology search area, and it is possible that these species may use the area occasionally, including the coastline adjacent to the current onshore project area. However, it is considered unlikely that otters will make use of the current onshore project area itself for more than occasional commuting.

24.82 Buildings present within the terrestrial ecology search area may offer potentially suitable roosting sites for bats, while the woodland around New Reay contains mature broadleaved trees which may provide additional suitable roosting sites. Potentially suitable foraging habitat for bats is also present within the terrestrial ecology search area. However, there are no structures suitable for roosting bats within the current onshore project area itself, and the habitat is likely to be of limited suitability for foraging bats.

24.83 No signs of any protected reptile species were recorded during the extended Phase 1 habitat survey. However, suitable habitat for adders, slow-worms and common lizards (*Zootoca vivipara*) is present within the terrestrial ecology search area.

NVC survey

Overview

24.84 The results of the novel NVC survey show that the composition of the habitats within and around Sandside Bay have remained broadly similar to that found during a previous survey (Dargie, 1998).

24.85 The strandline and bare, shifting sand above the Mean Spring High Water level on Sandside Bay contains very small areas of the sand dune communities of the NVC types SD2 *Honckenya peploides – Cakile maritima* strandline community and SD4 *Elytrigia juncea* foredune community. The area comprising these communities is less than several square metres in total.

24.86 The main area of sand dunes lies behind the beach. The dunes area is fronted by the pioneering SD6 *Ammophila arenaria* mobile dune community. As the dunes become more fixed, this community is replaced by the SD7 *Ammophila arenaria – Festuca rubra* semi-fixed dune community. Areas of SD6 mobile dune community persist in the more fixed dunes where disturbance and the collapse of dune structures exposes more bare sand.

24.87 SD7 semi-fixed dune communities form a mosaic with, and are gradually replaced by, the SD8 *Festuca rubra – Galium verum* fixed dune grassland where the dunes become more stable and erosion and the accretion of sand ceases; here the sward becomes grassier (Rodwell, 2000). Also forming a mosaic on the large fixed dunes is the mesotrophic grass community MG1 *Arrhenatherum elatius* grassland, dominated by large grasses and umbellifers. The golf course itself primarily consists of SD8 fixed dune grassland with less cultivated areas of taller dunes comprising of SD7, SD8 and MG1. A small area of flushed wet ground occurs in the centre of the golf course and consists of areas of M10 *Carex dioica – Pinguicula vulgaris* mire with SD8 colonising the drier patches within the wet ground.

24.88 This vegetation pattern occurs along the front of Sandside Bay, from the minor road leading to the parking area at Fresgoe, to the Burn of Isauld. North of the burn's mouth the sand dune communities persist and the vegetation pattern is repeated. A tiny area of SD2 and SD4 occurs on the loose sand immediately north of the burn's mouth. Behind this, the succession of SD6 into SD7 and SD8 is repeated. The SD8 fixed dune grassland is then succeeded by mesotrophic grasslands. A narrow strip of dunes no more than 5 m wide runs north from here toward White Geos above low cliffs and sea washed rocks.

24.89 The coastal strip north and east of Sandside Bay above low cliffs is colonised by a strip of the NVC type MC10 *Festuca rubra – Plantago* spp. maritime grassland. Small areas of H7 *Calluna vulgaris – Scilla verna* heath also occur up to 80 m from the cliff edge.

24.90 The remainder of the terrestrial ecology search area consists of agricultural fields of mesotrophic grasslands and arable fields. The fields are primarily MG7 *Lolium perenne* improved grassland with MG6 *Lolium perenne – Cynosurus cristatus* grassland in less intensively grazed areas. A small number of trampled areas have rank assemblages of grasses dominated by *Urtica dioica* (common nettle) closely resembling the OV25 *Urtica dioica – Cirsium arvense* community. MG1 *Arrhenatherum elatius* grassland lines the banks of the field margins and burns of the terrestrial ecology search area.

24.91 Small wooded areas of planted conifers (no NVC designation) with some *Alnus glutinosa – Fraxinus excelsior* woodland occur around the periphery of the plantations.

24.92 Full quadrat data, DAFOR (Dominant, Abundant, Frequent, Occasional, Rare) dominance scale data, and a list of plant species recorded during the NVC survey are provided in Technical Appendix 24.1.

Community descriptions

24.93 A total of 16 plant communities were recorded during the survey, eight of which (SD2, SD6, SD7, SD8, M10, M15 and H7) correspond with Annex I habitats listed under the Habitats Directive, while three were identified as highly (M10) or moderately (M15 and MG10) groundwater-dependent.

24.94 Relatively few vegetation communities were recorded within the current onshore project area, where the dominant habitat present is arable farmland, followed by various types of grasslands.

24.95 NVC communities are shown in Figures 24-7a (the eastern half of the terrestrial ecology search area) and 24-7b (the western half), and descriptions of each community are provided in Table 24-10.

24.96 The extents of NVC communities present within the current onshore project area are shown in Table 24-11, although it should be noted that two of the habitats were present as mosaics, and as such, exact areas of each component vegetation community cannot be calculated.

24.97 Other features recorded during the NVC survey were a *Picea sitchensis* plantation and buildings. These features do not have NVC designations but are shown in Figures 24-7a and 24-7b for completeness.

Table 24-171: Descriptions of vegetation communities recorded within the terrestrial ecology search area during the 2015 NVC survey

NVC Community	Distribution	Plant species noted	Corresponding Annex I habitat	GWDTE assessment
SD2 *Honckenya peploides – Cakile maritima* strandline community	Tiny areas were found along the strandline of the main beach at Sandside Bay.	Isolated *Honckenya peploides* (sea sandwort) and *Cakile maritima* (sea rocket) plants.	2110. Embryonic shifting dunes	Not a GWDTE
SD4 *Elytrigia juncea* foredune community	Two tiny areas found along the foredune at Sandside Bay, immediately east of the two burns flowing through the centre and east of the golf course.	Dominated by *Elytrigia juncea* (sand couch) with odd plants of *Elytrigia atherica* (sea couch), *Ammophila arenaria*, *Cakile maritima*, *Atriplex laciniata* (frosted orache) and *Tussilago farfara* (colt's-foot) amongst the bare sand.		Not a GWDTE
SD6 *Ammophila arenaria* mobile dune community; mostly of the species-poor sub-communities SD6e and SD6f, dominated by *A. arenaria* with very little cover of *Elytrigia* species	Occupies the more mobile coastal dunes along the foreshore of Sandside Bay.	Dominated by the sand-binding *Ammophila arenaria*. Other plant species commonly occurring include *Hypochaeris radicata* (cat's-ear), *Cirsium arvense* (creeping thistle) and *Tussilago farfara* as well as the more maritime species of *Atriplex laciniata* and *Cakile maritima* on the more exposed dune fronts.	2120. Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')	Not a GWDTE
SD7 *Ammophila arenaria – Festuca rubra* semi-fixed dune community (typical sub-community)	The large dune systems and golf course behind the beach at Sandside Bay.	*Ammophila arenaria* still dominates the vegetation. *Festuca rubra* is sub-dominant and other grasses, notably *Poa pratensis* (smooth meadow-grass), also become common; *Galium verum* is the other constant here. Other commonly occurring species are *Plantago lanceolata*, *Ranunculus acris* (meadow buttercup), *Lotus corniculatus* and the mosses *Hypnum cuppressiforme* and *Rhytidiadelphus squarrosus*.	2130. Fixed dunes with herbaceous vegetation ('grey dunes')	Not a GWDTE
SD8 *Festuca rubra – Galium verum* fixed dune grassland (typical sub-	The most common sand dune habitat at Sandside Bay, where it dominates the golf course and the more fixed areas of the tall dunes.	*Festuca rubra* dominates, although other grasses such as *Holcus lanatus*, *Poa pratensis* and *Dactylis glomerata* also commonly occur.		Not a GWDTE

NVC Community	Distribution	Plant species noted	Corresponding Annex I habitat	GWDTE assessment
community)		A variety of dicotyledons are present here including *Galium verum*, which occurs as a constant species. In addition, *Euphrasia* agg. (eyebright species), *Plantago lanceolata*, *Trifolium repens* (white clover), *Lotus corniculatus* and *Ranunculus acris* are all abundant. The presence of *Arrhenatherum eliatus* (false oat-grass) in quadrats within this community is probably accounted for by the presence of MG1 grassland within the larger dunes as it is rarely present in this community (Rodwell, 2000).		
M10 *Carex dioica – Pinguicula vulgaris* mire	Present within a small flushed area of the Reay Golf Course.	Dominated by *Carex panicea* (carnation sedge) with other sedges such as *Carex lepidocarpa* (long-stalked yellow-sedge) and *Carex nigra* (common sedge). Also common here is the grass *Briza media* (quaking-grass) and the dicotyledons *Linum catharticum* (fairy flax) and *Euphrasia* agg.	7230. Alkaline fens	Highly groundwater-dependent
M15 *Tricophorum germanicum – Erica tetralix* wet heath	The western boundary of the terrestrial ecology search area crosses the periphery of an area of M15 wet heath.	Dominated by a short cropped carpet of *Calluna vulgaris*, with abundant *Carex panicea*, *Carex nigra*, *Agrostis* species, *Nardus stricta* (mat-grass) and *Eriophorum angustifolium*.	4010. Northern Atlantic wet heaths with *Erica tetralix*	Moderately groundwater - dependent
H7 *Calluna vulgaris – Scilla verna* heath	Small areas occur within the coastal grasslands running north and north-east from Sandside Bay to HMS Vulcan.	Consists of a low sward dominated by *Calluna vulgaris* and the grasses *Festuca rubra*, *Anthoxanthum odoratum* (sweet vernal-grass) and *Agrostis capillaris* (common bent). Among the dicotyledons present are *Potentilla erecta*, *Scilla verna*, *Plantago lanceolata* and *Lotus corniculatus*.	4030. European dry heaths	Not a GWDTE
MG10 *Holcus lanatus – Juncus effusus* rush pasture	Small areas occur at the east end of the terrestrial ecology search area within the enclosed fields of MG6 grassland.	Dominated by *Juncus effusus.*	None	Moderately groundwater - dependent

NVC Community	Distribution	Plant species noted	Corresponding Annex I habitat	GWDTE assessment
MC8 *Festuca rubra – Armeria maritima* grassland.	Present as small areas of turf on the steep slopes on and immediately above the low cliffs running north and north-east from Sandside Bay.		None	Not a GWDTE
MC10 *Festuca rubra – Plantago* spp. maritime grassland	Lies above the low cliffs along the coast line from Sandside Bay to HMS Vulcan.	The short sword is dominated by *Festuca rubra* with *Anthoxanthum odoratum* as another constant. The plantain species *Plantago lanceolata* and *P. maritima* are also abundant, as is *Trifolium repens*.	None	Not a GWDTE
MG1 *Arrhenatherum elatius* grassland	Occurs throughout the terrestrial ecology search area, forming a mosaic with the dune communities within the more fixed dune systems. Also occurs along the burns running north to south through the terrestrial ecology search area and along field boundaries.	Primarily composed of the MG1c *Urtica dioica* and MG1d *Filipendula ulmaria* sub-communities. The MG1 community has been colonised to a large extent by the introduced *Hesperis matronalis* dame's rocket.	None	Not a GWDTE
MG6 *Lolium perenne – Cynosurus cristatus* grassland	Occurs in the less intensively treated and grazed fields east and west of Sandside Bay, mainly toward the coast.		None	Not a GWDTE
MG7 *Lolium perenne* improved grassland	Occurs in the intensively managed and grazed pastures in enclosed fields further inland.	Consists almost exclusively of *Lolium perenne*.	None	Not a GWDTE
W7 *Alnus glutinosa – Fraxinus excelsior* woodland	Small areas occur along the higher banks of the burns around New Reay. The small Sitka spruce plantation at the south end of the Burn of Isauld is fringed by tiny areas of W7 woodland with *Salix cinerea* (grey willow) scrub.		None	Not a GWDTE

NVC Community	Distribution	Plant species noted	Corresponding Annex I habitat	GWDTE assessment
OV25 *Urtica dioica – Cirsium arvense* community	A weedy assemblage of plants found in trampled areas.	Rank assemblages of grasses dominated by *Urtica dioica*.	None	Not a GWDTE

Table 24-11: Extent of vegetation communities recorded within the current onshore project area during the 2015 NVC survey, listed in descending area of extent

NVC code	NVC community	Area within terrestrial ecology search area (ha)
OV1-19	Arable land	11.75
MG6	*Lolium perenne – Cynosurus cristatus* grassland	8.23
MG7	*Lolium perenne* improved grassland	7.68
MC10/ H7/MG6	*Festuca rubra – Plantago* spp. maritime grassland/ *Calluna vulgaris – Scilla verna* heath/ *Lolium perenne – Cynosurus cristatus* grassland mosaic	5.38
MG6/ MG10	*Lolium perenne – Cynosurus cristatus grassland/ Holcus lanatus – Juncus effusus* rush pasture mosaic	4.27

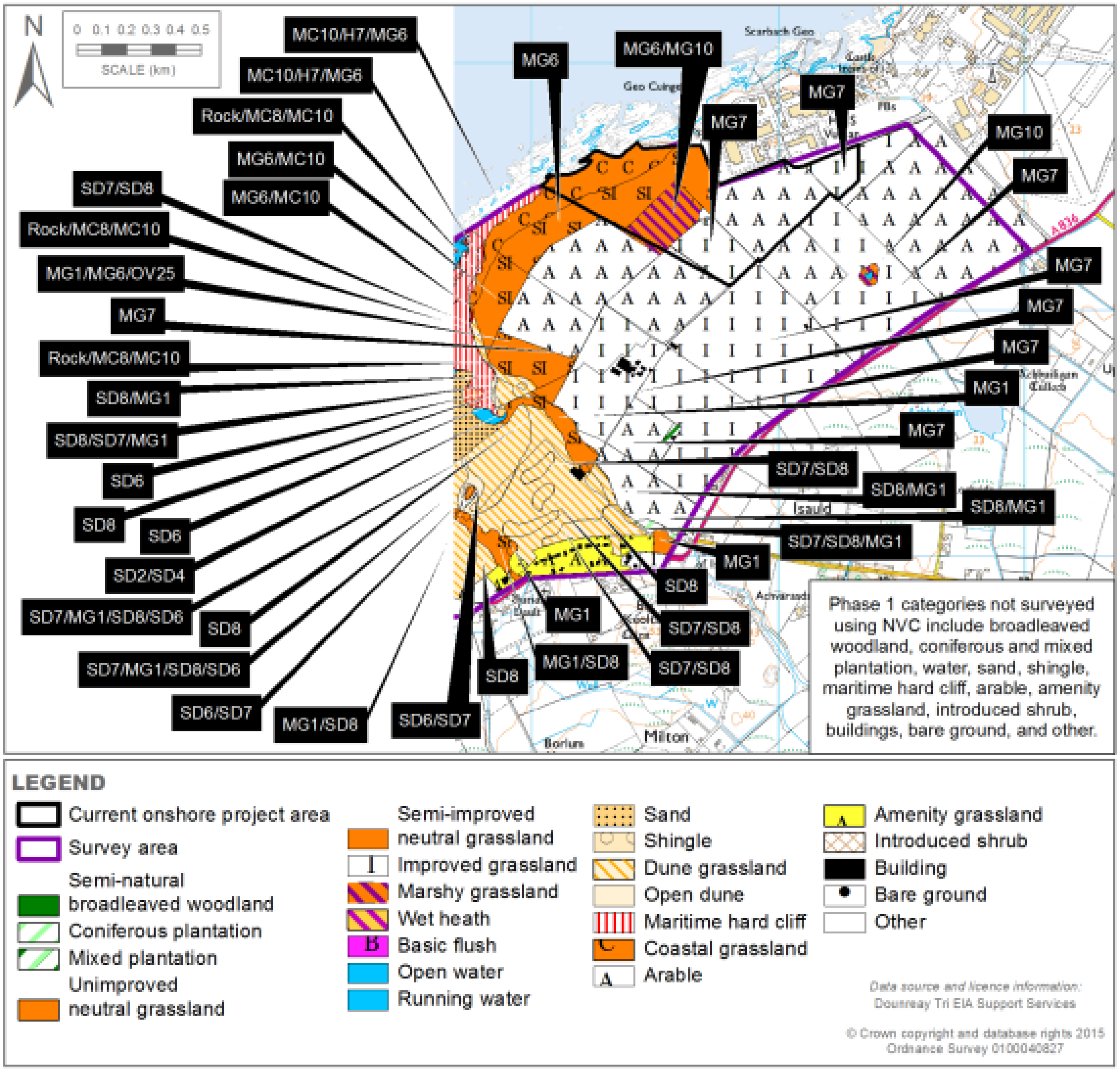

Figure 24-7a: NVC plant communities (eastern half of terrestrial ecology search area)

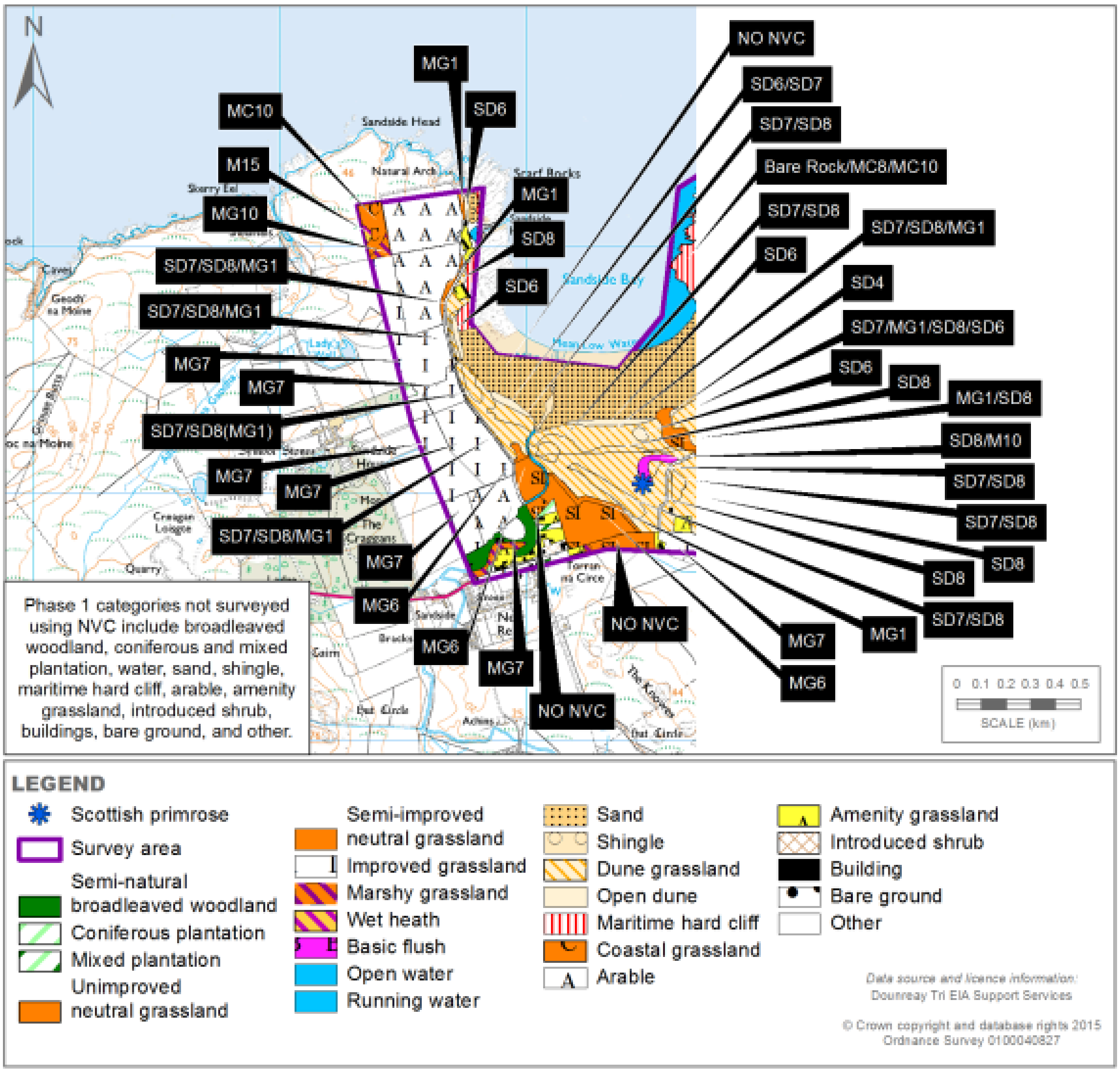

Figure 24-7b: NVC plant communities (western half of terrestrial ecology search area) and results of the Scottish primrose survey

Scottish primrose survey

24.98 An individual Scottish primrose plant was found at NC 96491 64980 on Reay Golf Course. The location is shown on Figure 24.7b. No plants were found within the area of suitable habitat along the coast to the north-east of Sandside Bay.

24.7 Potential effects

24.99 The main potential effects on terrestrial ecology arising from the onshore element of the Project are likely to be:

- Direct habitat loss due to land-take;
- Disturbance and damage/injury to habitats or protected species; and
- Indirect effects on habitats or protected species, e.g. due to pollution or sedimentation.

24.100 These potential effects are discussed in turn below for each phase of the proposed development (construction, operation and decommissioning).

24.101 In addition to potential effects that are directly related to the Project, effects may arise as a result of the cumulative effects of multiple developments within the local or regional area. However, as stated in Section 24.6, the onshore works are of a relatively small scale, and potential effects on important terrestrial ecological features are considered to be so small as to make it extremely unlikely that significant cumulative effects would occur. As such, potential cumulative effects have been scoped out of the assessment.

Potential effects during construction

24.102 Potential construction effects on terrestrial ecological features are identified below. These are likely to be temporary and occur within 12-18 months of the start of the onshore construction works.

Direct habitat loss

24.103 The onshore construction works will involve construction of the onshore cable corridor and substation/switchgear, as well as hardstanding, and potentially an HDD compound and widening of the existing access track, all of which would result in direct habitat loss.

24.104 As stated in section 24.6 (under 'Terrestrial ecology design envelope'), the location of the onshore infrastructure has yet to be determined. However, in order to provide an indication of the areas of habitat that would potentially be affected by onshore infrastructure, habitat loss estimates based on the two indicative onshore cable corridor routes/landfall options and associated infrastructure (shown in Figure 24-3) are presented in Table 24-12, broken down by Phase 1 habitat type.

Table 24-172: Extent of Phase 1 habitats that would be lost for each of the two indicative onshore cable corridor routes and associated infrastructure

Phase 1 code	Phase 1 habitat type	Extent of habitat loss (ha)							Total habitat loss (ha) associated with indicative onshore cable corridor route/ landfall option and associated infrastructure[1]	
		Cable corridor route 1	Cable corridor route 2	HDD compound (onshore cable route 1 only)	Access track	Hardstanding	Substation east	Substation west	Cable corridor route 1 and HDD landfall option	Cable corridor route 2 and pinning landfall option
J1.1	Arable	3.40	3.00	-	1.92	0.03	<0.01	0.90	6.24	5.84
B2.2	Semi-improved neutral grassland	0.20	0.68	0.78	0.00	0.48	-	-	1.46	1.16
B4	Improved grassland	0.04	0.01	-	1.47	-	0.55	-	1.51	1.48

Phase 1 code	Phase 1 habitat type	Extent of habitat loss (ha)							Total habitat loss (ha) associated with indicative onshore cable corridor route/ landfall option and associated infrastructure[1]	
		Cable corridor route 1	Cable corridor route 2	HDD compound (onshore cable route 1 only)	Access track	Hardstanding	Substation east	Substation west	Cable corridor route 1 and HDD landfall option	Cable corridor route 2 and pinning landfall option
B5	Marshy grassland	0.64	-	-	-	0.01	-	-	0.65	0.01
H8.4	Coastal grassland	-	-	0.03	-	-	-	-	0.03	<0.01
J4	Bare ground	0.19	-	-	-	0.20	-	-	0.39	0.20
Total		**4.48**	**3.69**	**0.81**	**3.40**	**0.72**	**0.55**	**0.90**	**10.29**	**8.70**
Note: [1]Based on construction of substation west, which would result in a greater total habitat loss than substation east										

24.105 As shown in Table 24-12, onshore cable corridor route 1 would result in a greater total habitat loss (10.29 ha) than onshore cable corridor route 2 (8.70 ha).

24.106 The estimated extents of NVC communities that would be lost for the two indicative onshore cable corridor routes/landfall options and associated infrastructure (shown in Figure 24-3) are presented in Table 24-13.

Table 24-173: Extent of NVC communities that would be lost for each of the two indicative onshore cable corridor routes and associated infrastructure

NVC code	NVC community description	Extent of habitat loss (ha)	Total habitat loss (ha) associated with indicative onshore cable corridor route/ landfall option and associated infrastructure[1]

		Cable corridor route 1	Cable corridor route 2	HDD compound (onshore cable route 1 only)	Access track	Hardstanding	Substation east	Substation west	Cable corridor route 1 and HDD landfall option	Cable corridor route 2 and pinning landfall option
MG6	*Lolium perenne – Cynosurus cristatus* grassland	0.20	0.68	0.80	-	0.49	-	-	1.49	1.17
MG7	*Lolium perenne* improved grassland	0.05	0.00	-	1.54	-	0.54	-	1.59	1.55
MG6/ MG10	*Lolium perenne – Cynosurus cristatus grassland/ Holcus lanatus – Juncus effusus* rush pasture mosaic	0.63	-	-	-	-	-	-	0.63	<0.01
MC10/ H7[2]/ MG6	*Festuca rubra – Plantago* spp. maritime grassland/ *Calluna vulgaris – Scilla verna* heath/ *Lolium perenne – Cynosurus cristatus* grassland mosaic	-	-	0.01	-	-	-	-	0.01	<0.01
OV1-19	Arable land	3.41	3.00	-	1.86	0.03	0.00	0.90	6.19	5.78
Totals		**4.29**	**3.69**	**0.81**	**3.40**	**0.52**	**0.55**	**0.90**	**9.91**	**8.50**

Notes:

[1]Based on construction of substation west, which would result in a greater total habitat loss than substation east.

[2]MG10 is moderately groundwater-dependent.

[3]H7 corresponds with the Annex I habitat 'European dry heaths'

24.107 As can be seen from Table 24-13, no NVC communities corresponding with Annex I habitats would be lost if the onshore cable corridor route matched indicative route 2 in Figure 24-3, However, route 1 and the associated HDD landfall option would require construction of an HDD compound, which (based on the indicative location shown in Figure 24-3) would result in the loss of a very small amount (0.01 ha) of mosaic habitat that includes the NVC community H7 *Calluna vulgaris – Scilla verna* heath, which corresponds with the 'European dry heaths' Annex I habitat. In addition, construction of the HDD compound would result in the loss of a small amount (0.63 ha) of mosaic habitat that includes MG10, which is moderately groundwater-dependent.

24.108 Note that all of these values are estimates only; the amount of total habitat loss will vary according to the finalised design, but is likely to be similar to the estimated values. However, these estimates indicate that the total area that will be lost is relatively small. Furthermore, once the onshore cable corridor has been installed, the habitat within which the trench is located will be restored. Similarly, if an HDD compound is required, this will be removed and the habitat reinstated following completion of the landfall works.

24.109 As well as directly affecting habitats themselves, land-take may have an effect on protected species making use of particular habitats for foraging, shelter, breeding etc.

Disturbance and damage/injury

24.110 The effects of disturbance to habitats are variable in their extent, depending on the nature of the disturbance and sensitivity of the habitat affected. Some disturbance types (for example, creation of temporary hardstanding areas) result in medium- to long-term disturbance with extended recovery periods. In other cases (for example, installation of cables) disturbance is short-term, and certain habitat types are able to recover quickly.

24.111 Construction works may also cause damage to habitats and plant species, and injury (which may lead to mortality) in animal species, e.g. through trampling, damage caused by vehicles, or entrapment in trenches etc.

24.112 In addition to effects resulting from potential disturbance to habitats used by protected species, animals may also be disturbed by increases to noise and light levels and perceived predation risk associated with the presence of site personnel and vehicles.

Indirect effects

24.113 Indirect effects on habitats and species that may arise as a result of construction activities include hydrological effects, pollution, sedimentation and effects of dust. For example, if an access track bisects an area of bog, this can result in one half drying out. Heavy rainfall can result in silt runoff and peat slides, which may cause siltation of watercourses, while pollution of watercourses may occur as a result of chemical or fuel spillage.

Potential effects during operation

24.114 Potential effects on terrestrial ecological features are identified below. These are likely to be associated with maintenance works and therefore infrequent and of temporary duration.

Disturbance

24.115 Human activities related to maintenance of onshore infrastructure have the potential to cause temporary and localised disturbance effects on ecological features. Due to the unpredictable nature of the requirement for maintenance works, it is difficult to determine precise effects on habitats and species. However, it is expected that maintenance activities would be infrequent and small scale, resulting in disturbance effects of a lower magnitude than those during construction.

Indirect effects

24.116 Maintenance may also result in indirect effects on habitats, e.g. pollution of watercourses as a result of spillage. However, the potential for indirect effects to occur during operation is generally lower than that during construction.

Potential decommissioning effects

24.117 Onshore works associated with decommissioning may cause disturbance to ecological features. The level of effect will depend on the ecological features present at the time of decommissioning; although this cannot be reliably predicted at this stage, it is likely that the habitats will be similar and will support a similar suite of species.

24.118 As decommissioning works are likely to be of a similar nature and duration as construction activities, the potential effects resulting from decommissioning are likely to be similar to those resulting from construction, with the exception that habitat will be restored.

Evaluation of importance

24.119 A summary of the evaluation of the importance of habitats and species recorded within the terrestrial ecology search area during the 2015 baseline surveys is provided in Table 24-14.

24.120 As the NVC survey covered the same area as the extended Phase 1 survey and produces more detailed results, evaluation (and subsequent assessment) of terrestrial habitats is based on the NVC communities rather than Phase 1 habitat types (which will already be encompassed within the NVC communities). Watercourses/waterbodies are exceptions to this, as they are not included in an NVC survey.

Table 24-174: Evaluation of the level of importance of habitats and non-avian species recorded within the terrestrial ecology search area during the 2015 baseline surveys

Importance	Ecological feature	Justification
Very High	None	No internationally important ecological features were recorded within the terrestrial ecology search area.
High	Sandside Bay SSSI/fixed and semi-fixed dune communities (SD7 and SD8)	Sandside Bay SSSI, which is located approximately 0.4 km to the west of the current onshore project area, is designated for its sand dune habitats. Sand dune habitats within the overlapping terrestrial ecology search area (SD7 and SD8) correspond with nationally important habitats that are protected under Annex I of the Habitats Directive. Coastal sand dunes are also an SBL priority habitat. None of these communities were present within the current onshore project area itself.
Medium	SD 2 strandline community; SD4 foredune community; and SD6 mobile dune community	Communities that correspond with nationally important habitats protected under Annex I of the Habitats Directive. Sand dune habitats are also qualifying features of Sandside Bay SSSI and coastal sand dunes are an SBL priority habitat. However, only very small areas of the SD2 and SD4 communities were present within the terrestrial ecology search area, and none of these communities were present within the current onshore project area itself.
	M10 mire community	Corresponds with nationally important habitat protected under Annex I of the Habitats Directive and is highly groundwater-dependent. However, the community was present only in a very small area within the terrestrial ecology search area, with none present within the current onshore project area itself.
	Heath communities (M15 and H7)	Communities that correspond with nationally important habitats protected under Annex I of the Habitats Directive. M15 is also moderately groundwater-dependent. Both lowland and upland heathland are SBL priority habitats. However, heathland communities were present only in very small areas within the terrestrial ecology search area, with none present within the current onshore project area itself.

Importance	Ecological feature	Justification
	Running water	Two of the three burns present within the terrestrial ecology search area are associated with the Caithness and Sutherland Peatlands SAC. In addition, burns are likely to be of local biodiversity value. However, all three burns are located outside the current onshore project area.
Low	W7 woodland	Some native broad-leaved woodlands are SBL priority habitats and may be of local biodiversity value. However, the woodland habitat was present only in a very small area with none present within the current onshore project area itself.
	MG10 rush pasture	Moderately groundwater-dependent but otherwise of no particular conservation importance and present only in small areas, including a small area within the current onshore project area.
	Standing water	Although ponds are an SBL priority habitat, only a single, very small pond was recorded, to the south-east of the current onshore project area.
	Scottish primrose	An SBL and LBAP priority species, but present only in very small numbers within the terrestrial ecology search area, with none present within the current onshore project area itself.
	Protected faunal species	There was no evidence that any protected species were present within the terrestrial ecology search area, but suitable habitat for reptiles, foraging/commuting pine marten, badger and otters, and roosting/foraging bats is present. In addition, several protected mammal and reptile species are known to be present in the wider area.
Negligible	Grassland communities (MC8, MC10, MG1, MG6 and MG7); OV25 open community ; and *Picea sitchensis* plantation (no NVC designation)	Widespread and abundant habitats with little biodiversity value and low conservation concern; includes intensively managed monocultures (MG7 and the non-native *Picea sitchensis* plantation).

Habitats and species not taken forward to the assessment phase

24.121 Habitats and species of negligible importance are not considered further in this assessment; these are generally common and widespread ecological features.

Habitats and species taken forward to the assessment phase

24.122 Results from the desk study and all relevant field surveys have been compiled to produce baseline descriptions for each habitat/species of a low or higher level of importance recorded within the survey area. Features are described in order of importance level, with those of greatest importance considered first.

24.123 To avoid repetition, where potential effects on ecological features of the same level of importance are likely to be similar due to similarities in ecology and/or distribution, they are assessed as a group rather than separately for each feature.

24.124 Although no significant impacts on ecological features of low value are likely, these features are nevertheless considered because they are of local conservation importance, and mitigation measures could be recommended for such features as a good practice measure.

24.125 Where relevant, potential effects on notified features of statutory sites are included in section 24.11, while overall effects on the sites themselves (in terms of effects on integrity and conservation objectives) are considered separately in section 24.12.

24.8 Assessment of terrestrial ecology

Ecological features of high conservation value

SD7 semi-fixed dune community and SD8 fixed dune community

24.126 The SD7 semi-fixed and SD8 fixed dune communities both correspond to Annex I habitat 2130 'fixed dunes with herbaceous vegetation ('grey dunes')'. Sand dune habitats are also qualifying features of Sandside Bay SSSI, and coastal sand dunes are an SBL priority habitat.

24.127 The SD7 semi-fixed dune community is typical of dunes throughout Britain, occupying a positon inland of the foredune communities. It is replaced further inland by more fixed vegetation dominated by grasses (Rodwell, 2000).

24.128 The SD8 fixed dune community is characteristic of more calcareous fixed sands on dunes and coastal plains all around Britain. It occurs in the first vegetated area inland of dune systems and in the more stable dune ridges and hollows of larger dune systems, such as those found within the terrestrial ecology search area (Rodwell, 2000).

Baseline

24.129 The dunes and golf course are large enough to allow the development of vegetation types such as the communities of SD7 and SD8, which dominate this area, and replace marram as the dunes stabilise and the organic content of the sand increases (JNCC, 2015). SD8 was the most common sand dune habitat recorded at Sandside Bay.

24.130 Together, the SD7 and SD8 occupy an area of up to 1.91 ha within the terrestrial ecology search area (the extent is likely to be lower as this total includes mosaics with other vegetation types). However, these communities were recorded outside the current onshore project area, approximately 0.4 km to the west (at the closest point).

Potential construction effects

24.131 As no onshore construction works are proposed in areas where SD7 or SD8 dune communities are present, no direct effects on these habitats are expected. Furthermore, as the onshore works are of relatively small scale and will be separated from the dune habitat by several hundred metres, it is considered unlikely that there will be any indirect effects on the SD7 and SD8 dune communities.

24.132 Therefore, **no significant impacts** are predicted and specific mitigation is not required. However, good practice measures to minimise potential effects on sensitive coastal habitats (e.g. through pollution) will be implemented, as outlined in Section 24.13.

Potential operation effects

24.133 As there are no SD7 or SD8 NVC communities present within the current onshore project area, and routine maintenance works during operation are likely to be of limited extent, no potential effects during operation are expected to occur. Therefore, **no significant impacts** on these NVC communities are predicted and specific mitigation is not required.

24.134 However, should any significant maintenance works be required, it is advised that the good practice mitigation measures outlined in section 24.13 should be applied to minimise potential effects on sensitive coastal habitats, including the dune system.

Potential decommissioning effects

24.135 Potential decommissioning effects are considered to be of the same nature as construction effects. Therefore **no significant impacts** to SD7 and SD8 dunes are predicted and no mitigation is required.

24.136 However, good practice relevant mitigation described in section 24.13 should be applied during decommissioning to protect sensitive coastal habitats.

Ecological features of medium conservation value

SD2 strandline community and SD4 foredune community

24.137 The SD2 strandline and SD4 foredune communities both correspond to Annex I habitat 2110 ‘embryonic shifting dunes’. Sand dune habitats are also qualifying features of Sandside Bay SSSI, and coastal sand dunes are an SBL priority habitat.

24.138 The SD2 strandline community is the characteristic pioneer vegetation of sand and fine shingle strandlines on flat or gently sloping beach-tops all around the British coast. It is ephemeral in nature with vegetation constantly removed by high tides or storms. Pioneering plants from similar habitats in the area are able to re-colonise bare sand, anchoring their roots to gravel under the sand surface. It is therefore best regarded as perpetually renewed pioneer vegetation (Rodwell, 2000).

24.139 The SD4 foredune community is a pioneer vegetation type of wind-blown sand on foreshores around most of the British coast. It develops along and above the strandline or among distinct foredunes. Like SD2, SD4 foredune communities are ephemeral in nature and recolonisation is common (Rodwell, 2000; JNCC, 2015).

Baseline

24.140 The strandline and bare, shifting sand above the Mean Spring High Water level on Sandside Bay (to the west of the current onshore project area) contain very small areas of SD2 and SD4 communities. It is possible that monitoring operations of potential radioactive particles along the beach may have removed SD2 communities, as it involves raking the sand by machine up to the strandline.

24.141 A tiny area of SD2 and SD4 is also present on the loose sand immediately north of the mouth of the Burn of Isauld.

Potential construction effects

24.142 As no onshore construction works are proposed in areas where SD2 or SD4 foredune communities are present, no direct effects on these habitats are expected. Furthermore, as the onshore works are of relatively small scale and will be separated from the foredune habitat by several hundred metres, it is considered unlikely that there will be any indirect effects on the SD2 and SD4 foredune communities.

24.143 As such, no effects on SD2 or SD4 communities resulting from construction works are expected. Therefore, **no significant impacts** are predicted and no specific mitigation is required.

24.144 However, good practice measures to minimise potential effects on sensitive coastal habitats (e.g. through pollution) will be implemented, as outlined in Section 24.13.

Potential operation effects

24.145 As there are no SD2 or SD4 communities present within the current onshore project area, and routine maintenance works during operation are likely to be of limited extent, no potential operation effects on SD2 or SD4 communities are expected. Therefore, **no significant impacts** are predicted and specific mitigation is not required.

24.146 However, should any significant maintenance works be required, it is advised that the good practice mitigation measures outlined in section 24.13 should be applied to minimise potential effects on sensitive coastal habitats, including the dune system.

Potential decommissioning effects

24.147 Potential decommissioning effects are considered to be of the same nature as construction effects. Therefore **no significant impacts** on the SD2 and SD4 communities are predicted and no mitigation is required.

24.148 However, good practice relevant mitigation described in section 24.13 should be applied during decommissioning to protect sensitive coastal habitats.

SD6 mobile dune community

24.149 The SD6 mobile dune community corresponds to Annex I habitat 2120 'Shifting dunes along the shoreline with *Ammophila arenaria* ('white dunes')'. Sand dune habitats are also qualifying features of Sandside Bay SSSI, and coastal sand dunes are an SBL priority habitat.

24.150 SD6 is a dynamic vegetation type maintained only by the movement of sand, and quickly replaced if stability is imposed. It rarely occurs in isolation because of its dynamic nature and because it is successionally related to other dune habitats (JNCC, 2015). This vegetation type occurs widely on suitably mobile sands in dune systems all around the British coast (Rodwell, 2000), although in many places it is restricted to a narrow strip (JNCC, 2015).

Baseline

24.151 The total extent of SD6 vegetation type within the terrestrial ecology search area is relatively low (0.13 ha), with small patches occupying the more mobile coastal dunes along the foreshore of Sandside Bay. A single, small area is also present to the north of the Burn of Isauld, but there is none within the current onshore project area itself.

Potential construction effects

24.152 As no SD6 mobile dune communities are present within the current onshore project area, no direct effects on this habitat are expected. Furthermore, as the onshore works are of relatively small scale and will be separated from the dune habitat by several hundred metres, it is considered unlikely that there will be any indirect effects on the SD6 mobile dune communities. Therefore, **no significant impacts** are predicted in the long-term and specific mitigation is not required.

24.153 However, good practice measures to minimise potential effects on sensitive coastal habitats (e.g. through pollution) will be implemented, as outlined in Section 24.13.

Potential operation effects

24.154 As no SD6 communities are present within the current onshore project area, and routine maintenance works during operation are likely to be of limited extent, no potential operation effects on SD6 communities are expected. Therefore, **no significant impacts** are predicted and specific mitigation is not required. However, should any significant maintenance works be required, it is advised that the good practice mitigation measures outlined in section 24.13

should be applied to minimise potential effects on sensitive coastal habitats, including the dune system.

Potential decommissioning effects

24.155 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the SD6 community are predicted and no mitigation is required.

24.156 However, good practice relevant mitigation described in section 24.13 should be applied during decommissioning to protect sensitive coastal habitats.

M10 mire community

24.157 M10 mire corresponds to Annex I habitat 7230 'alkaline fens'. The M10 habitat recorded within the terrestrial ecology search area was assessed as highly groundwater-dependent. M10 mires are of high conservation value because, although they are usually small, they make a substantial contribution to the diversity of upland vegetation. They also support a number of scarce plant species (Averis *et al*., 2004).

24.158 M10 mires occur throughout the uplands of Scotland (as well as northern England and Wales), wherever there are base-rich substrates and associated flushes (Averis *et al*., 2004).

Baseline

24.159 A small area of M10 habitat was present at a single location, within a flushed area of the Reay Golf Course, outside the current onshore project area.

Potential construction effects

24.160 As the extent of M10 habitat is very small and located over 250 m beyond the current onshore project area, there are unlikely to be any direct effects on this vegetation community during construction. Therefore, **no significant impacts** are predicted.

24.161 However, good practice measures to minimise potential indirect effects on sensitive wetland habitats (e.g. through pollution) will be implemented, as outlined in Section 24.13.

Potential operation effects

24.162 As the extent of M10 habitat was very small and located outside the current onshore project area, routine maintenance works during operation are unlikely to have any effect on this habitat. Therefore **no significant impacts** are predicted and specific mitigation is not required.

24.163 However, should any significant maintenance works be required, it is advised that the good practice mitigation measures outlined in section 24.13 should be applied to minimise potential indirect effects on sensitive wetland habitats.

Potential decommissioning effects

24.164 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the M10 habitat are predicted and no mitigation is required.

24.165 However, good practice relevant mitigation described in section 24.13 should be applied during decommissioning to protect sensitive wetland habitats.

Heath communities

24.166 M15 wet heath corresponds to Annex I habitat 4010 'Northern Atlantic wet heaths with *Erica tetralix*', while H7 heath corresponds to the Annex I habitat 4030 'European dry heaths'. M15 is also moderately groundwater-dependent. In addition, upland and lowland heathland are SBL priority habitats.

24.167 M15 wet heath is widespread in the north and west of Great Britain, and is most common in the western Highlands. The habitat is important for nature conservation, particularly in Scotland, due to the large extent present in the western Highlands relative to the rest of the world (Averis *et al*., 2004).

24.168 H7 heath occurs over a wide variety of moderately base-poor soils on the less exposed parts of maritime cliffs all around the British coast, except to the east and south between Durham and Dorset (Rodwell, 1991b; Elkington *et al*., 2001).

Baseline

24.169 The western boundary of the terrestrial ecology search area crosses the periphery of an area of M15 wet heath; this was the only area where this habitat was located and it is outside the current onshore project area.

24.170 Very small areas of H7 heath were recorded within the current onshore project area in the coastal grasslands running north and north-east from Sandside Bay to HMS Vulcan.

Potential construction effects

24.171 The extent of M15 habitat is very small and is located outside the current onshore project area on the western side of Sandside Bay. It is therefore unlikely to be affected by onshore construction works. It is possible that a small amount of H7 habitat may be lost or disturbed, depending on the final design of the onshore infrastructure. However, the amount of habitat that would be affected is likely to be small. For example, construction of the indicative HDD compound shown in Figure 24-3 would result in the loss of ≤0.01 ha. Furthermore, if possible, the onshore infrastructure will be microsited to avoid sensitive habitat such as H7 heath.

24.172 As such, potential effects on the M15 habitat during construction are considered likely to be of a negligible level, while effects on H7 are likely to be of a low level. **No significant impacts** on either heath vegetation type are predicted and specific mitigation is not required. However, good practice measures to minimise potential indirect effects on sensitive wetland habitats such as M15 (e.g. through pollution) will be implemented, as outlined in Section 24.13.

Potential operation effects

24.173 The extent of M15 and H7 habitat is small and the M15 habitat is located outside the current onshore project area. In addition, routine maintenance works during operation are likely to be of limited extent. Potential operation effects are therefore likely to be of a low to negligible level. **No significant impacts** are predicted and specific mitigation is not required.

24.174 However, should any significant maintenance works be required, it is advised that the good practice mitigation measures outlined in section 24.13 should be applied to minimise potential indirect effects on sensitive wetland habitats such as M15.

Potential decommissioning effects

24.175 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the M15 and H7 habitats are predicted and no mitigation is required.

24.176 However, good practice relevant mitigation described in section 24.13 should be applied during decommissioning to protect sensitive wetland habitats such as M15.

Running water

24.177 SEPA RBMP data are available for two of the three burns present within the terrestrial ecology search area: Sandside Burn and Achvarasdal Burn. Both are associated with Caithness and Sutherland Peatlands SAC; and the overall status of both burns is assessed as good[68]. In addition, watercourses can support a diverse range of aquatic flora and fauna and are therefore likely to be of local conservation value.

Baseline

24.178 Three burns run across the western part of the terrestrial ecology search area into Sandside Bay: Sandside Burn, Reay Burn, and Burn of Isauld, which is named Achvarasdal Burn upstream of Reay. All three burns fall within the Thurso coastal catchment[68]. The Burn of Isauld is located approximately 750 m to the south-west of the current onshore project area, while the other two burns are located several hundred metres to the south-west.

Potential construction effects

24.179 As all three burns are separated from the current onshore project area by several hundred metres, they will not be directly affected by construction works. Furthermore, as the onshore works are of relatively small scale and will be separated from the watercourses by several hundred metres, it is considered that there is limited potential for indirect effects, e.g. due to siltation or pollution incidents, on watercourses to occur. Therefore, **no significant effects** are predicted and specific mitigation is not required.

24.180 However, good practice measures to minimise potential indirect effects on watercourses will be implemented, as outlined in Section 24.13.

Potential operation effects

24.181 As all three burns are separated from the current onshore project area by several hundred metres and routine maintenance works during operation are likely to be of limited extent, it is considered unlikely that there would be any direct or indirect operational effects on watercourses. Therefore, **no significant impacts** are predicted and specific mitigation is not required.

24.182 However, should any significant maintenance works be required, it is advised that the good practice mitigation measures outlined in section 24.13 should be applied to minimise the potential for indirect effects on watercourses to occur.

Potential decommissioning effects

24.183 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** to watercourses are predicted and specific mitigation is not required.

24.184 However, relevant mitigation described in section 24.13 should be applied during decommissioning to ensure that potential indirect effects on watercourses are minimised.

[68] http://gis.sepa.org.uk/rbmp/ (last accessed 26/01/2016)

Ecological features of low conservation value

W7 woodland

24.185 The estimated extent of broadleaved woodland in Scotland is 375,000 ha (Forestry Commission, 2015). Certain woodland habitats are included on the SBL as priority habitats. Although the W7 broadleaved woodland recorded within the terrestrial ecology search area is not of high conservation concern per se, and its extent was very small, it is likely to have some biodiversity value, not only by increasing the habitat and plant diversity of the local area, but also because it may support a range of other species such as fungi, lichens and invertebrates, and potentially birds and bats.

Baseline

24.186 Small areas of W7 woodland were recorded outside the current onshore project area, along the higher banks of the burns around New Reay. A very small amount of this habitat also fringed the small Sitka spruce plantation at the south end of the Burn of Isauld.

Potential construction effects

24.187 The extent of W7 habitat is very small and is located outside the current onshore project area; none of this habitat will be lost as a result of construction works, and the potential for disturbance is low. As such, there are unlikely to be any effects on this habitat during construction. Therefore, **no significant impacts** are predicted and no mitigation is required.

Potential operation effects

24.188 As the extent of W7 habitat was very small and located outside the current onshore project area, routine maintenance works during operation are unlikely to have any effect on this habitat. Therefore **no significant impacts** are predicted and no mitigation is required.

Potential decommissioning effects

24.189 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore no significant impacts on the W7 habitat are predicted and no mitigation is required.

MG10 rush pasture

24.190 MG10 rush-pasture is a widespread habitat in lowland Britain. It also occurs at low altitudes in most upland areas (although it is rare in the north-west Highlands, Lewis, Harris, Skye, Orkney and Shetland). The MG10 habitat recorded within the terrestrial ecology search area was assessed as moderately groundwater-dependent. However, MG10 is an impoverished vegetation type and rarely contains any uncommon species. It is generally regarded as being of lower conservation value than other types of damp grassland, although it can provide important breeding habitat for waders and wildfowl (Averis *et al*., 2004).

Baseline

24.191 Small areas of MG10 occur at the eastern end of the current onshore project area within the enclosed fields of MG6 grassland.

Potential construction effects

24.192 It is possible that some MG10 vegetation may be lost or disturbed, depending on the final design of the onshore infrastructure. However, this vegetation type is relatively common and widespread and generally considered to be of low biodiversity value (Averis *et al*., 2004).

Furthermore, the amount of MG10 vegetation that would be affected is likely to be small. For example, installation of the indicative onshore cable corridor route 1, and associated HDD compound, shown in Figure 24-3 would result in the loss of up to 0.63 ha of MG10 vegetation (since the MG10 vegetation in this area was present as a mosaic with MG6 grassland, which is of negligible importance, the extent of habitat loss would be lower than these values).

24.193 As such, potential effects on MG10 vegetation during construction are considered likely to be of a medium to low level and **no significant impacts** are predicted.

24.194 However, as MG10 is moderately groundwater-dependent, specific mitigation is recommended in Section 24.13 as a good practice measure, in line with SEPA guidance (SEPA, 2014) and scoping advice (Table 24-2). In addition, good practice measures to minimise potential indirect effects on sensitive wetland habitats (e.g. through pollution) will be implemented. After a preferred route has been determined, it may be possible to further minimise impacts (if any) on MG10 habitat through micrositing.

Potential operation effects

24.195 The extent of MG10 habitat is small, while routine maintenance works during operation are likely to be of limited extent. As such, potential effects on this vegetation type during operation are likely to be of a low to negligible level. **No significant impacts** are predicted and no mitigation is required.

24.196 However, in line with SEPA guidance (SEPA, 2014), should any significant maintenance works be required within 250 m of MG10 vegetation, the good practice measures outlined in Section 24.13 should be applied for the duration of the works.

Potential decommissioning effects

24.197 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the MG10 vegetation type are predicted.

24.198 However, the good practice measures outlined in Section 24.13 should also be applied during decommissioning.

Ponds

24.199 Ponds are an SBL priority habitat, and may be of biodiversity value due to their potential to support a relatively diverse range of taxa that may not be present in other habitats.

Baseline

24.200 A single small pond was present within an area of marshy grassland in one of the improved fields to the east of the current onshore project area.

Potential construction effects

24.201 The pond is small and located outside the current onshore project area. As such, construction effects are likely to be of a negligible level. **No significant impacts** are predicted and specific mitigation is not required.

24.202 However, the good practice measures to minimise potential indirect effects on sensitive wetland habitats (e.g. through pollution) outlined in Section 24.13 will be implemented.

Potential operation effects

24.203 As the pond is small and located outside the current onshore project area, maintenance works during operation are likely to be of a negligible level. **No significant impacts** are predicted and no mitigation is required.

24.204 However, should any significant maintenance works be required, the good practice measures outlined in Section 24.13 should be applied for the duration of the works.

Potential decommissioning effects

24.205 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the pond are predicted and no mitigation is required.

24.206 However, the good practice measures outlined in Section 24.13 should also be applied during decommissioning.

Scottish primrose

24.207 Scottish primrose is an endemic plant that occurs only in Caithness, Sutherland and Orkney (Morris, 2009). It is included in the Caithness and Sutherland LBAPs, and is a designated feature of the Red Point Coast SSSI located approximately 0.9 km to the north-west of the terrestrial ecology search area.

24.208 The population of Scottish primrose in Caithness and Sutherland has been surveyed in 1969, 1985, 1995 and 2007-08. At the majority of sites surveyed in 2007-08, estimates of population size had either not changed or had increased compared with previous surveys, although there were some local population losses, particularly on the east coast (Morris, 2009).

24.209 During the most recent survey in 2007-08, three individual Scottish primrose plants were recorded at Reay Golf Course (Morris, 2009). This was a newly recorded population, although unconfirmed records of the species at this site from previous years suggest that it had been present previously (although records suggest that there may only ever have been a small population at the site). Much larger populations of Scottish primrose were recorded during the 2007-08 survey at Red Point (204 plants) and Sandside Head (200,000-400,000 plants) to the west of the terrestrial ecology search area, and Oigin's Geo (1,000-5,000 plants) to the east.

Baseline

24.210 A single Scottish primrose plant was recorded within the terrestrial ecology search area on Reay Golf Course, suggesting that the local population may have declined since the previous survey in 2007-08 (Morris, 2009).

Potential construction effects

24.211 The Scottish primrose population on Reay Golf Course is very small (compared with those in the surrounding area) and is located outside the current onshore project area. As such, there are unlikely to be any effects on this population during construction and **no significant impacts** are predicted.

24.212 However, specific mitigation is recommended as a good practice measure to ensure that Scottish primrose plants are protected.

Potential operation effects

24.213 As the Scottish primrose population was very small and outside the current onshore project area, routine maintenance works during operation are unlikely to have any effects on the local population. Therefore effects are expected to be of a negligible level and **no significant impacts** are predicted.

24.214 However, should any significant maintenance works be required, it is advised that specific mitigation described in section 24.13 should be applied prior to works being undertaken, to ensure that any new Scottish primrose plants are protected.

Potential decommissioning effects

24.215 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on the local Scottish primrose population are predicted.

24.216 However, as a precautionary measure, relevant mitigation described in section 24.13 should be applied during decommissioning.

Protected faunal species

24.217 Protected mammal species that may make occasional use of the current onshore project area for foraging and/or commuting include otter, pine marten, badger and bat species. Protected reptile species that may be present within the current onshore project area include adder, slow-worm and common lizard.

24.218 Otter is an EPS and the animals and their shelters are fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). It is also an SBL priority species, and a designated feature of the Caithness and Sutherland Peatlands SAC located approximately 1.7 km to the south-west of the terrestrial ecology search area. Scotland is a European stronghold for otters and the species is now widespread across the entire country (SNH, 2015a), although there is evidence that the Caithness and Sutherland Peatlands SAC population is declining (Findlay *et al*., 2015).

24.219 Pine martens and their dens are fully protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Pine marten is also an SBL priority species. Following dramatic historic declines caused by persecution and deforestation, Scottish pine marten populations are recovering and the species has slowly re-colonised many parts of its former range (The Vincent Wildlife Trust, 2014).

24.220 Badgers are protected under the Protection of Badgers Act 1992. The species is relatively common in Scotland, particularly in the lower-lying, more fertile parts of the country. Although there are no accurate figures for the Scottish population, it has been estimated at around 25,000. Although the overall population is probably stable, there are parts of Scotland where badgers appear to be on the increase (SNH, 2002a).

24.221 All bat species are EPS, and the animals and their roost sites are fully protected under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended in Scotland). Nine of the ten bat species that occur in Scotland are SBL priority species. Bats are found throughout Scotland, with numbers generally decreasing with latitude (SNH, 2015b).

24.222 Adders, slow-worms and common lizards are protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended). Adders and slow-worms are widespread throughout much of Scotland, although adders are absent from much of the Central Lowlands, the Outer Hebrides and Northern Isles. Common lizard is widespread throughout the Highlands, Inner

Hebrides and Southern Uplands but rare in the Central Lowlands and absent from the Northern Isles (Buckley & Cole, 2004).

Baseline

24.223 No evidence of any protected mammal or reptile species was recorded during the 2015 extended Phase 1 survey and no signs were recorded during any other terrestrial ecology or ornithology surveys.

24.224 Suitable habitat for reptiles, and foraging and/or commuting pine marten, badger, otter and bats is present within the terrestrial ecology search area. However, due to the small size of the current onshore project area and lack of ecological features such as trees, burns or ponds, it is likely to be of limited importance for protected species.

24.225 HBRG returned two historic records of pine marten within 2 km of the terrestrial ecology search area, one of which, from 2009, relates to a confirmed breeding den. HBRG also returned records of brown long-eared and common pipistrelle bats within 2 km, one of which, from 2006, relates to a confirmed pipistrelle roost.

24.226 No existing records of badgers or otters were identified within 2 km of the terrestrial ecology search area, although both species are known to be present in the wider area (based on SB records and historic Caledonian Conservation data).

24.227 Although there are no historic records of reptiles within 2 km of the terrestrial ecology search area, the data provided by HBRG and ARC included records of adders and slow-worms from the wider area.

Potential construction effects

24.228 There was no evidence that any protected species was making use of the terrestrial ecology search area. Although potentially suitable roosting habitat for bats was identified at several locations (buildings and mature broadleaved trees), these are all outside the terrestrial ecology search area, with the majority separated from it by several hundred metres.

24.229 Effects are therefore likely to be restricted to low levels of temporary disturbance to occasional foraging or commuting animals, and loss of very small amounts of foraging habitat. As such, effects on local populations of protected faunal species during construction are likely to be of a negligible level and **no significant impacts** are predicted.

24.230 However, specific mitigation is recommended as a good practice measure to ensure that these species are protected during construction.

Potential operation effects

24.231 As no evidence of any protected species was recorded within the terrestrial ecology search area, routine maintenance works during operation are unlikely to affect protected species. Therefore effects are expected to be of a negligible level and **no significant impacts** are predicted.

24.232 However, should any significant maintenance works be required, it is advised that specific mitigation described in section 24.13 should be applied to prevent accidental harm to any protected species.

Potential decommissioning effects

24.233 Potential decommissioning effects are considered likely to be of the same nature as construction effects. Therefore **no significant impacts** on any protected species are predicted.

24.234 However, as a precautionary measure, relevant mitigation described in section 24.13 should be applied during decommissioning.

24.9 Potential effects on statutory sites

Sites of international importance

24.235 As detailed in section 24.7, there are four SACs, located within 20 km of the terrestrial ecology search area: Caithness and Sutherland Peatlands, Broubster Leans, Strathy Point and River Thurso.

24.236 Under the Habitats Regulations, any development likely to have a significant effect on an SAC, either alone or in combination with other projects, requires an Appropriate Assessment (part of the HRA process) to be carried out by the relevant competent authority, to determine whether or not the development, would have an adverse effect on the integrity of the SAC.

24.237 In order to assist the competent authority in determining whether an Appropriate Assessment is required, potential effects on each of the SACs is considered below, in order of proximity to the current onshore project area.

Caithness and Sutherland Peatlands SAC

24.238 Caithness and Sutherland Peatlands SAC is located approximately 4.0 km to the south-west of the current onshore project area. This site is designated for a number of freshwater and upland habitats, as well as populations of marsh saxifrage and otter. In terms of designated habitats, there is not considered to be any connectivity between the Project site and the SAC, and no otters or marsh saxifrage plants were recorded within the terrestrial ecology search area (although there is a possibility that otters may make occasional use of it). Furthermore, there are no hydrological linkages between the current onshore project area and the SAC. As such, **no likely significant effects** on the integrity of the Caithness and Sutherland Peatlands SAC are predicted.

Broubster Leans SAC

24.239 Broubster Leans SAC is located approximately 6.6 km to the south-east of the current onshore project area. This site is designated for its transition mires and quaking bogs. There is not considered to be any habitat connectivity between the Project site and the SAC, and **no likely significant effects** on the integrity of the Caithness and Sutherland Peatlands SAC are predicted.

River Thurso SAC

24.240 River Thurso SAC is located approximately 12.6 km to the east of the current onshore project area. This site is designated for its population of Atlantic salmon. The current onshore project area is not located within the River Thurso catchment, and therefore there is no connectivity with this SAC. As such, **no likely significant effects** on the integrity of the River Thurso SAC are predicted.

Strathy Point SAC

24.241 Strathy Point SAC is located approximately 13.7 km to the west of the current onshore project area. This site is designated for its vegetated sea cliff habitat. Due to the distance between this SAC and the current onshore project area, **no likely significant effects** on the integrity of the Strathy Point SAC are predicted.

Requirement for Appropriate Assessment

24.242 Although the competent authority will determine whether an Appropriate Assessment is required, the information presented in this assessment indicates that the onshore element of the Project will not have a likely significant effect on any SAC.

Sites of national importance

24.243 As detailed in section 24.7, three SSSIs designated for ecological features are located within 5 km of the terrestrial ecology search area: Sandside Bay, Red Point Coast and East Halladale.

Sandside Bay SSSI

24.244 Sandside Bay SSSI is located approximately 0.4 km to the west of the current onshore project area. The site is designated for its sand dune habitats.

24.245 As the onshore infrastructure will be located outside Sandside Bay SSSI and no onshore works would be required within the SSSI, there will be no direct effects on the SSSI. Furthermore, as the SSSI is separated from the current onshore project area by several hundred metres, and there is no hydrological connectivity between the two, it is considered unlikely that there will be any indirect effects on the SSSI are.

24.246 As such, **no significant impacts** on Sandside Bay SSSI are predicted. However, good practice measures to minimise potential effects on sensitive coastal habitats (e.g. through pollution) will be implemented, as outlined in Section 24.13.

Red Point Coast SSSI

24.247 Red Point Coast SSSI is located approximately 1.4 km to the north-west of the current onshore project area. This site is a designated partly for its maritime cliff vegetation and Scottish primrose population. Although both features were present within the terrestrial ecology search area, no significant effects on either were predicted during any phase of development. Therefore, **no lsignificant impacts** on the on the integrity of the Red Point Coast SSSI are predicted.

East Halladale

24.248 East Halladale SSSI is located approximately 4.0 km to the south-west of the current onshore project area. This site is a component of Caithness and Sutherland Peatlands SAC and is designated partly for its blanket bog habitat, which is also a feature of the SAC. Therefore, potential effects on this site are considered to be the same as for the SAC, and **no significant impacts** on the on the integrity of the East Halladale SSSI are predicted.

24.10 Mitigation measures

24.249 The principal mitigation measure adopted to minimise onshore elements of the Project on important terrestrial ecology features has been the use of an iterative design process, which has involved consideration of key ecological issues and constraints throughout the design process. This means that most mitigation measures are embedded within the overall design, allowing the opportunity to site onshore infrastructure away from sensitive ecological features, such as Sandside Bay SSSI.

24.250 Although no significant impacts on any ecological features recorded within the terrestrial ecology search area are predicted, reinstatement of the onshore cable corridor route (and HDD compound, should this landfall option be selected) is proposed, in order to minimise effects on habitats and the species they support. Although a detailed restoration plan cannot be produced until the onshore infrastructure design is finalised, proposed restoration methods are outlined below.

24.251 In line with SEPA guidance (SEPA, 2014) and scoping advice (Table 24-2), good practice mitigation measures to protect GWDTEs are also proposed to ensure that potential effects on these wetlands are avoided.

24.252 Specific mitigation measures are proposed as good practice to minimise the potential for indirect effects (e.g. resulting from pollution events) on watercourses and sensitive coastal and wetland habitats.

24.253 Similarly, good practice measures are proposed to avoid accidental damage or disturbance to protected or sensitive plant and animal species and ensure compliance with relevant legislation.

24.254 A suitably experienced Ecological Clerk of works (ECoW) should be appointed to ensure compliance with ecological good practice measures during the construction and decommissioning phases (and during the operational phase, should any significant maintenance works be required).

Specific mitigation meaures

Table 24-15: Mitigation meaures specific to Terrestrial Ecology

Mitigation Measures Specific to Terrestrial Ecology		
Ref	**Title**	**Description**
Construction		
TE1	Onshore cable corridor route habitat reinstatement	Where habitat is to be reinstated, turfs will be removed to a suitable storage point where they will be maintained during works. Topsoil and subsoil will also be stored separately, and excavations backfilled with these materials to maintain the original stratification as well as is practical. Turfs will then be replaced as close to their original location as possible. Due to the temporary and short-term nature of most construction activities, this method will allow the reinstatement of habitat immediately after works are completed in a given area. This method will be suitable for the majority of habitats, although is not appropriate for sand dune habitats which may require specific measures as discussed below.
TE2	Measures to protect watercourses and sensitive coastal and wetland habitats	An Environmental Management Plan (EMP) will be developed prior to construction to ensure that all watercourses and sensitive coastal and wetland habitats connected with the current onshore project area are protected during construction. This will include a Pollution Incident Response Plan to minimise potential pollution effects. Further details are provided in Chapter 22: Geology and Hydrology and Hydrogeology.

Mitigation Measures Specific to Terrestrial Ecology		
Ref	**Title**	**Description**
TE3	Measures to protect GWDTEs	Where possible, the following buffers between GWDTEs and excavations will be implemented: 250 m for the onshore cable corridor route and any other excavations greater than 1 m in depth; and 100 m for excavations less than 1 m in depth. If the onshore cable corridor route is located within 250 m of any GWDTEs, clay stoppers will be included in the cable trench to prevent them from acting as preferential pathways for drainage.
TE4	Pre-construction Scottish primrose survey	It is recommended that a pre-construction survey for Scottish primrose is undertaken to identify any plants present in the vicinity of construction works. Should any plants be identified, appropriate mitigation would need to be considered and agreed with appropriate stakeholders, such as SNH. This could involve, for example, an exclusion zone around the plants or, where this is not feasible, translocation.
TE5	Measures to prevent harm to protected mammals and reptiles	It is recommended that pre-construction surveys for protected mammal and reptile species are undertaken to identify any species making use of the current onshore project area (e.g. badger setts or potential reptile hibernacula). Should any protected species be identified, appropriate mitigation would need to be considered in consultation with SNH. This could involve, for example, an exclusion zone around the area in use. It is recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid animals becoming trapped during the construction phase. It is recommended that any piping is capped to avoid its potential use as refugia by animals. Construction works should be overseen by a suitably experienced and qualified Ecological Clerk of Works.
Operation		
TE6	Mitigation during operation	Routine maintenance required during operation of the Project is expected to be minimal, involving only small areas, and of a temporary duration. However, should significant works be required during the operational phase, it is recommended that the mitigation outlined above is implemented to protect important ecological features.

Mitigation Measures Specific to Terrestrial Ecology		
Ref	**Title**	**Description**
Decommissioning		
TE7	Mitigation during decommissioning	As decommissioning works are likely to be of a similar nature and duration to construction activities, the mitigation outlined above for construction works should also be implemented during the decommissioning phase in order to protect important ecological features.

Residual effects

24.255 Although no significant effects on terrestrial ecological features are predicted, specific mitigation measures are proposed in section 24.13 as good practice to avoid or minimise the level of potential effects on sensitive coastal and wetland habitats, watercourses, Scottish primrose, and protected mammal and reptile species.

24.256 Following implementation of this mitigation, residual effects on terrestrial ecological features are likely to be reduced to a negligible level. Therefore **no significant residual impacts** on terrestrial ecology are predicted during the construction, operational, or decommissioning phases of the Project.

24.11 Summary

24.257 The key findings of the terrestrial ecology chapter are as follows:

- Fixed and semi-fixed sand dune habitats (SD7 and SD8) which correspond to habitats protected under Annex I of the Habitats Directive, and are part of the notified features of Sandside Bay SSSI, are present within the terrestrial ecology search area, but not within the current onshore project area itself. No direct or indirect effects on these vegetation types are considered likely. Therefore, no significant impacts are predicted and specific mitigation is not required. However, good practice measures will be implemented to ensure that sensitive coastal habitats are protected from potential indirect effects resulting from onshore works.
- Small areas of embryonic and mobile dune communities (SD2, SD4 and SD6) which correspond to habitats protected under Annex I of the Habitats Directive are present within the terrestrial ecology search area, but outside the current onshore project area. No direct or indirect effects on these vegetation types are considered likely. Therefore, no significant impacts are predicted and specific mitigation is not required. However, good practice measures will be implemented to ensure that sensitive coastal habitats are protected from potential indirect effects resulting from onshore works.
- A small area of M10 mire community which corresponds to habitat protected under Annex I of the Habitats Directive, and is assessed as being highly groundwater-dependent, is present within the terrestrial ecology search area, but outside the current onshore project area. No direct or indirect effects on these vegetation types are considered likely. Therefore, no significant impacts are predicted and specific mitigation is not required. However, good practice measures will be implemented to ensure that sensitive wetland habitats are protected from potential indirect effects resulting from onshore works.

- Small areas of heath communities (M15 and H7) which correspond to habitats protected under Annex I of the Habitats Directive are present within the terrestrial ecology search area, with small areas of H7 (but not M15) present within the current onshore project area. M15 is also assessed as being moderately groundwater-dependent. Potential effects on these vegetation types are assessed as being of a low to negligible level and no significant impacts are predicted. However, good practice measures will be implemented to ensure that sensitive wetland habitats such as M15 are protected from potential indirect effects resulting from onshore works.
- Small areas of W7 woodland, which is likely to have some benefits for local biodiversity, are present outside the current onshore project area. No direct or indirect effects on this habitat are considered likely. Therefore, no significant impacts are predicted and no mitigation is required.
- Three burns were recorded within the terrestrial ecology search area (but outside the current onshore project area), two of which are associated with the Caithness and Sutherland Peatlands SAC. No potential effects on watercourses are expected to occur and no significant impacts are predicted. Specific mitigation is not required, but good practice measures will be implemented to ensure that watercourses are protected from potential indirect effects resulting from onshore works.
- Small areas of MG10 rush pasture community, which is assessed as being moderately groundwater-dependent, are present within the current onshore project area. Potential effects on this vegetation type are assessed as being of a medium to low level and no significant impacts were predicted. However, specific mitigation is recommended to ensure that GWDTEs are protected, and good practice measures will be implemented to ensure that sensitive wetland habitats are protected from potential indirect effects resulting from onshore works.
- A single small pond is present within the terrestrial ecology search area. No significant impacts are predicted and specific mitigation is not required. However, good practice measures will be implemented to ensure that sensitive wetland habitats are protected from potential indirect effects resulting from onshore works.
- A single Scottish primrose plant, which is a designated feature of the nearby Red Point SSSI and a Caithness LBAP and SBL priority species, was recorded outside the current onshore project area on Reay Golf Course. Potential effects on this species are assessed as being of a negligible level and no significant impacts are predicted. However, specific mitigation is recommended to ensure that all plants are protected.
- No signs of any protected faunal species were recorded within the terrestrial ecology survey area, although several protected mammals and reptiles are known to be present in the wider area and limited suitable habitat for these species is present within the current onshore project area. Thus it is expected that some protected species may make occasional use of the current onshore project area. Potential effects on protected faunal species are assessed as being of a negligible level and no significant impacts are predicted. However, specific mitigation is recommended to avoid the potential for accidental disturbance or injury to protected species.
- Although no significant impacts on any ecological features recorded within the terrestrial ecology search area are predicted, reinstatement of the onshore cable corridor route (as well as the HDD compound, should this landfall option be selected) is proposed, in order to minimise effects on habitats and the species they support.

- Following implementation of mitigation, residual effects on all ecological features are likely to be reduced to a low to negligible level and no significant residual impacts are predicted during any phase of the Project.

25 Onshore Archaeology and Cultural Heritage

25.1 Introduction

25.1 This chapter describes the existing archaeological environment in the onshore Study Area (see Section 25.2) and presents the assessment of the potential impacts arising from the development of the proposed Dounreay Trì Project – the 'Project' - during the construction, operation and maintenance and decommissioning phases, on terrestrial archaeological and cultural heritage resources. Such resources include:

- Scheduled Monuments;
- Listed Buildings;
- Conservation Areas;
- Other archaeological sites and monuments; and
- Other non-designated historic environment assets.

25.2 Archaeological and cultural heritage resources of potential relevance to this Project are identified individually and the possible impact(s) of the Project on them is assessed. The potential impacts within the assessment include: (a) direct physical impacts that may be caused by the cable landfall installation and the onshore substation as well as infrastructure requirements such as construction of landfall areas, equipment laydown, working areas and construction compounds and (b) indirect impacts that may be caused by the construction of the onshore aspects of the Project, such as setting.

25.3 Direct effects on all designated and non-designated cultural heritage assets within the onshore site boundary have been assessed. Certain operational impacts can indirectly affect sites outside the site boundary. Indirect effects may relate to the development affecting views to, or from a heritage asset within important landscape settings. The effect on the setting of onshore designated cultural heritage assets from the proposed construction and siting of the substation and offshore wind farm forms part of this assessment.

25.4 Information on impacts of the landscape and visual setting of cultural resource sites are assessed in Chapter 27 Landscape and Visual Amenity.

25.2 Study Area

25.5 The onshore Study Area is considered to be the onshore cable search area (from Mean High Water Springs (MHWS), cable jointing infrastructure and associated substation site. For the baseline assessment, an onshore Study Area from Dounreay to Fresgoe, encompassing Sandside Bay and Reay was considered in order to establish an historic environment baseline (see Figure 25-1). This was used to identify any known sites within this area and to determine the potential for unidentified sites and landscapes that could potentially be affected by the Project.

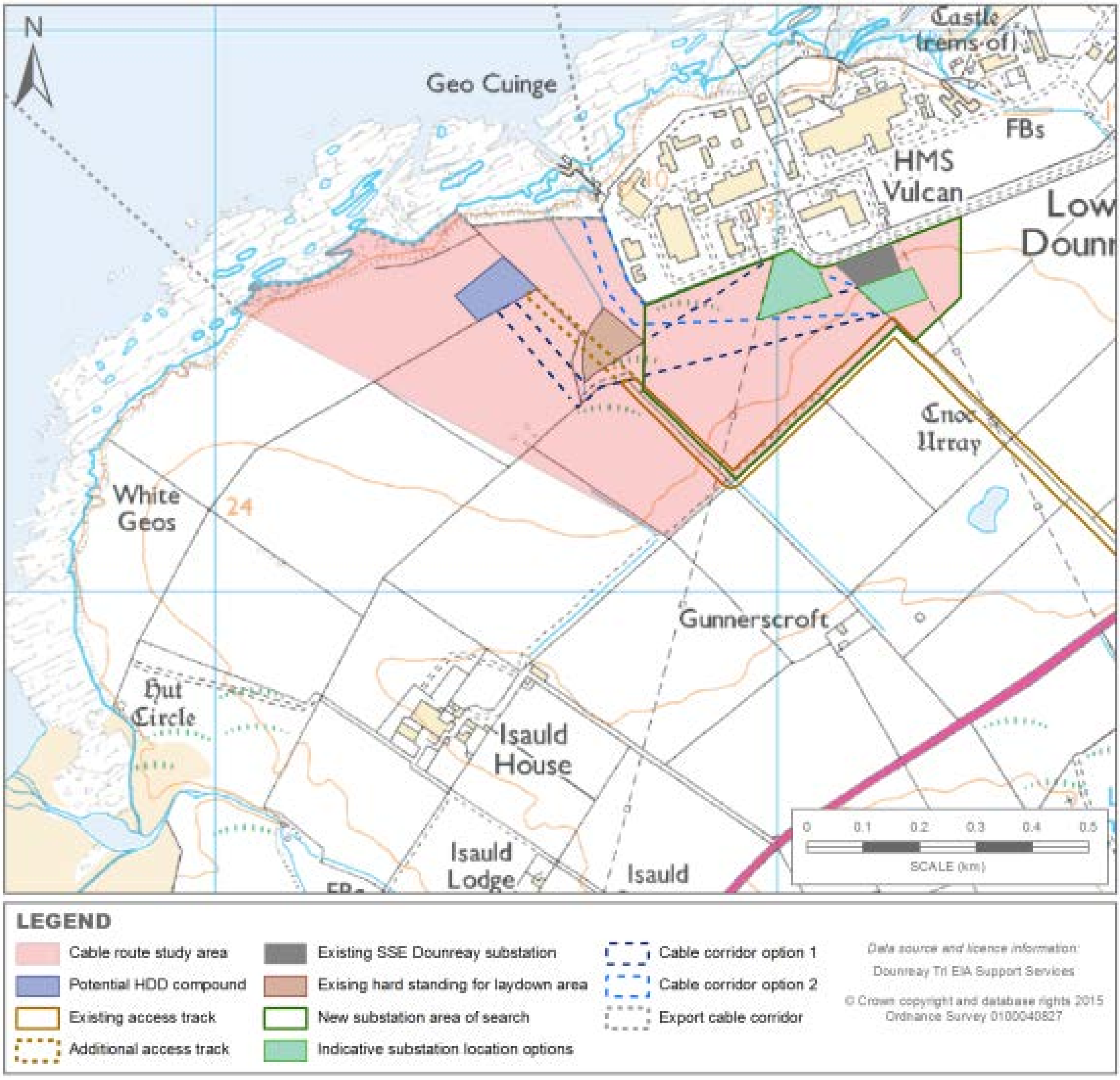

Figure 25-61 Onshore site

25.3 Legislation and Guidance

25.6 There are internationally legally binding conventions, EU Directives, UK and Scottish legislation, policy frameworks and guidance to consider in relation to the historic environment. Various EU EIA directives have been incorporated in UK and Scottish legislation, all of which include the requirement to address impacts on the historic environment. The following relevant guidance and legislation relating to onshore cultural heritage was used in the preparation of this chapter:

International/EU legislation and policy

25.7 Two international conventions which concern cultural heritage are of relevance to this study:

- The European Convention on the Protection of the Archaeological Heritage (revised); and
- The European Landscape Convention (ratified by the UK Government in 2006).

UK and Scottish legislation and policy

- The Ancient Monuments and Archaeological Areas Act 1979 (AMAAA);

- Scottish Historic Environment Policy (SHEP) 2011;
- The Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 and subsequent amendments;
- The Town and Country Planning (Scotland) Act (1997) and amendments and The Planning etc. (Scotland) Act 2006;
- Scottish Planning Policy (SPP 2014), with the companion Planning Advice Note (PAN 2/2011): Planning and Archaeology 2011, and Historic Environment Circular 1 (2015); and
- Third National Planning Framework (2014).

Local planning policy

- The Highland-wide Local Development Plan (2012).

25.4 Sources of Information

25.8 A detailed review was undertaken of the existing literature and data relating to the onshore cultural heritage and was used to give an overview of the existing environment. This report includes:

- A review of existing data sources to identify known sites in the area, and the potential for unidentified cultural heritage sites and areas; and
- The detailed results of the review and walkover survey are appended as Appendix 25.1: Onshore Historic Environment: Technical Baseline Report.

25.9 The principal reference sources used in the preparation of this chapter are listed in Table 25-1:

Table 25-175 Key data sources

Source	Content
The National Monuments Record of Scotland, using the Canmore and Pastmap database websites	Database of sites, monuments and buildings in Scotland maintained by Historic Environment Scotland
The Highland Historic Environment Record	Database of historically important features within the local environment
Ordinance Survey Maps	Topographical maps of the local area
National Library of Scotland	Relevant historic maps
North Highland Archive	Local history books and pamphlets, relevant historic maps
The Old and New Statistical Accounts of Scotland	The Reay Parish Entries

25.10 In addition to the above sources, the following archaeological, historical databases and publications sources used in the preparation of this assessment were:

- Aerial photographs and The National Collection of Aerial Photography; and
- Various other readily available archaeological and historical reports, databases and publications were consulted for information about the Study Area and, where used, are cited within the report.

25.5 Surveys and Studies Carried out to Date

Desktop surveys

25.11 The principal reference sources examined for this assessment were:

- The National Monuments Record of Scotland, using the Canmore database website;
- Statutory lists, registers and designated areas, including List of Scheduled Ancient Monuments, Designated Wrecks and Historic Marine Protected Areas;
- The Highland Council's Historic Environment Record;
- Ordnance Survey maps and historic maps in the online database at the National Library of Scotland;
- The North Highland Archive; and
- The Old and New Statistical Accounts of Scotland.

Field surveys

25.12 A walkover survey was undertaken within the onshore site boundary in October 2015 and executed in accordance with the relevant sections of the CIfA Standard and Guidance for Archaeological Field Evaluation (2014). The walkover survey of the then onshore site boundary (see Figure 25-2) was undertaken to:

- Identify the nature, extent and condition of known sites;
- Identify any sites visible on the ground that had not been identified so far; and
- Evaluate them in terms of cultural heritage significance.

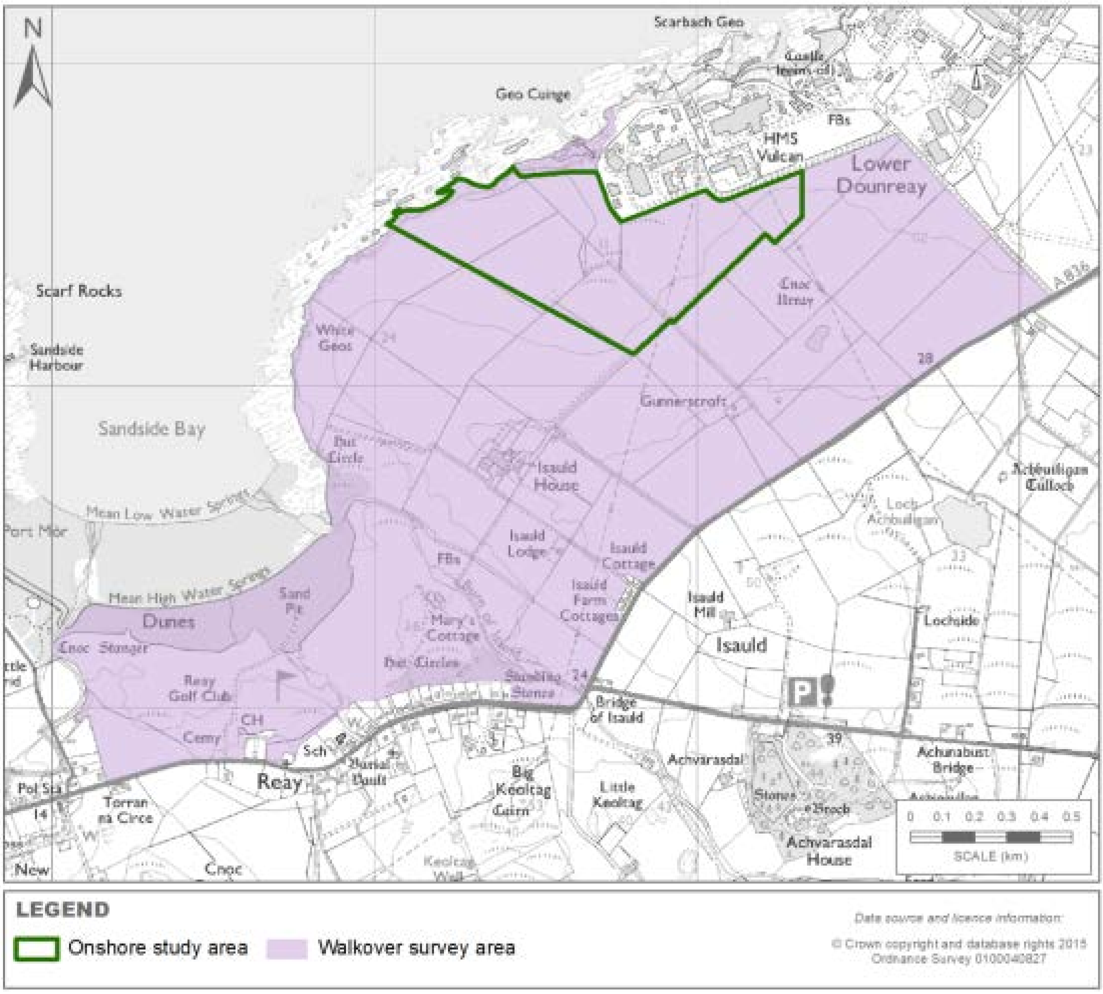

Figure 25-62 Area of walkover survey

25.13 The detailed results of the desktop and field surveys are detailed in Appendix 25.1: Onshore Historic Environment: Technical Baseline Report.

25.14 Additional terrestrial ecology surveys have been undertaken and these are reported in Chapter 24 Terrestrial Ecology.

25.6 Consultation

Pre-application consultation

25.15 Pre-application advice was sought by the Applicant from The Highland Council in June 2015.

25.16 The key points raised by stakeholders regarding the terrestrial historic environment are presented in Table 25.2 and have been used to guide the assessment and this chapter.

Scoping Feedback

25.17 The key points raised by stakeholders regarding Onshore Archaeology and Cultural Heritage are presented in Table 25-2.

Table 25-176 Scoping feedback

Consultee	Comment	Relevance/Cross Reference
Historic Environment Scotland: Pre-application advice, dated 7 July 2015	A detailed assessment of direct and indirect impacts on the historic environment, including a cumulative impact should be undertaken.	Noted and addressed within the assessment
	Focus should be particularly given to the following Scheduled Monuments and Listed Buildings: Knock Stanger cairn, Cnoc Stanger broch, Dounreay Castle, Achunabust broch, Reay burial ground, old church and cross slab, Sandside House, and Cnoc Freiceadain long cairns.	See Section 25.10
The Highland Council Historic Environment Team: Pre-application advice, dated 7 July 2015	Cultural heritage will be rigorously assessed as part of any forthcoming Environmental Statement.	Cultural heritage assessed within the baseline assessment and summarised within the Environmental Statement
	A discussion of direct impacts will be supported by a full and detailed archaeological survey.	See Sections 25.10, and Appendix 25.1: Onshore Historic Environment: Technical Baseline Report
	Appropriate mitigation strategies will be formulated where adverse impacts are predicted.	See Section 25.11
The Highland Council Historic Environment Team: Scoping Response, dated 1 March 2016	Cultural heritage will require assessment for both the on and offshore elements of the Project.	Cultural heritage assessed within the baseline assessment and summarised within the Environmental Statement
	The ES Chapter will need to follow The Highland Council Standards for Archaeological Work.	Noted

Consultee	Comment	Relevance/Cross Reference
	The assessment will consider potential impacts to upstanding features and also on the potential for buried remains, features and deposits to be present within the landscape. Areas subject to survey must be clearly marked on a map.	Noted and assessed
	The indirect impact assessment will need to include a cumulative impact assessment. Where indirect impacts are predicted, these will be illustrated using photomontages that comply with Highland Council visualisation standards.	See Section 25.12
	Where impacts are unavoidable, The Highland Council expect proposed methods to mitigate this impact to be discussed in detail, including both physical and where appropriate, compensatory and off-setting.	Noted and assessed

25.7 Assessment Methodology

25.18 The overarching approach to the onshore assessment is described in Chapter 5 Environmental Impact Assessment Methodology. In addition to the overarching approach to assessment and the government legislation and policy outlined in Section 25.3, the following codes of practice, professional guidance and standards directly relevant to the evaluation of potential impacts on the onshore cultural heritage assets;

- The Highland Council Standards for Archaeological Work (2012);
- The Chartered Institute for Archaeologists: Standard and guidance for historic environment desk-based assessment (2014);
- Historic Environment Scotland's Managing Change in the Historic Environment Guidance Note: Setting (2010);
- COWRIE Ltd's Historic Environment Guidance for the Offshore Renewable Energy Sector (Wessex Archaeology Ltd, 2007); and
- COWRIE Ltd's Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology and George Lambrick Archaeology & Heritage, 2008).

Scope definition

Onshore cultural heritage assets design envelope

25.19 As described in Chapter 5 Environmental Impact Assessment Methodology, the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

25.20 In the case of onshore cultural heritage assets, the installation of the export cable to the onshore substation as well as the construction of the substation building, access roads, working areas, construction compounds and temporary laydown areas have the potential to cause the greatest impact. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

25.21 Table 25-3 describes the Design Envelope parameters specific to the onshore cultural heritage assets.

Table 25-177 Design envelope parameters

Design Envelope Parameter	Value/Parameter
Open cut trenching technique Horizontal Directional Drilling (HDD) Technique	Once the onshore cable route is finalised the appropriate installation method will be decided. However, it is anticipated that open-cut trenching will be the primary installation method. A trench will be dug using backed-hoe excavators to a depth of 1 – 2 m.
Excavated trenches	Cable trench – 3 m wide with a working width of 20 m. Trench 800 m long (assume up to 1 km for the assessment). The working width includes the corridor in which the access road, cable trench, excavated material, turf and any other equipment/machinery is placed. The access track would be temporarily fenced off to keep livestock out. It is expected that one cable will be installed in a single trench up to 3 m wide with an associated working corridor width of up to 20 m.
Footprints of the substation building will be contained within the site boundary Setting issues on onshore cultural heritage assets from the construction of the substation	Footprint of the edge of the fence line likely to be an area of approximately 50 m x 50 m. Maximum height of the main electrical components is up to 8 m above finished ground level. Building is 30 m x 17.5 m x 8 m high. Land take for the substation is estimated at approximately 2,500 m^2.
Footprints of laydown areas will be contained within the site boundary	HDD requires a temporary landward working area of up to 1000 m^2 to accommodate the drilling equipment and ancillary plant (Figure 4.7). The existing area of hardstanding would be used for storage, welfare facilities and laydown.

Methodology for baseline surveys

25.22 The desk-based survey was executed in accordance with the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for historic environment desk-based assessment* (2014) and The Highland Council's *Standards for Archaeological Work* (2012). The principal sources of information are outlined in Section 25.4). The detailed methodology can be found in Appendix 25.1: Onshore Historic Environment: Technical Baseline Report.

25.23 The walkover survey was executed in accordance with the relevant sections of the Chartered Institute for Archaeologists (CIfA) *Standard and Guidance for Archaeological Field Evaluation*

(2014) and The Highland Council Standards for Archaeological Work (2012). The walkover survey was undertaken in a systematic manner, field by field, with transect width appropriate to the conditions (mostly pasture and rough pasture). Any features or sites identified were assigned an individual site number, briefly recorded by notes, sketches, photographs and handheld GPS and evaluated.

Cultural heritage significance criteria

25.24 Cultural significance lies in the value of the heritage asset to this and future generations because of its heritage interest, this may be artistic, archaeological, architectural, historic, traditional[69], aesthetic, scientific, or social. Known and potential heritage assets within the site and wider Study Area have been identified from national and local designations, HER data and expert opinion. The determination of the significance of these assets is based on statutory designation and/or professional judgement against the following characteristics[70]:

- Intrinsic: the condition in which the monument has survived. This includes the potential survival of archaeological survival above ground and buried, and goes beyond the survival of marked field characteristics. The archaeological, scientific, technological or other research potential of the monument or any part of it needs to be considered. The apparent development sequence of the monument as well as the original or subsequent functions of the monument and its parts is also considered;
- Contextual: relates to the monument's place in the landscape or within the body of existing knowledge. This takes into account the rarity of the monument as well as the relationship of the monument to other monuments of the same or related classes or period, or to features or monuments within the vicinity. The relationship of the monument within the wider landscape and setting are also considered; and
- Associative: historical, cultural and social influences that have affected the form and fabric of the monument as well as the aesthetic attributes and significance in the national consciousness. This is also influenced by the way in which historical, traditional or artistic characters or events have been derived from the monument.

25.25 The main thresholds of relative cultural heritage importance are defined as: National, Regional and Local Importance, and relate reasonably closely to heritage value/sensitivity of receptor as shown in Table 25-4. The definition of cultural significance used within this report, and in historic environment legislation and guidance, should not be confused with the unrelated usage of significance in referring to effects in EIA.

[69] Factors listed in the Ancient Monuments and Archaeological Areas Act, 1979

[70] From Scottish Historic Environment Policy: Annex 1: Criteria for and guidance on the determination of 'national importance' for scheduling.

Table 25-178 Cultural heritage sensitivity criteria

Heritage Value/ Sensitivity of Receptor	Criteria
High	Sites of relative national or international importance, including: World Heritage Sites Scheduled Monuments and sites proposed for scheduling Category A Listed Buildings Gardens and Designated Landscapes Outstanding Conservation Areas Historic Battlefields Designated Wreck Sites Undesignated archaeological sites, areas and buildings of national importance (identified in the HER/SMR)
Medium	Sites of relative regional importance, including: Category B and Category C(S) Listed Buildings Burial Grounds Protected heritage landscapes Conservation Areas Undesignated archaeological sites, areas and buildings of equivalent regional importance (identified in the HER/SMR)
Low	Sites of relative local importance (unless designated or of high value locally), including: Cultural heritage assets of poor preservation and/or poor survival of contextual associations Cultural heritage assets of local value or interest for education or cultural appreciation Undesignated archaeological sites, areas and buildings of equivalent importance (identified in the HER/SMR) Unlisted historic buildings and townscapes with local characteristics
Negligible	Sites of little or no importance, including: Sites of former archaeological features Unlisted buildings of very minor historic or architectural interest Poorly preserved examples of particular types of features Single findspots

Magnitude of direct effect

25.26 The magnitude of a direct physical effect is the degree of change to the baseline condition of a feature that would result from the construction of one or more elements of the Project. The criteria for assessing the magnitude of effect are defined in Table 25-5.

Table 25-179 Magnitude of direct effect

Magnitude of Effect	Description
High	Major effects fundamentally changing the baseline condition of the receptor, leading to total or major alteration of character
Medium	Moderate effects changing the baseline condition of the receptor materially, but not fundamentally, leading to partial alteration of character
Low	Minor detectable effects that do not alter the baseline condition of the receptor materially
Negligible	A very slight and barely distinguishable change from baseline conditions, approximating to the 'no change' situation
None	No change to the baseline condition of the character of the receptor

Assessment of potential direct effects

25.27 The assessment of the significance of a direct physical impact was determined by evaluating two key criteria: the importance or heritage value/sensitivity of the site being affected (Table 25-4) and the magnitude of that effect (Table 25-5).

25.28 Table 25-6 summarises the criteria for assigning significance of impact. Like the previous table, this requires professional judgement in order to make an assessment and the table below is a tool, not a mechanical system in itself.

Table 25-180 Significance of direct impact

Heritage Value/Sensitivity of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

Indirect impacts (setting)

25.29 Where the setting of a heritage asset has the potential to be affected by the Project, the assessment of possible effects followed the following guidelines:

- Identification of the asset's setting (as defined by Historic Environment Scotland and the ZTV);
- Assessment of the sensitivity of that setting;
- Identification of how the presence of the proposed wind turbines will affect that setting (magnitude of effect); and
- Assessment of significance of effect.

Definition of setting

25.30 Although there is no statutory definition, 'setting' is an important consideration in assessing changes to the historic environment in the planning process. Scottish Planning Policy (2014) defines setting as:

> more than the immediate surroundings of a site or building, and may be related to the function or use of the place, or how it was intended to fit into the landscape or townscape, the view from or how it is seen from areas round about, or areas that are important to the protection of the place, site or building (SPP 2014: Glossary, p75).
>
> The setting of a heritage structure, site or area is defined as the immediate and extended environment that is part of, or contributes to, its significance and distinctive character (ICOMOS, 2005).

25.31 All heritage assets have a setting in a sense that they survive in a recognisable place or places within the wider landscape. However, the extent to which setting contributes to the overall cultural significance of heritage assets can vary widely.

25.32 Guidance on setting is contained in Historic Environment Scotland's Managing change in the Historic Environment series. Here, setting is defined as how monuments were:

25.33 deliberately positioned with reference to the surrounding topography, resources, landscape and other monuments or buildings. These relationships will often have changed through the life of a historic structure. Setting can be thought of as the way in which a historic structure's surroundings contribute to how it is experienced, understood and appreciated. Setting often extends beyond the immediate property boundary of a historic structure into the broader landscape (Historic Scotland, 2010: paras 2.2 & 2.3).

25.34 Historic Environment Scotland's guidance note on setting lists ten factors and indicates that this is not exhaustive (Historic Scotland, 2010: Section 3):

- "Current landscape or townscape context;
- Visual envelope, incorporating views to, from and across the historic structure;
- Key vistas, framed by rows of trees, buildings or natural features that give a structure a context, whether or not intentional;
- The historic structure's prominence in views throughout the surrounding area;
- Character of the surrounding landscape;
- General and specific views including foregrounds and backdrops;
- Relationships between both built and natural features;
- Aesthetic qualities;
- Other non-visual factors such as historical, artistic, literary, linguistic, or scenic associations, intellectual relationships (e.g. to a theory, plan or design), or sensory factors; and
- A 'Sense of Place': the overall effect formed by the above factors".

25.35 The relevance of setting to the cultural significance of a heritage asset does not depend on whether or not a site is visited (Historic Scotland, 2010: 4.10).

25.36 If a cultural heritage asset is not visible on the ground surface, it is unlikely that the visual factors in the list above will apply, although other non-visual factors including relationships with other features, aesthetic qualities and a 'sense of place,' as mentioned above, may still do so.

Criteria for assessing sensitivity of setting

25.37 Setting is considered particularly relevant in cases of well-preserved cultural heritage assets that are prominent features within the landscape. The integrity and preservation of the setting of a cultural heritage asset is an important factor. The setting of a cultural heritage asset that survives as part of a well-preserved historic landscape that also includes other related heritage assets, is ascribed a greater weight as compared to a cultural heritage asset that is set within an area of more recent land use that would have disrupted the asset's setting therefore making it more difficult to appreciate. However, the setting of a cultural heritage asset that has undergone change may still contribute to the value of the heritage asset and may remain sensitive to further change.

25.38 The sensitivity of the setting was assessed by considering two factors: the relative weight that statute and policy attach to the asset and its setting, i.e. its heritage value/sensitivity, and the degree to which the baseline setting contributes to the understanding and/or appreciation (value) of the asset.

25.39 The relative weight that statute and policy attach to the asset and its setting is determined using the heritage value/sensitivity of heritage assets as defined in Table 25.4. The degree to which the baseline setting contributes to the understanding and/or appreciation of the assets has been assessed by the criteria outlined in Table 25-7.

Table 25-181 Contribution of setting to the understanding and appreciation of a cultural heritage receptor

Importance of Setting/Sensitivity	Description
High	A setting that makes a critical contribution to the understanding and/or appreciation of the siting and/or historical/archaeological/architectural context of a receptor. (Examples of this include: prominent topographic locations; surroundings that include related monuments in close association; surroundings that are believed to be little changed from those when the receptor was created).
Medium	A setting that makes a positive contribution to the understanding and/or appreciation of the siting and/or historical/archaeological/architectural context of a receptor. (Examples of this include: surroundings that complement the siting and appearance of a receptor, such as the presence of a feature of the rural past within a more recent farming landscape containing little or no urban or industrial development).
Low	A setting that makes little positive contribution to the understanding and/or appreciation of the siting and/or historical/archaeological/architectural context of a receptor. (Examples of this include: surroundings that only partially complement the siting and appearance of a receptor, such as the presence of a feature of the rural past within a partly urbanised or industrialised landscape).

Importance of Setting/Sensitivity	Description
Negligible	A setting that does not contribute positively to the understanding and/or appreciation of the siting and/or historical/archaeological/architectural context of a receptor. (Examples of this include: immediate surroundings, such as commercial coniferous woodland or an industrial development, that are not relevant to the understanding of the context of the receptor).

Evaluation of magnitude of effect on setting

25.40 The magnitude of effect on the setting of cultural heritage assets is a function of the scale of changes likely to result from the Project to the characteristics identified in HES' guidance on setting, such as the character of the landscape in how it relates to associated cultural heritage assets. This may include physical changes to the fabric of the landscape, effects on significant individual elements of the landscape, and effects on characteristic combinations or patterns of elements, all in relation to archaeology and cultural heritage. It is also a function of the scale and type of change in the composition and character of the view of, to or from the heritage receptor under consideration. This includes the distance to the change, whether the change blends in or stands out, the location of the Project within the view and the extent of the view affected.

25.41 The magnitude of effect on the setting was assessed using the criteria set out in Table 25-8.

Table 25-182 Magnitude of effect on setting

Magnitude of Effect	Description
High	Major effects fundamentally changing the setting of a receptor, leading to total or major alteration.
Medium	Effects discernibly changing the setting of a receptor leading to a setting that is partly altered.
Low	Slight but still detectable effects that do not materially alter the baseline setting of the receptor.
Negligible	A very slight and barely distinguishable change from baseline conditions.
None	No change to the baseline condition of the receptor.

Significance of indirect impact

25.42 The significance of an effect on setting is assessed using a matrix (Table 25.9) which combines the assessed magnitude of the impact prior to the application of any management or mitigation strategies (Table 25.8) and the sensitivity of the setting to the asset (Table 25.7). The assessment of significance of effect requires professional judgement in order to make an assessment and the table below is a tool to be used as a guide and is not a mechanical system in itself.

Table 25-183 Significance of indirect impact matrix

Sensitivity of Setting	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

25.43 Significance of impact is classified as Major, Moderate, Minor or Negligible as set out in Table 25-9 and defined in Table 25-10. Under Environmental Impact Assessment (EIA) regulations, significant effects must be reported. In this methodology impacts of moderate and high significance are considered significant effects that may require consideration by the competent authorities and will require control, management and mitigation (Scottish Government, 2011b). However, it should be noted that impacts of minor significance may still require some management or mitigation to remain within acceptable levels.

Table 25-184 Significance of Indirect Impact

Significance of Impact	Description
Major	A fundamental or key change to the setting that leads to a substantial and material effect on the character, quality or context of a receptor.
Moderate	Changes to the fabric or setting that leads to a partial and material effect on the character, quality or context of a receptor
Minor	Changes to the fabric or setting that lead to a detectable but non-material effect on the character, quality or context of a receptor
Negligible	Changes to the fabric or setting that lead to, or at most, a negligible effect on the character, quality or context of a receptor

25.8 Description of the Current Environment

25.44 This section will assess the potential for cultural heritage assets to be present on the site. It will assign significance to known heritage assets present that may be affected by the Project. Known cultural heritage assets were assigned a number that was referred to within the text. A full and detailed account of the onshore historic environment can be referred to in Appendix 25.1: Onshore Historic Environment: Technical Baseline Report.

Established baseline conditions

25.45 There are no Scheduled Monuments or Listed Buildings within the onshore site boundary, nor is it located within an area designated as a Conservation Area, or Garden and Designed Landscape, and there are no known battlegrounds on the site.

25.46 The Highland Council HER held three records for sites within the onshore site boundary. A further site was identified through the walkover survey (see Figure 25-2).

Identified cultural heritage assets within the site boundary

25.47 Within the onshore site boundary, a total of four sites were identified through the HER and the walkover survey (see Figure 25-2, and Table 25-11). Of these two were Post-medieval in date and were of low heritage value/sensitivity (sheepfold, ORCA No. 6-7).

25.48 The remaining two cultural heritage assets that were identified within the onshore site boundary were not characteristic enough to be definitively assigned to a time period (see Figure 25-2, and Appendix Table A1). One of these cultural heritage assets was of negligible heritage value (an earthwork bank, ORCA No. 5). The remaining site was of uncertain heritage value (a layer of burnt ash or silt, ORCA No. 53). It should be noted that there is potential for some of the sites of uncertain value (uncertain because their nature and/or period could not be ascertained) to be of high heritage value.

Cultural heritage potential

25.49 There is a *moderate* to *high* potential for unknown sites from the prehistoric period to be present within the onshore site boundary. The onshore site boundary is located in a landscape rich in prehistoric activity. To the west of the onshore site boundary there is a concentration of prehistoric activity in the form of Neolithic clearance cairns and Bronze Age hut circles, indicative of prehistoric cultivation practices and settlement (Refer to Figure 25-3, Baseline Assessment in Appendix 25.1, and Table 25-11).

25.50 There is a *moderate* to *high* potential for unknown sites from the early medieval period to be present within the onshore site boundary. The Reay and Sandside Bay area was a site of known significance in pre-Viking times that continued on into the Viking and Norse periods (the early medieval). To the south west of the onshore site boundary an early medieval chapel has been recorded (Baseline Assessment, ORCA No. 30). Nothing is known of this chapel that is thought to be pre-Norse. This site has since been covered by sand drifts. Sand erosion noted to the south of the site boundary has revealed a number of Norse burials as well as fragments of circular buildings, horse bones and cist burials. There is a notable coastal concentration amongst known Viking and Norse sites.

25.51 There is a *low* potential for the presence of unknown sites from the late medieval periods. No sites from this period are recorded within the onshore site boundary. Local tradition states that the fallen from the battle of Ruoig-Hansett may be buried within the Sandside Bay area, and Reay was an established settlement by this time. Heritage assets dating to the late medieval period may be of low or moderate heritage value based on the intrinsic, contextual and associative characteristics of the heritage asset if present.

25.52 There is a *low* potential for unknown sites from the Post-medieval and Modern periods to be present within the onshore site boundary. A traditional Caithness Flagstone dyke wall was noted to the south west of the onshore site boundary that was extant for *c.* 400 m, aligned north east/south west (Baseline Assessment, ORCA No. 58). This type of boundary wall is considered to be of Regional heritage value. A sheepfold was noted within The Highland Council HER within the northern aspect of the onshore site boundary. This site now survives as a sub-circular depression and is considered to be of low heritage value (ORCA No. 6). Further sites that date to the Post-medieval and Modern periods that may be present within the onshore site boundary are most likely to be agricultural and possibly in a ruinous condition, and therefore of low heritage value.

25.9 Identification of Potential Impacts

25.53 The following potential impacts relative to the onshore historic environment were identified.

25.54 Direct impacts are those that would produce a physical effect on cultural heritage assets and archaeological features. Direct impacts could include potential damage to, or destruction of, either known or unknown cultural heritage assets through:

- The excavation of the cable route and infrastructure associated with the cable route;
- The construction and reinforcing of associated access roads;
- The construction of a substation building; and
- The construction of temporary construction compounds, working areas, and equipment laydown areas.

25.55 Certain operational impacts can indirectly affect sites outside the site boundary, especially those where the setting of a site may be affected. These effects are likely to persist throughout the operational phase. Potential indirect impacts include can include:

- Views to, or from, a cultural heritage assets located within an important landscape setting may be affected; and
- Noise and vibration.

25.56 The potential for indirect impacts from construction noise levels on the setting of cultural heritage assets is unlikely from this distance. Therefore, this potential impact is not addressed further within this assessment.

Potential impacts in the construction phase

25.57 Direct impacts on heritage assets are normally adverse, permanent and irreversible. It is likely that only sites within the proposed onshore site boundary would be directly affected. The construction of the substation, temporary construction compounds and working areas may require the footprint of the structures to be excavated to the natural soil beneath. This would severely truncate or destroy any sub-surface archaeological features, if present, as would cable trenching.

Potential Impacts in the operational phase

25.58 Indirect effects may relate to the Project affecting views to, or from a cultural heritage asset set within the landscape. Within the assessment, it was considered whether or not an indirect setting effect would occur on designated sites within a 10 km radius around the onshore site boundary, and on those sites within a 10 km radius of the offshore site boundary.

25.10 Impact Assessment

Impact in the construction phase

25.59 A total of four sites were identified through the HER, cartographic analysis and the walkover survey within the onshore site boundary (See Figure 25.3 below and Table 25-11 for a full listing of these sites).

Table 25-185 Gazetteer of sites identified within the proposed onshore site boundary

ORCA Site No.	THC HER Mon UID	Site Name	Heritage Value/Sensitivity	Magnitude of Effect	Significance of Direct Impact
5	MHG765	Earthwork Bank, Isauld House	Negligible	High	Minor
6	MHG2483	Sheepfold, Ling Geo	Low	None	None
7	MHG43538	Sheepfold, Ling Geo	Low	None	None
53	---	Deposit	Uncertain	None	None

25.60 Potential impacts on known cultural heritage assets within the onshore site boundary as a result of Cable Corridor 1 (where open cut trenching would be used from the HDD compound to the substation location) are identified in Table 25-12. No impacts were identified for cable corridor 2.

Table 25-186 Cable corridor 1 impacts

ORCA Site No.	Site Name	Level of Sensitivity	Magnitude of Effect	Significance of Impact
5	Earthwork Bank	Negligible	High	Minor

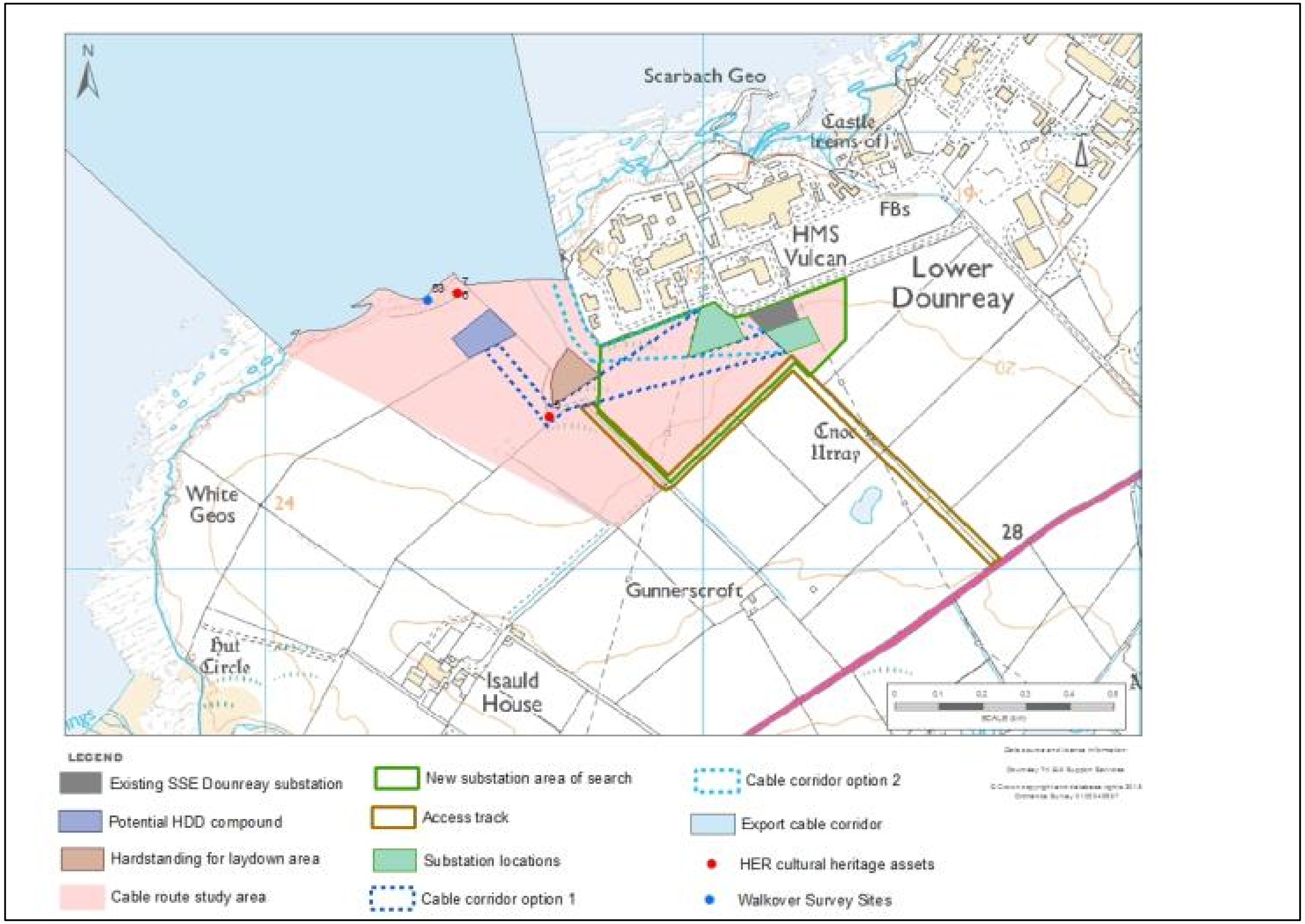

Figure 25-63 Cultural heritage assets within onshore site boundary

Impact in the operation and maintenance phase

25.61 Operational effects on cultural heritage assets relate largely to effects on the setting of heritage assets. Potential operational effects will result in changes of views to or from cultural heritage assets that are relevant with their setting. The view of a cultural heritage asset can be obscured, compete with or distract from the valued characteristics of that view by the presence of wind turbines. Infrastructure works can also have an effect on the setting of cultural heritage assets. The potential impacts on the setting of designated cultural heritage assets within 10 km of the offshore wind turbines and the onshore infrastructure works are assessed below.

Impacts in the decommissioning phase

25.62 It is assumed that no further direct effects will occur during any potential decommissioning, as long as any intrusive works remain within the same construction phase footprint.

25.63 If the offshore wind turbines were to be decommissioned and the associated infrastructure removed, the effects on the setting of the cultural heritage assets would be removed and there would be no residual effects from the Project on the setting of heritage assets.

Impacts on setting

25.64 Historic Environment Scotland expressed the view that particular attention be given to the setting of the following Scheduled Monuments: Cnoc Stanger cairn, Cnoc Urray broch, Dounreay Castle, Achunbust broch, Reay burial ground, old church and cross slab, two carved stones at Sandside, Cnoc Freicedain long cairns, and the following Category A Listed Buildings: Reay Parish church and enclosure wall, Sandside House Kiln Barn and single storey range of former byres, cottage and dairy, and implement shed as well as Sandside Harbour 1 and 2, Sandside and Fishing Store. A further 15 Scheduled Monuments, five Category B Listed Buildings and two Category C(S) Listed Buildings were identified within the 10 km radius and the ZTV. An assessment of the potential impact from the offshore wind turbines and the onshore substation building on these designated cultural heritage assets within the ZTV was undertaken (refer to Figure 25-4 and Table 25-13).

25.65 The final location of the proposed onshore substation building is yet to be determined. However, it is proposed that the substation will be constructed near the existing SSE 132/33/11kv Dounreay substation. As the Nuclear Facility and existing SSE substation are built, they are considered part of the existing baseline. As the proposed substation building will be adjacent to the Nuclear Facility and existing SSE substation, there will be no additional effect on the setting of onshore cultural heritage assets from the construction of the proposed substation building.

25.66 A ZTV was established for the Dounreay Trì offshore wind farm. In total a 10 km boundary was centred on the offshore wind turbines in order to identify any designated cultural heritage assets from which the Project will be partially or fully visible (see Figure 25-4). There were 34 designated cultural heritage assets within the 10 km radius that were not within the ZTV and, after initial consideration in case they could be affected, were not considered further within the assessment. Wireframes were provided by the client that showed the worst case scenario for each of the designated sites that Historic Environment Scotland wanted particularly assessed. As the siting of the offshore turbines is yet to be finalised, the worst case scenario for all of the designated sites, with the exception of Sandside House, would be in the south east corner of the area of search. The worst case scenario from Sandside House would be from the middle of the area of search.

25.67 The significance of some impacts are identified as Moderate or Major, using the process and significance matrix described in Section 25.8. However, there are no High magnitude effects on setting that result in a total or major alteration to the baseline setting, and no effect removes the understanding, appreciation or experience of the heritage asset to which the affected setting relates.

25.68 The following setting assessment considers those sites within 10 km of the proposed offshore wind farm, where setting may be affected by the proposed wind turbines (see Figure 25-4 and Table 25-13).

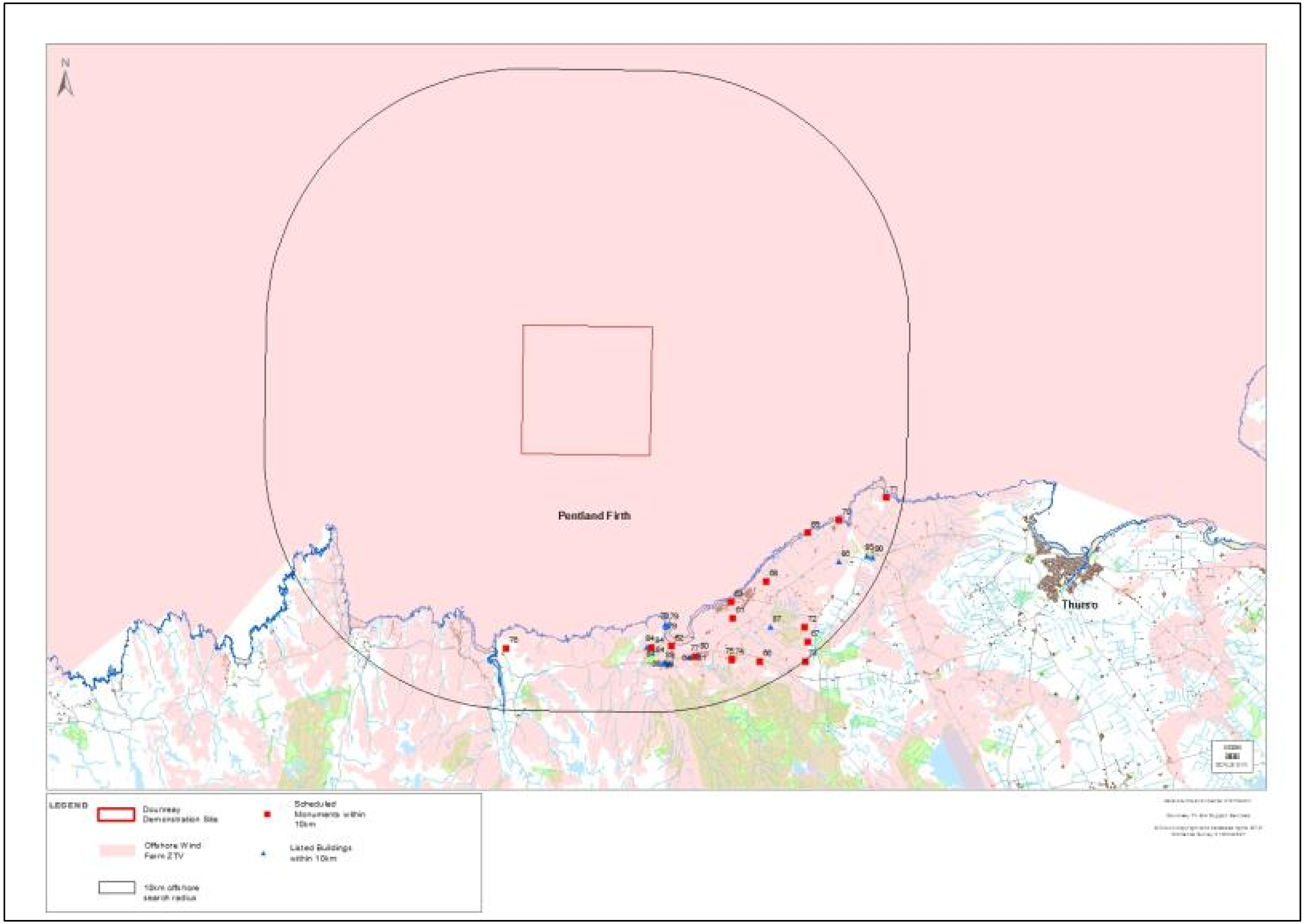

Figure 25-64 Designated cultural heritage assets within 10 km of offshore site boundary

Impact on the setting of Cnoc Urray broch 400 m north/north east of Gunnscroft (Index No. 564; ORCA No. 61)

25.69 There are more remains of brochs in Caithness than in any other area of Scotland. Brochs would have been impressive stone built towers that allowed for viewing the landscape over some distance. Brochs are commonly found in coastal settings that may have been deliberate for defensive reasons, such as monitoring coastal traffic, or possibly for prestige. Within 10 km of the onshore site boundary there are at least five designated broch sites. The concentration of brochs set within the immediate landscape to the onshore site boundary, indicates that this was an area of prehistoric settlement and activity. Intervisibility between broch sites may have also played an important political and/or social role.

25.70 The Scheduled broch of Cnoc Urray survives as a turf covered mound measuring 26.54 m in diameter and 3.05 m high with a flat top 16.47 m in diameter situated on a flat plateau to the east of Sandside Bay. The setting of the broch site was changed dramatically with the construction of the Dounreay Nuclear Facility *c.* 390 m to the north. Due to this, the setting of the broch makes little positive contribution to the understanding and/or appreciation of the siting of the monument (a Low contribution of setting). As Cnoc Urray has a High Heritage Value and a Low contribution of setting the Scheduled broch therefore has a medium sensitivity to change.

25.71 Wireframes provided by the client shows that the wind turbines would be visible in their entirety (masts, nacelles and blades). The proposed wind turbines would not materially alter the baseline setting of the broch site (a Low magnitude of effect on setting) as the Project would be seen in-combination with the Dounreay Nuclear Facility as well as overhead power lines and associated pylons. The resulting significance of impact on setting would be **Minor**.

Impact on the setting of Cnoc Stanger cairn 730 m east of Sandside House (Index No. 458; ORCA No. 62)

25.72 The Scheduled cairn of Cnoc Stanger is located at *c.* 10 m OD on the south west side of Sandside Bay. In 1909 the site was described as a 'Pictish cairn' with an area of exposed circle of small stones set on edge at the base of the cairn. A more recent (1981) visit to the cairn described the site as a "*consolidated sand dune. The summit is disturbed by trenching and some stone is apparent here and on the upper slopes of the dune, but there are insufficient remains to classify these stones as a cairn. An absence of stone in the rapidly eroding east side may indicate that the stones on the summit were merely a minor surface feature i.e. a sea mark*".

25.73 The mound stands at *c.* 4 m in height and 18 m in diameter and is one of the higher points within the sand dune system around Sandside Bay. Key views from the cairn would have been to other funerary or settlement sites around Sandside Bay. In the bank of Sandside Burn, 20 m south of Cnoc Stanger cairn, remains of dry stone built structures were identified. These circular or sub-circular houses were being built in the Caithness area around *c.* 1000 BC. Cnoc Stanger may well have been the funerary site for this settlement. If Cnoc Stanger was used as a sea marker, the key view would have been to the adjacent sea.

25.74 Key views to the coast and sea from the cairn at Cnoc Stanger will be affected by the Project to the north. Key views from the cairn to surrounding settlement sites and inland will not be affected by the offshore Project. Wireframes provided by the client show that in a worst case scenario the offshore wind turbines will be visible in their entirety. If the turbines were to be positioned in the north west or south west area of search, the turbines would be largely obstructed from view by the Fresgoe headland.

25.75 The cairn is set within a prominent topographic location, within an area of prehistoric activity that is also located within an area of more recent development (Sandside House, Reay Golf Course, Dounreay Nuclear Facility). As such, the setting of the monument makes a small positive contribution to the understanding and/or appreciation of the siting of the monument (a Low contribution of setting). As Cnoc Stanger has a High Heritage Value and a Low contribution of setting the Scheduled cairn therefore has a medium sensitivity to change. As the proposed wind turbines would alter the sea views from the cairn, the setting of the receptor would discernibly change leading to a setting that is partially altered (a Moderate magnitude of effect on setting). This results in a **Moderate** significance of impact on the setting on Cnoc Stanger cairn.

Impact on the setting of Dounreay Castle (Index No. 6401; ORCA No. 63)

25.76 The Scheduled Dounreay Castle consists of the remains of a probable 16th century castle. The location of Dounreay Castle utilised the sea as a natural defence to the north and due to the relatively flat topography of the area, would have been visible for some distance. Key views from Dounreay Castle would have been the 360° landscape around the tower.

25.77 Much of the site was levelled, with the exception of the castle and a north east cottage block when the area was occupied by the Nuclear Facility (a Low contribution of setting). As Dounreay Castle has a High Heritage Value and a Low contribution of setting the Scheduled Castle therefore has a medium sensitivity to change.

25.78 Wireframes provided by the client shows that the wind turbines would be visible in their entirety (masts, nacelles and blades) from Dounreay Castle looking west/north west. The proposed wind turbines would not materially alter the baseline setting of the castle site (a Low magnitude of effect on setting). The resulting significance of impact on setting would be **Minor**.

Impact on the setting of Reay burial ground, old church and cross slab, 175 m east of Parish Church (Index No. 615), also a Category B Listed Building (Index No: LB14980; ORCA No. 64)

25.79 This monument consists of a burial ground, surrounded by a wall, which contains a burial aisle, that incorporates the remains of a medieval church and houses a cross slag that dates from the late 9th or the 10th century.

25.80 The burial ground is surrounded by a cemetery wall with in-built steps on the wall. These steps were the original means of entry into the graveyard, it is believed that they were constructed to keep out evil spirits. As such the burial ground is assumed to have been self-contained, with key views being into the graveyard itself and not out into the surrounding landscape. As the burial ground survives as such and remains unchanged from the time of the last interment, the setting of the burial ground makes a critical contribution to the understanding, appreciation and historical context of the receptor (a High contribution of setting) contribution. As the Reay burial ground has a High Heritage Value and a High contribution of setting, the Scheduled Monument has a High sensitivity to change.

25.81 From inside the burial ground, the proposed wind turbines will not be visible. From the cemetery wall, views to the coast are largely blocked by the adjacent modern housing and landscaping. The western-most corner of the cemetery wall does have views to the coast, that is somewhat restricted by overhead power lines and a transformer as well as the Fresgoe headland. Wireframes provided by the client shows that the wind turbines would be visible in their entirety (masts, nacelles and blades). As the proposed wind turbines would be visible from one aspect of the Scheduled Monument, the western extent of the cemetery wall, there would be a slight but detectable effect that does not materially alter the baseline setting of the burial ground (a Low magnitude of effect on setting). The resulting significance of impact on the setting of Reay burial ground would by matrix definition be **Moderate**, although it is unlikely that in reality the change would have a material effect, and is therefore more likely to be of **Minor** significance.

Impact on the setting of Sandside House, Reay, two carved stones (Index No. 616; ORCA No. 65)

25.82 The Scheduled carved stones at Sandside House were not originally found upon the Estate. One of the Pictish symbol stones was found in *c.* 1853 near the remains of an early settlement site on the sand links by the shore at Sandside. The other Pictish stone was found built into a stone dyke at Shurrery, the site of an early chapel. Both of the stones are now within the garden of Sandside House. As neither of the stones are *in situ* and are located within the garden of Sandside House the contribution of setting is Negligible. The Pictish carved stones are of High Heritage Value, but have a Negligible contribution of setting, resulting in a Low sensitivity to change.

25.83 The garden walls of Sandside House will also obscure the view from the carved stones towards the Project resulting in a Negligible magnitude of effect. The resulting significance of impact on the setting of the carved stones is **Negligible**.

Impact on the setting of Achunabust broch (Index No. 513; ORCA No. 66)

25.84 This Scheduled Monument consists of the ruins of a broch site that survives as a turf-covered mound that stands 1.3 m high that has been extensively quarried.

25.85 The concentration of broch sites and other prehistoric sites within the area indicates that this was an area of prehistoric activity and settlement. However, as the broch site has undergone extensive quarrying and immediately west of the broch are the footings of a more recent rectangular building with an attached enclosure that have contributed to the setting of the broch making little positive contribution to the understanding and appreciation of the siting (a Low contribution of setting). As Achunabust broch has a High Heritage Value and a Low contribution of setting the Scheduled broch has a Low sensitivity to change.

25.86 Key views to and from the broch would have been to other similar monuments such as Achvarasdal House broch site *c.* 1 km to the west and Cnoc Urray *c.*2 km to the north. Wireframes provided by the client shows that the wind turbines would be visible in their entirety (masts, nacelles and blades). The proposed wind turbines would partly materially alter the baseline setting of the broch site (a Moderate magnitude of effect on setting). The resulting significance of impact on setting would be **Minor**.

Impact on the setting of Cnoc Freiceadain long cairns (Index No. 90078; ORCA No. 67), also a Property in Care of Scottish Ministers

25.87 The Scheduled long cairns of Cnoc Freiceadain consists of two long cairns in a hill top location. Both of these cairns are well preserved and may still contain surviving burial deposits.

25.88 The setting of the burial mound on an elevated topographical position would have allowed for 360° views of the surrounding landscape. Key views from the burial mounds would have been to other funerary sites or settlement sites in the surrounding area, such as the Hill of Shebster chambered cairn, *c.* 750 m to the south and Glaodh Odhar cairn to the west.

25.89 The long cairns are set in a prominent topographic location that makes them a prominent feature on the skyline. The cairns are located within an area of prehistoric activity that is also within a more recent farming landscape that has seen little to no urban or industrial development (a Medium contribution of setting). As the Cnoc Freiceadain long cairns have a High Heritage Value and a Medium contribution of setting, the Scheduled funerary monument therefore has a High sensitivity to change.

25.90 Wireframes provided by the client shows that the wind turbines would be visible in their entirety (masts, nacelles and blades). Key views to the long cairns from other funerary monuments will not be affected by the Project. Key views from the long cairns to funerary monuments north west may be affected by the Project in the middle to far background. Therefore, the proposed wind farm would partly alter the baseline setting (from the mounds), defined as having a Medium Magnitude of Effect on setting. The resulting significance of impact on setting would be **Major** by matrix definition. However, because the effect is only in this quadrant, it might be considered that the change is material but partial, and therefore in reality more likely to be of **Moderate** significance.

Impact on the setting of Hill of Shebster chambered cairn (Index No. 476; ORCA No. 73)

25.91 The Hill of Shebster chambered cairn consists of a turf covered mound that has been heavily robbed out as well as having been mutilated by an excavation trench in the north east. The top of the cairn has been robbed out that revealed stone slabs that form the stalls of a gallery grave.

25.92 The Hill of Shebster cairn site is located within an area of prehistoric activity that is also located within a more recent framing landscape with little to no urban and industrial development (a Medium contribution of setting). As the chambered cairn has a High Heritage Value and a Medium contribution of setting, the Scheduled funerary monument therefore has a High sensitivity to change.

25.93 The key views to and from the cairn would have been to the surrounding funerary monuments of Cnoc Freiceadain long cairn to *c.* 750 m the north, as well as the numerous other cairn sites in the east and south. The entrance to the cairn is on the south east side of the mound. Key views upon entering the mound would have therefore been to the south west. Therefore, the offshore Project will slightly alter one aspect of the setting (from the entrance of the mound) that will not materially alter the baseline setting of the monument, defined as having a Low Magnitude of Effect on setting. The resulting impact on setting would be of **Minor** significance.

Impact on the setting of Green Tullochs broch and cairn (Index No. 554; ORCA No. 69)

25.94 These two Scheduled monuments are prominent grassy mounds located on the cliff top overlooking and visible from the North Atlantic/Pentland Firth. The cairn survives as a grass-covered mound at a height of 3 m. The adjacent broch (*c.* 117 m north east) also stands at 3 m high and survives as a grass-covered circular enclosure that has suffered from coastal erosion on the north side.

25.95 As previously mentioned, there are numerous brochs in Caithness and were deliberately sited in locations for defence or possibly prestige. Close to the Green Tullochs broch was the now destroyed broch at Crosskirk and one at Tulloch of Lybster that survives as a low grassy mound. The concentration of broch sites within the landscape immediately around the onshore site boundary indicates that this was an area of prehistoric activity and settlement.

25.96 The Green Tullochs cairn is thought to be a chambered cairn of Neolithic or possibly Early Bronze Age date. There are a number of cairn sites located across the coastal plain with a concentration of cairns at the Hill of Shebster to the south. Many of these cairn sites are located in elevated topographic positions with intervisiblity between these sites having an important role in their siting as well as an important social role.

25.97 Green Tullochs cairn and broch have a close physical association as well as having an association with similar monuments within the immediate vicinity that would make a critical contribution to the understanding and appreciation of the siting of these monuments. However, the Scheduled cairn and broch are located within an area that has seen some urban and industrial development, with the more recent housing and farm buildings as well as Forss Wind Farm and the Forss Technology and Business Park to the east (a Medium contribution of setting).

25.98 Wireframes provided by the client shows that the wind turbines would be visible in their entirety (masts, nacelles and blades). Key views to and from the broch would have been to other surrounding broch sites as well as to the coast. Key views to surrounding broch sites will not be affected by the proposed wind farm. Key views to the coast from the broch and the view from the broch to the cairn would partly alter the baseline setting of the monuments (a Moderate magnitude of effect on setting). The resulting significance of impact on setting would be **Major** by matrix definition. However, because the effect is only on some aspects of the setting, it might be considered that the change is material but partial, and therefore in reality more likely to be of **Moderate** significance.

Impact on the setting of Baligill Burn Limekilns (Index No. 4290; ORCA No. 76)

25.99 Baligill limekilns are thought to have been constructed in *c.* 1820 and *c.* 1870. The limekilns are set low down within the landscape and constructed against the surrounding raised topography, which has changed little since (a Medium contribution of setting). The key part of the setting of the limekilns is the immediate context, set down in a narrow valley adjacent to the rock outcrops quarried to provide the raw material. As the limekilns have a High Heritage Value and a Medium contribution of setting, the Scheduled site therefore has a High sensitivity to change.

25.100 The view on approach looking northwards towards the limekilns as well as looking out northwards from the kilns will be affected by the proposed offshore wind farm, with the turbines being theoretically visible; therefore having a detectable effect that does not alter the immediate context of the kilns which is the key factor in the baseline setting of the monument (a Low magnitude of effect on setting). The resulting significance of effect on setting would be of **Moderate** significance

Impact on the setting of Reay Parish church and enclosure wall, a Category A Listed Building (Index No. LB14992; ORCA No. 77)

25.101 The Category A Listed Building of Reay Parish church was constructed in 1739 on a T-plan with a bell tower at the eastern end. Later additions were added in 1909 and a Gothic window in 1933. The entrance to the church is on the south facing side with four windows on the south facing side, one window on the north elevation, a large Gothic window on the western elevation and an entrance on the eastern Bell tower.

25.102 As the entrance and windows of the Parish church are located on the southern elevation of the building, it is an indication that the exterior of the building was meant to be viewed from the south looking north. From inside the building, the views would have been outwards to the landscape further south.

25.103 Reay Parish church stands largely in isolation, with no immediate neighbouring buildings in any direction. It is located in a setting that makes a positive contribution to the understanding, appreciation of the siting of the church as well as its historical and architectural context (a Medium contribution of setting). As the church has a High Heritage Value and a Medium contribution of setting, the Category A Listed Parish church therefore has a High sensitivity to change.

25.104 Views from the church looking southward will not be affected by the Project. Views to the church looking north will be affected by the Project with the turbines being visible in some extent. Wireframes provided by the client show that in a worst case scenario the offshore wind turbines will be visible in their entirety. If the turbines were to be positioned in the north west or south west area of search, the turbine masts would be largely obstructed from view by the Fresgoe headland.

25.105 As the Project would be visible from the approaches to and main elevation of the Parish church, the Project would partly alter the setting of the church (a Moderate magnitude of effect on setting). The resulting impact on the setting would be of **Major** significance. However, the turbines would be almost 10 km distant and so the change could be acceptable.

Impact on the setting of Sandside House Kiln Barn and single storey range of former byres, cottage and dairy and implement shed, a Category A Listed Building (Index No. LB14986; ORCA No. 78) and the B-Listed Sandside House and Garden features (Index Nos. LB14984 and 14985; ORCA Nos. 83 and 84)

25.106 The Category A Listed Kiln Barn at Sandside House is of probable mid-18th century date. The byres, cottage and dairy are a long single storey range of buildings aligned north/south from the kiln barn south gable and are of probable late 18th to early 19th century date. The implement shed is of mid-19th century date. The kiln barn is in an L-shaped plan with long elevations facing east and west.

25.107 In the Scottish Highlands, prevailing winds usually dictate the site of barns with winnowing floors and vents being located at east and west. Key views of these farm buildings would have been to the surrounding land, the main house or other adjacent farm buildings.

25.108 The Sandside Estate also consists of the Category B Listed Sandside House and Garden walls, two walled gardens, a dovecote and privy. All of the Listed buildings within the Sandside Estate survive in a setting that has seen some more recent farming landscape as well as the construction of the Dounreay Nuclear Facility within the wider setting (a Medium contribution of setting). As the kiln barn and range of former byres, cottages, dairy and implement shed has a High Heritage Value and a Medium contribution of setting, the Category A range of buildings therefore have a High sensitivity to change. However, the Category B Listed Sandside House and walled garden, dovecot and privy have a Medium Heritage Value and a Medium contribution of setting the resulting sensitivity to change is moderate.

25.109 Key views from within the Sandside Estate would have been to other adjacent farm houses as well as to the main house itself. The key design axes of the estate grounds are east-west (as are the main house elevations and windows) and to the south. Wireframes provided by the client show that in a worst case scenario (the middle of the southern edge of the area of search in this instance) the offshore wind turbines will be visible in their entirety. However, if the offshore turbines were to be sited in the south east or north east corners, they would be largely obstructed from view by the headland, with the turbine blades still visible.

25.110 As the offshore wind turbines will be visible when looking out towards the Pentland Firth, the setting of the Sandside Estate is partly altered (a Moderate magnitude of effect on setting). The resulting significance of impact on the setting would by matrix definition be **Major** for the Category A Listed Buildings and **Moderate** for the Category B Listed Buildings. However, this effect is not to the key views or axes of the estate, or its relationship with any of the key aspects of the estate, and so the change could be considered acceptable.

Impact on the setting of Sandside Harbour 1 and 2, Sandside and Fishing Store, a Category A Listed Building (Index No. LB14988; ORCA No. 79)

25.111 The Category A Listed Sandside Harbour was constructed in *c.* 1830. The harbour was built by Major Innes of Sandside House for trade and fishing. The harbour is sheltered at the west by high ground and looks east over the Pentland Firth and Dounreay. Numbers 1 and 2 Sandside Harbour as well as the fishing store are contemporary with the harbour. Numbers 1 and 2 are two storey dwellings that were built against the bank with access from the east and west at first floor level. The fishing store was built in a similar style to 1 and 2. The harbour and the exterior of the surrounding buildings remain little changed throughout their history. These buildings survive within a setting that has seen some industrial development, with the construction of the Dounreay Nuclear Facility across Sandside Bay to the east (a Medium contribution of setting). As the harbour Numbers 1 and 2, and the fishing store have a High Heritage Value and a Medium contribution of setting, the Category A Listed buildings therefore have a High sensitivity to change.

25.112 Key views from the harbour would have been out towards the Pentland Firth and Dounreay. Key views from 1 and 2 Sandside as well as the fishing store would have been to the east, towards the eastern Pentland Firth and Sandside Bay, and to the surrounding countryside to the west, as indicated by the entrances and windows being on these elevations. Wireframes provided by the client shows that in a worst case scenario the offshore wind turbines will be visible in their entirety, not in these key sightlines, but in views to the harbour and the cottages from the south and the harbour walls. However, if the offshore turbines were to be sited in the north west or south west area of search they will be largely obstructed from view by the headland, with the blade tips still visible.

25.113 As the offshore wind turbines will be visible when looking out towards the Pentland Firth from the harbour as well as Numbers 1 and 2, the setting of the harbour, Numbers 1 and 2 and the fishing store are partly altered (a Moderate magnitude of effect on setting). The resulting significance of impact on the setting would be **Major**, but would not remove the understanding or appreciation of the reason and context for the harbour and associated buildings.

25.114 Impact on the setting of remaining designated sites within 10 km of the offshore Project

25.115 The remainder of the designated sites within the ZTV and 10 km search radius will have a low to negligible magnitude of effect on the setting of the receptor that results in a Minor-Negligible significance of impact on the setting.

25.116 The Category B Listed Reayburn House (ORCA No. 80) of early to mid-19th century date is a range of three houses, now one dwelling, set on a gentle slope from west to east. The main elevation of this dwelling house is on the south elevation, as indicated by the entrance and windows. Reayburn House is located in a setting that is located in an area of more modern housing as well as the Dounreay Nuclear Facility within the wider setting (a Medium contribution of setting). The Category B Listed Building has a Medium Heritage value and a Medium contribution of setting therefore having a Low sensitivity to change.

25.117 Views from Reayburn House looking southwards will not be affected by the Project. Views to Reayburn House looking north will be affected by the Project, partly altering the setting of the Listed dwelling (a Moderate magnitude of effect on setting). The resulting significance of impact on the setting of Reayburn House would be **Minor**.

25.118 The Scheduled Cnoc-na-h'Uiseig chambered cairn (ORCA No. 68) is located adjacent to the former airfield on the Dounreay Nuclear Power Plant thus having a Low contribution of setting. The proposed offshore wind turbines will also not materially alter the baseline setting of the designated chambered cairn. This results in a **Negligible** significance of impact on the setting. Similarly, St. Mary's Chapel and broch (ORCA No. 70), and Brims Castle (ORCA No. 71) are in a ruinous state and adjacent to more modern urban and industrial developments. Taking into account the current setting of these sites, the additional visibility of the proposed wind farm would not materially alter the baseline setting of the designated sites; resulting in a **Negligible** significance of impact on the setting.

25.119 The setting of Upper Dounreay steading (ORCA No. 87), has largely been altered by the construction of the Dounreay Nuclear Facility. Therefore, the proposed offshore wind farm will not materially alter the baseline of the Listed Building, resulting in a Negligible significance of impact on setting.

25.120 The Project has No magnitude of effect on the setting of the remainder of the designated sites, mostly due to these sites being obscured from view to the Project by woodland (Achvarasdal House broch and standing stones (ORCA No. 74 and 75), Forss House and Cottage (ORCA No. 85 and 90), or more modern housing developments and landscaping (Reay Village Market Cross (ORCA No. 82), Brackside Bridge and Smithy Cottage and Steading Range (ORCA No. 88 and 89)). The Cnoc Freiceadain stone rows (ORCA No. 72) are largely obscured from view by vegetation (peat and heather) and are standing at such a height (up to 0.6 m) that the Project would have **Negligible** impact on their baseline setting.

Table 25-187 Gazetteer of designated sites (scheduled monuments and listed buildings) identified within 10 km of the offshore site

ORCA Site No.	Site Name	Reference Number	Distance from site (minimum)	Heritage Value/Sensitivity[71]	Contribution of Setting[72]	Magnitude of Effect[73]	Sensitivity of Setting + Magnitude of Effect = Significance of Impact[74]
61	Cnoc Urray, broch 400 m NNE of Gunnscroft	SM564	7.14 km	High	Low	Low	Minor
62	Cnoc Stanger cairn, 730 m east of Sandside House	SM458	7.44 km	High	Low	Moderate	Moderate
63	Dounreay Castle	SM6401	6.58 km	High	Low	Low	Minor
64	Reay, burial ground, old church and cross slab 175 m east of Parish Church	SM615	8.06 km	High	High	Low	Moderate
65	Sandside House, Reay, two carved stones	SM616	7.47 km	High	Negligible	Negligible	Negligible
66	Achunabust broch	SM513	9.03 km	High	Low	Moderate	Minor
67	Cnoc Freiceadain long cairns	SM90078 also a Property in Care of Scottish	9.53 km	High	Medium	Moderate	Major

[71] Refer to Table 25.4 within ES

[72] Refer to Table 25.7 within ES

[73] Refer to Table 25.8 within ES

[74] Refer to Tables 25.9 & 25.10 within ES

ORCA Site No.	Site Name	Reference Number	Distance from site (minimum)	Heritage Value/Sensitivity[71]	Contribution of Setting[72]	Magnitude of Effect[73]	Sensitivity of Setting + Magnitude of Effect = Significance of Impact[74]
		Ministers					
68	Cnoc-na-h' Uieseig, chambered cairn	SM444	6.70 km	High	Low	Low	Negligible
69	Green Tullochs, broch and cairn 640 m NNW of Borrowston Mains	SM554	6.83 km	High	Medium	Moderate	Major
70	Crosskirk, St Mary's Chapel and broch S of Chapel Pool	SM90086	7.63 km	High	Low	Low	Negligible
71	Brims Castle	SM5510	9.34 km	High	Negligible	Low	Negligible
72	Cnoc Freiceadain, stone rows 640 m N of Upper Dounreay	SM2386	9.13 km	High	Medium	None	Negligible
73	Hill of Shebster, chambered cairn	SM476	10.04 km	High	Medium	Low	Minor
74	Achvarasdal House, broch	SM514	8.58 km	High	Medium	None	Negligible
75	Achvarasdal House, two standing stones	SM421	8.55 km	High	Medium	None	Negligible
76	Baligill Burn, limekilns	SM4290	7.5km	High	High	Low	Moderate
77	Reay Parish church and	Category A	8.00 km	High	Medium	Moderate	Major

ORCA Site No.	Site Name	Reference Number	Distance from site (minimum)	Heritage Value/Sensitivity[71]	Contribution of Setting[72]	Magnitude of Effect[73]	Sensitivity of Setting + Magnitude of Effect = Significance of Impact[74]
	enclosure wall	Listed Building: LB14992					
78	Sandside House Kiln Barn and single storey range of former byres, cottage and dairy, and implement shed	Category A Listed Building: LB14986	7.42 km	High	Medium	Moderate	Major
79	Sandside Harbour 1 and 2, Sandside and Fishing Store	Category A Listed Building: LB14988	6.63 km	High	Medium	Moderate	Major
80	Reayburn House, Reay Village	Category B Listed Building: LB17592	7.95 km	Medium	Low	Moderate	Minor
81	Reay Old Burial Ground	Category B Listed Building: LB14980	8.01 km	Medium	Medium	Low	Minor
82	Reay Village Market Cross adjacent to the Terrace, new Reay	Category B Listed Building: LB18831	8.13 km	Medium	Low	Low	Negligible
83	Sandside House	Category B Listed Building: LB14984	7.50 km	Medium	Medium	Moderate	Moderate

ORCA Site No.	Site Name	Reference Number	Distance from site (minimum)	Heritage Value/Sensitivity[71]	Contribution of Setting[72]	Magnitude of Effect[73]	Sensitivity of Setting + Magnitude of Effect = Significance of Impact[74]
84	Sandside House, Garden Walls, 2 Walled Gardens, Dovecote and Privy	Category B Listed Building: LB14985	7.43 km	Medium	Medium	Moderate	Moderate
85	Forss House	Category B Listed Building: LB14923	9.31 km	Medium	Medium	None	Negligible
86	Lybster Farm Steading	Category B Listed Building: LB14991	8.43 km	Medium	Medium	Negligible	Negligible
87	Upper Dounreay Farm Steading	Category B Listed Building: LB14989	8.16 km	Medium	Low	Low	Negligible
88	Brackside Bridge over Brackside-Sandside Burn, Reay Village	Category C(S) Listed Building: LB14981	8.06 km	Medium	Low	Low	Negligible
89	Smithy Cottage and Steading Range, Reay Village	Category C(S) Listed Building: LB14982	8.10 km	Medium	Low	Low	Negligible
90	Forss Cottage	Category C Listed Building: LB14924		Medium	Medium	None	Negligible

25.11 Mitigation Measures

25.121 Mitigation measures were developed by assessing a number of impacts likely from the Project that were considered to be significant by the criteria outlined in Section 25.8 above. Any direct impacts will only occur within the site boundary. Construction work associated within the export cables landfall area as well as the cable corridor from landfall to the substation and footprints for the substation building and any temporary laydown areas will have a direct impact on any potential archaeological remains. In contrast, the impact on setting of the historic resource is likely to occur across a much wider area, affecting a number of cultural heritage assets.

Project design mitigation

25.122 The final project design will have been prepared with the knowledge of known cultural heritage assets and their locations. This will inform the developer at the detail design stage so that known cultural heritage assets will be avoided by the export cable landfall area, cable routing, access roads, working areas, temporary laydown areas and the footprints of the substation building.

General mitigation

25.123 The developer will prepare a Construction Environmental Management Document (see Chapter 4: Project Description, Project Commitments GM2) that will include an historic environment section that provides the locations of all cultural heritage assets to avoid. A reporting protocol for the accidental discovery of cultural heritage assets should also be instated.

Specific mitigation

25.124 Mitigation measures are proposed to avoid, reduce, remedy and offset any impacts on cultural heritage by the proposed works. All such measures should conform to accepted professional standards and guidelines provided by the Chartered Institute for Archaeologists (CIfA) and The Highland Council. Table 25-14 lists the specific mitigation measures that are recommended for the proposed onshore works.

Table 25-14 Mitigation measures specific to the onshore historic environment

Reference	Title	Description
OACH01	Avoidance	It is best to manage the presence of cultural heritage assets by locating the Project footprints and export cables as well as the construction of building footprints and other infrastructure to avoid them. This strategy is best employed where it is easy to avoid the site with little or permanent infrastructures, for example construction laydown areas, to avoid known archaeological sites. The export cable landfall area should be routed to best avoid any known archaeological features. If avoidance of cultural heritage assets cannot be assured, then features should be recorded thus ensuring preservation by record.

Reference	Title	Description
OACH02	Archaeological Monitoring of Geotechnical Works	Archaeological monitoring will help to inform the presence and extent of any archaeological deposits or sites within the onshore site boundary. No archaeological monitoring is needed for the excavation of boreholes, if undertaken; however, an inspection of any geotechnical cores, as well as an assessment of the borehole logs should be undertaken by an archaeologist in order to determine if there is any potential archaeology present, if boreholes are used.
OACH03	Archaeological evaluation	Non-intrusive evaluation methods such as geophysical survey could be conducted in the onshore study area to help inform final location of the onshore elements and any groundbreaking works within this area. Depending on the results of any geophysical surveys conducted in the proposed landfall, substation and cable study area, intrusive evaluations may be required.
OACH04	Archaeological Watching Brief	This will be conducted during ground-breaking construction works if there is a significant potential for, but no conclusive proof of, archaeological remains, or as a precautionary measure if a site has been identified nearby. This work will allow for opportunity for appropriate recording and excavation of any unknown sub-surface archaeological features or those that cannot be avoided.

25.12 Residual Effects

Construction

25.125 There may be residual effects on any unknown sub-surface archaeological features that may be discovered during any watching brief required (see Table 25-16). In line with the requirements of National and Regional planning policy, any archaeological remains that are identified will be either preserved *in situ*, or excavated and recorded to a standard agreed with The Highland Council Archaeology Unit thereby resulting in preservation through recording.

Operational

25.126 Depending on the offshore turbine location, the residual indirect effects of the Project will vary. The worst case effects and impacts of the Project on the setting of cultural heritage assets is summarised in Table 25-13. The significance of many impacts is identified as Low or Negligible. The significance of some impacts are identified as Moderate (ORCA Nos. 62, 64, 76, 83 and 84) or Major (ORCA Nos. 67, 69, 77, 78, 79), using the process and significance matrix described in Section 25.8.

25.127 No mitigation measures are currently proposed for potentially significant effects on setting, because there are no High magnitude effects on setting that result in a total or major alteration to the baseline setting, and no effect fundamentally removes the understanding, appreciation or experience of the heritage asset to which the affected setting relates. The level of impact may therefore be considered acceptable.

Decommissioning

25.128 There will be no residual impacts from decommissioning the proposed works to cultural heritage assets or their setting, since no likely effects have been identified.

25.13 Cumulative effects

25.129 This section considers the magnitude of cumulative effects and significance of cumulative impacts of the offshore Project on the setting of cultural heritage assets on the Scottish Mainland. Wind farm developments on the Orkney Islands were not considered within the Cumulative Impact Assessment as they would not be visible due to the distance from the Mainland to the Orkney Isles closest wind energy development (*c.* 35 km to the north east).

25.130 Cumulative impacts on the setting of cultural heritage assets are derived from the combination of the overall impacts of a series of developments or from the combination of different environmental impacts. There are no agreed criteria or explicit guidance on a method for assessing potential cumulative effects on setting. However, the following guidance that refers to the key principles underlying the assessment of cumulative impacts was used as a basis for this assessment:

- Guidance for Assessment of Cumulative Impacts on the Historic Environment from Offshore Renewable Energy (Oxford Archaeology & George Lambrick Archaeology and Heritage from COWRIE Ltd, 2008);
- The Setting of Heritage Assets: Historic Environment Good Practice Advice in Planning 3 (Historic England 2015);
- Assessing the Cumulative Impacts of Onshore Wind Energy Developments (SNH 2012); and
- Guidelines for Landscape and Visual Assessment (Landscape Institute and Institute of Environmental Management and Assessment, 3rd edn, 2013).

25.131 A cumulative impact, for example, may result from different developments within a single view, or as seen when looking from different directions from a single viewpoint, or the sequential viewing of multiple developments when moving through the setting of one or more cultural heritage assets.

25.132 The significance of cumulative effects was assessed based on the heritage value of the cultural heritage asset (See Table 25-4) and the magnitude of impacts expected to occur within the setting. The magnitude of impacts was based on:

- The scale of change to the setting;
- Proximity of the proposed offshore Project to other wind farm developments within 10 km radius;
- Whether the Projects integrate or contrast within the existing landscape; and
- Whether the proposed offshore Project appears as an extension to another development or introduces a new aspect of the view.

25.133 The magnitude of cumulative effect on the setting of a cultural heritage asset was assessed using the criteria set out in Table 25-15.

Table 25-1885 Magnitude of cumulative effect

Magnitude of Effect	Criteria
High	The Project would be visually prominent along with other prominent wind farm developments within the setting/landscape. The Project severs last or key link between asset and original setting. Proposed Turbines and additional turbines visible in multiple directions creating a feeling of being surrounded, removing Sense of Place.
Moderate	The Project would add to the successive or simultaneous visibility of other wind farm developments making wind farm developments seem larger and more spread out within the landscape setting. The Project interrupts but does not sever links between asset and setting. Turbines would be visible in two directions with the Project in one of these views.
Low	The Project will not add to the successive visibility with other wind farm developments. The Project does not interrupt links between asset and setting. Turbines would be visible in only one direction with the Project in this view.
Negligible	The Project is the only one in the setting, thus no Cumulative Effect (although there may still be significant direct or indirect effects).

25.134 The significance of cumulative effect is then assessed by the matrix in Table 25-6.

25.135 All operational and consented wind farms as well as submitted wind farm applications within 10 km were included in the cumulative assessment and are listed in Appendix 25.1.

25.136 Table 25-16 provides a list of the nationally important designated cultural heritage assets within the 10 km Study Area and the number of other consented and in planning wind farms that are theoretically visible from each location. It should be noted that this represents the worst case scenario as in reality not all of these wind farms will be visible.

Table 25-1896 Designated cultural heritage assets located within the cumulative ZTV and the wind farms theoretically visible from them

Nationally important Cultural Heritage Asset	Name	Status
Cnoc Freiceadain long cairns (SM90078 and a Property in Care of Scottish Ministers)	Achlachan	Approved
	Achlachan 2	Approved
	Bad a Cheo	Approved
	Blackpark	Application
	Camster	Operational
	Causeymire	Operational
	Forss II	Operational
	Gaultiquoy	Approved
	Halsary	Approved
	Lochend	Application

Nationally important Cultural Heritage Asset	Name	Status
	Lower Thura	Application
	Lybster Road	Approved
	Seatter Farm	Application
	Strathy Forest	Application
	Strathy South	Application
	Tresdale	Application
	Weydale Farm	Approved
Hill of Shebster (SM476)	Achlachan	Approved
	Achlachan 2	Approved
	Bad a Cheo	Approved
	Blackpark	Application
	Causeymire	Operational
	Flexhill	Operational
	Forss II	Operational
	Gaultiquoy	Approved
	Halsary	Approved
	Lochend	Application
	Lower Thura	Application
	Lybster Road	Approved
	Seatter Farm	Application
	Tresdale	Application
	Wathegar I	Operational
	Wathegar II	Approved
	Weydale Farm	Approved

N.B. Lybster Road is visible from all onshore projects EXCEPT for Dounreay Castle, Reay Burial Ground, Baligill Burn limekilns and Reayburn House

Forss II is visible from all onshore projects EXCEPT for Baligill Burn limekilns and Reayburn House

25.137 The cumulative assessment of Cnoc Freiceadain long cairns (Index No. 90078) indicates that, in addition to the proposed wind farm, 17 other wind farms would be visible. Of these, three are currently operational (Table 25.16), seven have been granted planning permission and are likely to be constructed and the further seven are currently within the application stage of the process. The operational Forss II development is closest to the Scheduled Monument. Cnoc Freiceadain is a monument considered to be highly sensitive to change. The cumulative effect from the addition of the Project would add to the successive and simultaneous visibility of other wind farm developments, making wind farm development seem more spread out (a medium magnitude of effect on setting) within the landscape resulting in a **Major** cumulative impact on the setting of the Scheduled Monument. However, this may be considered acceptable since the effect of other operational and approved wind farms was considered to be acceptable by the statutory authorities.

25.138 From the Hill of Shebster chambered cairn (Index No. 476), analysis of the cumulative ZTV indicates that, in addition to the Project, 17 other wind farms would be potentially visible. Of these, four are currently operational (Table 25.16). In addition to the operational wind farms, eight have been granted planning permission and a further five are currently in the application process. The operational Forss II wind farm is closest to the designated chambered cairn site. The Hill of Shebster chambered cairn is a monument considered to be highly sensitive to change. The cumulative effect from the addition of the Project would add to the successive and simultaneous visibility of other wind farm developments, making wind farm development seem more spread out (a medium magnitude of effect on setting) within the landscape resulting in a **Major** cumulative impact on the setting of the Scheduled Monument. However, this may be considered acceptable since the effect of other operational and approved wind farms was considered to be acceptable by the statutory authorities.

25.139 Analysis of the cumulative ZTV indicates that the currently operational wind farm of Forss II is visible from all Scheduled Monuments and Listed Buildings within 10 km with the exception of Baligill Burn limekilns (Scheduled Monument Index No. 4290) and Reayburn House (Category B Listed Building, Index No. LB17592). The addition of the proposed Dounreay offshore wind farm will have turbines visible in two directions, with the Project in one of these views (a medium magnitude of effect on setting). This results in a **Moderate to Major** cumulative effect on the setting of designated Scheduled Monuments and Listed Buildings. However, this may be considered acceptable since the effect of other operational and approved wind farms was considered to be acceptable by the statutory authorities.

25.140 The approved wind farm project at Lybster Road, Forss is adjacent to the currently operational Forss II wind farm. Analysis of the cumulative ZTV indicates that the proposed wind turbine at Lybster Road will be visible from all Scheduled Monuments and Listed Buildings within 10 km with the exception of Dounreay Castle (Scheduled Monument Index No. 6401), Reay burial ground, old church and cross slab (Scheduled Monument Index No. 615 and Category B Listed Building Index No. LB14980), Baligill Burn limekilns (Scheduled Monument Index No. 4290) and Reayburn House (Category B Listed Building, Index No. LB17592). However, the addition of this wind farm will most likely appear as an extension to the operational Forss II wind farm and therefore will have no additional cumulative effect from that of Forss II and the Project.

25.14 Summary and Conclusions

- There are no Scheduled Monuments or Listed Buildings within the onshore site boundary, nor is it located within an area designated as a Conservation Area, or Garden and Designed Landscape, and there are no known battlegrounds on the site;
- Those cultural heritage assets within the onshore site boundary that can be avoided by the proposed construction of the onshore cable route and associated infrastructure will require no mitigation as they will be avoided and thus preserved *in situ*;
- There is a concentration of sites along the coastal margin of the onshore site boundary. One known non-designated site is located within the area of proposed Cable Corridor 1. No known cultural heritage assets were identified in Cable Corridor 2 or potential HDD compound or substation locations;
- If these known cultural heritage assets cannot be avoided during construction it is likely that they will require mitigation in the form of excavation and recording to a standard agreed with The Highland Council thereby resulting in preservation through recording;
- Excavation for the onshore export cable route, foundations for the substation, temporary work compounds as well as associated temporary laydown areas and access routes could

potentially damage any as yet unknown cultural heritage assets present within the footprint of the Project;

- It is suggested that archaeological evaluations are conducted prior to construction to reduce the risk of impacting unknown archaeology, with the possibility of instating an archaeological watching brief and/or reporting protocol for the accidental discovery of unknown remains during construction;
- In terms of setting, there may be a Major impact on the setting of five Listed Buildings or Scheduled Monuments and a Moderate impact on five more. However, it is considered that these impacts will not fundamentally remove the understanding, appreciation or experience of the heritage asset to which the affected setting relates; and
- The erection of a substation building adjacent to the Dounreay Nuclear Facility will have no impact on the setting of onshore cultural heritage assets.

Table 25-1907 Summary of direct residual impact

Impact	Heritage Value/Sensitivity	Sensitivity of Setting	Magnitude of Effect	Pre-Mitigation Significance	Mitigation	Residual Significance
Direct Impact on known archaeological features	Low to Negligible	N/A	Low to High	Uncertain to Major	Avoidance	Negligible
Damage to as yet unrecorded sub-surface features within the onshore site boundary	Unknown	N/A	Unknown	Negligible to Moderate	Preservation *in situ* or preservation through recording	Minor to Negligible

26 Air Quality

26.1 Introduction

26.1 This chapter describes the air quality and carbon baseline in the onshore Study Area. A discussion of the key sensitivities and potential air quality impacts arising from the development of the proposed Dounreay Trì Project (the 'Project') during the construction, operation and maintenance and decommissioning phases has been carried out and the findings are presented in this chapter. The mitigation measures which will be implemented to prevent, reduce or offset any potential adverse effects are described.

26.2 Onshore construction activities could give rise to local air quality impacts associated with dust especially in dry and windy conditions; traffic volumes associated with construction are such that associated local air quality effects have been scoped out. No localised offshore air quality effects have been identified and hence are not considered.

26.3 One of the main attractions of wind energy technology is fact that it is a sustainable source of power and does not give rise to emissions to air. There is a potential for a positive environmental effect with regard to carbon saving and avoidance of gaseous discharges associated with global climate change. However there will be a carbon cost of the development hence the carbon cost and savings are calculated to provide an understanding of the overall carbon balance of the Project.

26.2 Study Area

26.4 The local onshore air quality impacts are associated with dust. Dust effects are relatively localised, within 100 m of the source. The Study Area is therefore defined as being everything within 100 m of the potential dust sources. Dust sources include the onshore cable excavation, the access road, construction laydown area and the sub-station/ switch gear building earthworks.

26.5 At this point a defined cable route is not available and this will not be defined until later in the design process. An Onshore Area of Search has therefore been identified for the Project, a 100 m buffer has been utilised around the area of search to provide the Study Area as shown by the blue line in Figure 26-1.

26.6 Climate change issues associated with carbon dioxide are on a global scale, hence no specific study area has been defined.

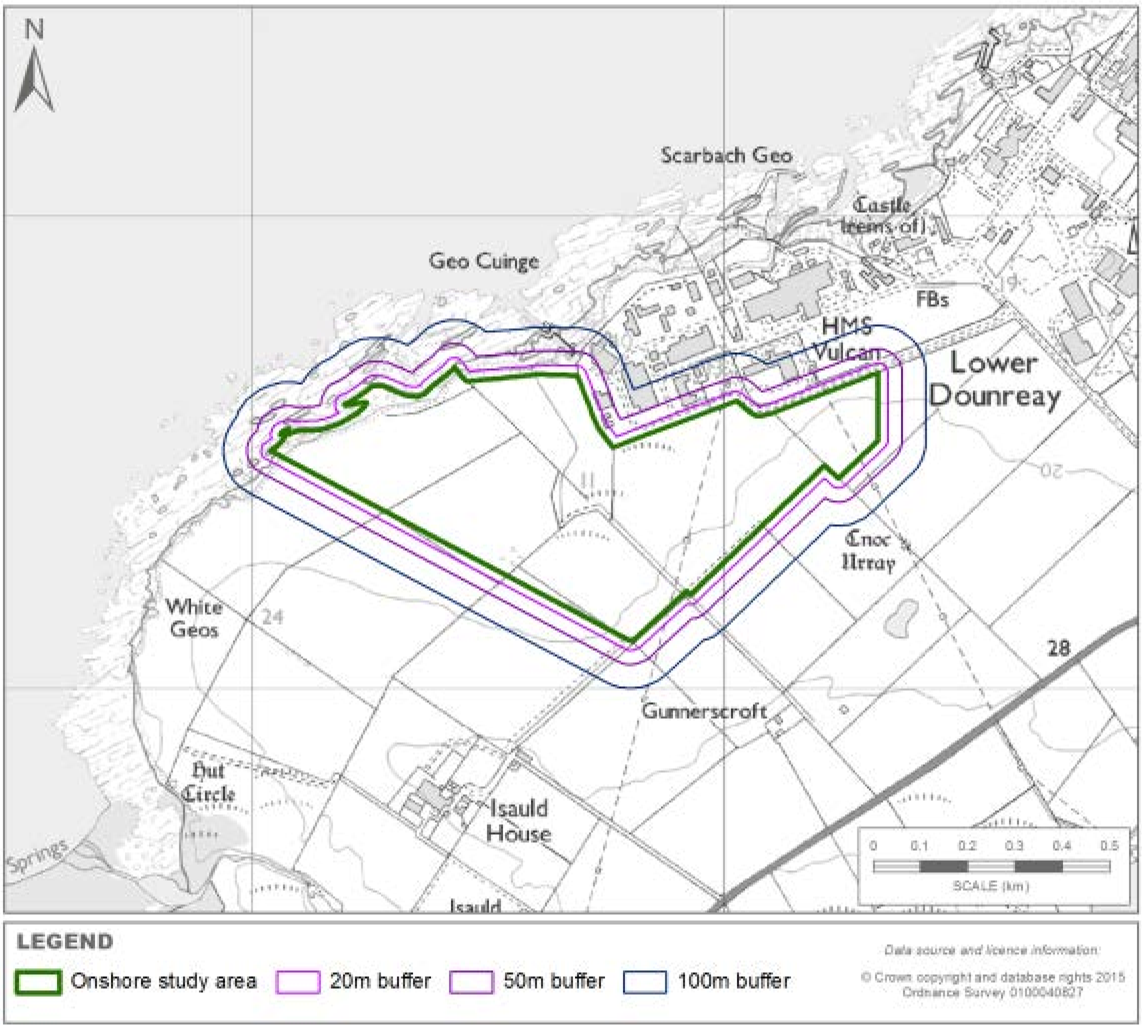

Figure 26-65 Air Quality Study Area

26.3 Legislation and Guidance

26.7 The offshore elements of the Project below the mean high water springs (MHWS) are within 12 nautical miles (nm) of the Scottish Coastline, hence they fall within the remit of the Marine (Scotland) Act 2010. The Scottish National Marine Plan (NMP) covering inshore waters was adopted earlier this year; this was as a requirement of the act. The NMP lays out Scottish Minister’s policies for the sustainable development of Scotland's seas (Scottish Government, 2015). The NMP provides General Planning Principles (GEN). GEN 14 is relevant to air quality:

- GEN 14 Air Quality: Development and use of the marine environment should not result in the deterioration of air quality and should not breach any statutory air quality limits.

26.8 Relevant methodologies for the assessment and monitoring of dust include:

- Assessment of dust from demolition and construction (IAQM, 2014); and
- Air Quality Monitoring in the Vicinity of Demolition and Construction Sites (Institute of Air Quality Management (IAQM), 2012).

26.9 Relevant guidance with regard to the control of air quality includes:

- Pollution Prevention Guidelines 6 (PPG6): Working at Construction and Demolition Sites (SEPA *et al*, 2012).

26.4 Sources of Information

26.10 The Highland Council carries out air quality monitoring throughout the area the most recent information published is 2013 Air Quality Progress Report (The Highland Council, 2013) this information has been reviewed.

26.11 In addition, the following information has also been referenced in the preparation of this assessment:

- Information from the Project team;
- 1: 25 000 Ordnance Survey (OS) map;
- Feedback from consultees (see Section 26.6); and
- UK-AIR Air Quality Information Resource (DEFRA, 2016).

26.5 Surveys and Studies Carried out to Date

Desktop Surveys

26.12 Sources of information used to inform the assessment are summarised in Section 26.6. In this section further context is provided.

26.13 A review of the most recent; 2013 Air Quality Progress Report (The Highland Council, 2013) has been undertaken identify if there are any Air Quality Management Areas in the vicinity of the Project or if there are any relevant monitoring data available.

26.14 A review of Ordnance Survey 1:25,000 and the maps of designated has been carried out to identify potentially vulnerable receptors to dust.

26.15 DSRL provided copies of their dust monitoring regime and its results and these have been reviewed to gain an understanding of dust baseline conditions in the area.

26.6 Consultation

26.16 The nuclear sites of Vulcan and Dounreay in the immediate vicinity of the onshore elements of the Project will be subject to air quality monitoring of their discharges. In addition due to recent construction activities Dounreay Site Restoration Ltd (DSRL) have carried dust monitoring in recent years installed around the site to measure dust levels. Information from the monitoring campaign was requested from DSRL, the data received is considered in Section 26.10.

Scoping responses

26.17 The following stakeholder responses have been received specifically relating to this chapter (Table 26-1) and acted upon where possible.

Table 26-191 Scoping Responses

Consultee	Comment	Relevance / Cross Reference
Scottish Government Planning and Architecture Division	The EIA should evaluate the potential for benefits associated with the Project, particularly in contributing to the decarbonisation of electricity generation through the long-term operation of the wind farms (i.e. displacement of non-renewable power generation.	A carbon calculation has been completed for the Project and is included within this chapter.

26.7 Assessment Methodology

26.18 The overarching approach to the environmental impact assessment is described in Chapter 5: Environmental Impact Assessment Methodology. To support this, the following is a description of the specific criteria which have been used to evaluate the impacts of the proposals on Air Quality. The methodology is based on the Institute of Air Quality Management (IAQM) guidance (IAQM 2012 and 2014).

26.19 The Project description is set out in Chapter 4: Project Description. Design assumptions about the Project envelope (the Design Envelope) are summarised in Section 26.7. Assumptions with regard to material requirements, their sources and delivery methods made to facilitate the carbon cost calculations these are included in Section 26.11.4.

Air Quality Design Envelope

26.20 As described in Chapter 5: Environmental Impact Assessment Methodology, the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor.

26.21 In the case of dust the cable route and sub-station/switch gear building footprint has the potential to cause the greatest impact as these determine the source of dust involved. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

26.22 For the carbon calculation estimates have been made of the material requirements and associated mileage; along with power production predictions. These are based on the best available information at the time of writing the chapter.

26.23 Table 26-2 describes the Design Envelope parameters specific to Air Quality. Chapter 4: Project Design provides further detail on the Project.

Table 26-192 Design Envelope Details

Design Envelope Parameter	Value/description
Total area of the onshore cable excavation.	3 m wide by up to 800 m long Area 2,400 m^2
Total area of onshore construction work area/laydown area	Area 1000 m^2. This will utilise existing hard standing area hence no earth works.
Total foundation footprint for the Sub-station/ switch gear building.	30 m x 17.5 m Area 525 m^2

Design Envelope Parameter	Value/description
Total volume of the sub-station/ switch gear building.	30 m x 17.5 m x 8 m Volume 4,200 m^3
Total area of new access road	300 m long x 5 m wide Area 1,500 m^2
HGV trips to site per day.	Maximum 30 HGVs trips, (60 movements) for 5 days.
Materials and Masses/ Volumes	16 x 30 tonne steel Anchors – 480 tonnes Platform Steel – 4,000 tonnes Concrete foundations assume 300 mm thick for footprint of laydown area and sub-station/switch gear building 457.5 m^3 of cement required.
The total number of TWh hours of power produced by the Project during operations.	Generation capacity of 8 MW – 12 MW turbines operational for 25 years assuming 93 % production rate. 1.63 TWh – 2.45 TWh of electricity produced.

Methods of Prediction

26.24 For dust, potential effects are identified and significance of impact is assessed for each stage of the Project lifecycle and significance attributed relative to the background conditions, utilising the IAQM Guidance.

26.25 For carbon the carbon cost of construction is calculated taking account of materials intrinsic carbon costs and carbon associated with transport requirements for the Project. Due to the lack of design and installation detail available at this time, the calculation is based on reasonable assumptions with a focus on the large carbon cost items to provide an understanding of the order of magnitude of the carbon cost.

26.26 The carbon savings associated with the operation and maintenance phase are predicted based on the predicted energy and converting to the carbon equivalent cost of the electricity being produced by a modern gas fired power station.

26.27 At the point of decommissioning there is an opportunity to recycle components which will in-turn give rise to a carbon saving when compared to the use of virgin materials, hence the benefit of this is also calculated.

26.28 All carbon calculations have utilised publically available carbon conversion figures. The costs and savings are combined to provide an understanding of the overall carbon impacts of the Project.

Magnitude of effect - dust

26.29 The definitions of effect magnitude for various dust emitting operations that may occur on a construction site provided in the IAQM Guidance (IAQM, 2014) will be utilised as outlined in Table 26-3.

Table 26-193 Magnitude of Potential Effect

Categories	Characteristic
Dust Emission Classes for Earthworks Activities	
High	Total site area >10,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry to due small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >8 m in height, total material moved >100,000 tonne.
Medium	Total site area 2,500 m^2 – 10,000 m^2, moderately dusty soil type (e.g. silt), 5-10 heavy earth moving vehicles active at any one time, formation of bunds 4 m – 8 m in height, total material moved 20,000 tonne – 100,000 tonne.
Low	Total site area <2,500 m^2, soil type with large grain size (e.g. sand), <5 heavy earth moving vehicles active at any one time, formation of bunds <4 m in height, total material moved <10,000 tonne, earthworks during wetter months
Dust Emissions Classes for Construction Activities	
High	Total building volume >100,000 m^3, piling, on site concrete batching; sandblasting
Medium	Total building volume 25,000 m^3 – 100,000 m^3, potentially dusty construction material (e.g. concrete), piling, on site concrete batching
Low	Total building volume <25,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber)
Dust Emissions Classes for Trackout[75]	
High	>100 HGV (>3.5 t) trips in any one day, potentially dusty surface material (e.g. high clay content), unpaved road length >100 m
Medium	25-100 HGV (>3.5 t) trips in any one day, moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m
Low	<25 HGV (>3.5 t) trips in any one day, surface material with low potential for dust release, unpaved road length <50 m

[75] Trackout is The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then resuspended by vehicles using the network. This arises when lorries leave the construction / demolition site with dusty materials, which may then spill onto the road, and/or when lorries transfer dust and dirt onto the road having travelled over muddy ground on site.

Vulnerability of Receptor

26.30 The sensitivity of various receptors to air pollution is determined by a number of factors including:

- Duration spent within the area, i.e. transient or constant presence;
- Sensitivity of receptor i.e. the very old or young or certain plant species; and
- Distance from the source.

26.31 Table 26-4 takes into account a range of factors based on the IAQM Guidance (2014) to define sensitivity of air quality receptors. IAQM guidance characterises vulnerability at the community level rather than at the individual level hence why vulnerability increases with increasing number of houses.

Table 26-194 Dust Vulnerability

Categories	Characteristic
High	Hospitals, Care homes, Schools within 100 m of source. >10 residences within 20 m of source. >10 residences within 50 m of source Areas of high level amenity where people will spend long periods of time e.g. museum. Long-term carparks Internationally designated sites where the qualifying feature may be sensitive to air pollution within 50 m. Nationally designated sites where the qualifying feature may be sensitive to air pollution (SSSI) within 20 m. Red Data list species within 50 m.
Medium	>10 residences within 50 m of source 2-10 residences within 20 m of source Non-residential properties were people are present for long periods of time e.g. offices within 20 m. Areas of amenity value where people may linger e.g. parks. Medium-term carparks. Nationally designated sites where the qualifying feature may be sensitive to air pollution (SSSI) within 50 m.
Low	1 residence within 20 m of source >10 residences within 100 m of source Transient exposure groups, people moving through an area i.e. footpaths. Short-term carparks Non-residential properties were people are present for long periods of time e.g. offices within 50 m. Locally designated sites where the qualifying feature may be sensitive to air pollution.

Significance of impact

26.32 Magnitude of effect is combined with vulnerability of the receptor to provide an indication of an overall significance of impact. The significance of impact has been determined taking account of these two factors using Table 26-5 and professional interpretation. No ‘negligible’ effects or receptor vulnerability are included as only effects on receptors within 100 m are considered and as such their vulnerability and effects are at least ‘Low’.

Table 26-195 Categorising Significance of Impact

Vulnerability of Receptor	Magnitude of Effect			
	Negligible	Low	Medium	High
Negligible	Negligible	Negligible	Minor	Minor
Low	Negligible	Minor	Minor	Moderate
Medium	Minor	Minor	Moderate	Major
High	Minor	Moderate	Major	Major

26.8 Description of the Current Environment

Desktop study results

26.33 The review of the 2013 Highland Council Air Quality Progress Report identified that there is only one area that, due to its current low air quality, has been identified as an Air Quality Management Area in the Highland Council Area and it is in Inverness City Centre approximately 160 km south of the proposed Project site. The Highland Council only have three automatic air quality monitoring sites; these are in Inverness, Fort William and Strath Viach. In 2012 an additional 10 non-automatic monitoring sites for nitrogen dioxide were incorporated utilising passive diffusion tubes in Inverness and Dingwall (The Highland Council, 2013). All of The Highland Council monitoring locations are too far from the proposed Project to be representative. However, the lack of monitoring would suggest that there are no air quality issues in the area.

26.34 A review of the 1:25,000 Ordnance Survey map of the Project area was used to identify receptors within the search area and close to the area. The findings are as summarised in Table 26-6.

Table 26-196 Receptors within the Study Area

Receptor Type	Within Search Area	Within 20 m of Search Area	Within 50 m of Search Area	Within 100 m of Search Area
Hospital, Care Homes, Schools	None	None	None	None
Residential properties	None	None	None	None
Non-residential Properties	None	HMS Vulcan 1 building (NC 9779 6655)	HMS Vulcan 3 buildings (NC9776 6661, NC9794 6661 & NC97760 66712)	HMS Vulcan multiple buildings (NC9784 6663)
Amenity Areas	None	None	None	None
Designated Sites	None	None	None	North Caithness Special Protection Area
Red Data List Species	Lapwing Skylark	None	None	None
Carparks	None	None	None	None

26.35 DSRL carried out dust monitoring to measure the potential for nuisance from dust generated by a number of construction projects. They used directional samplers and depositional samplers. These were analysed on a fortnightly basis for the duration of the construction projects. They found dust levels to be very weather dependant, more dust during periods of dry weather and dust movements in the direction of the wind (DSRL, 2011, 2012a &b).

26.36 In addition to construction dust sources, they identified the presence of 'background' dust sources namely, general traffic movement, agriculture and dust suspended from the surrounded land and carparks (DSRL, 2012a). The construction works are now complete and as such do not pose a source of cumulative effects. The carparks and DSRL associated traffic movements are predominantly to the east of the onshore works area, the wind is predominantly from the west and south and these background sources will be less of likely to give a source of background dust to receptors in the Study Area. Agricultural dust sources may however be a relevant existing source of dust which contributes toward the existing dust in air within the Study Area.

26.37 The geology of the area is discussed in Chapter 21: Geology and Hydrology, the superficial geology in the area includes:

- Natural sands;
- Sandy/silty clay (Glacial Till);
- Gravel;
- Topsoil;
- Soft Peat; and

- Sandy Gravel.

26.38 The actual materials encountered during excavations will depend on the final routing, however it is noted that the larger particle size materials (sand, gravel and peat) are less likely to give rise to dust. Clay based material is more likely to give rise to dust due to its small particle size.

Receptors not taken forward to the assessment phase

26.39 Non-residential properties greater than 50 m from the search area boundary are not considered further in the assessment as they will not be sensitive to dust (see Table 26-4). These are:

- HMS Vulcan multiple buildings (NC9784 6663).

Receptor sensitivity for consideration taken forward to the assessment phase

26.40 All the receptors identified in Table 26-6 have been considered as part of the impact assessment. The sensitivity for each receptor is provided in Table 26-7 using information in Table 26-4 and professional judgement to inform the assessment. It has been conservatively assumed that the dust source is the entire search area which is very pessimistic. Once the actual cable route and construction area has been confirmed it is likely that the number of vulnerable receptors will reduce.

Table 26-197 Receptor Vulnerability

Receptor	Vulnerability	Reason
HMS Vulcan 1 building (NC 9779 6655)	Medium	Non-residential property within 20 m of the search area boundary, use unknown but potential for people to be present for long periods.
HMS Vulcan 3 buildings (NC9976 6661, NC9794 6661 & NC97760 66712)	Low	Non-residential properties within 50 m of the search area boundary, with potential for people to be present for long periods of time.
North Caithness Special Protection Area	Low	International designation more than 50 m from the search area, designation for various birds (see Chapter 23 Terrestrial Ornithology for more information). Birds are not considered highly sensitive to dust hence vulnerability is medium not high.
Lapwing Skylark	Medium	Red Listed species within the search area, birds are not considered highly sensitive to dust effects.

26.9 Identification of Potential Impacts

26.41 The potential impacts associated with the various stages of the Project are considered, and overall impacts identified.

26.42 This section sets out the key potential effects of the proposals on air quality and presents an initial assessment of the effects including their predicted significance prior to mitigation.

Potential impacts in the construction phase

Dust

26.43 Construction of the substation/switch gear building and access road will include groundworks, aggregates and cements all of which can be sources of dust. Excavation works associated with the cable installation have the potential to give rise to dust impacts. The magnitude of the effects are provided in Table 26-8.

Table 26-198 Dust, Magnitude of Effects

Source	Magnitude of Effect	Reason
Onshore cable excavation works.	Low	2,400 m^2 of ground will be disturbed during the works, which is less than 2,500 m^2 and is defined as low as per Table 26-3.
Sub-station/ switch gear building earthworks for foundations.	Low	525 m^2 of ground to be disturbed, medium effect in accordance with Table 26-3.
Sub-station/ switch gear building construction works.	Low	Construction of a 4,200 m^3 building which is less than 25,000 m^3 and is defined as a low effect accordance with Table 26-3.
Ground works associated with the installation of a site access road.	Low	1,500 m^2 area likely to be disturbed during construction of the access road, which is less than 2,500 m^2 and is defined as low as per Table 26-3.
HGV trips to site per day.	Medium	Maximum of 30 vehicle return trips in one day contributing to trackout of dust and dirt onto the public road network, this is a medium effect (see Table 26-3).

26.44 The unmitigated impacts each of the dust sources could have on each of the receptors is provided in Table 26-11. At this point it has been pessimistically assumed that any of the activities could be carried out anywhere within the search area and as such could be at the closest point to each of the receptors, which will not be the case. Once the cable and access road routing and building and laydown areas have been fully defined it is highly likely that the unmitigated significance of impacts will reduce.

Carbon

26.45 There is a carbon cost of construction associated with materials utilised and their transport. The major contributors to carbon dioxide are identified and associated carbon dioxide equivalence (CO2e) calculated in Table 26-10. It should be noted that Table 26-10 is based on information available at this point in the design of the Project and as such provides only an indicative understanding of the carbon cost of construction.

Table 26-199 Worst Case Unmitigated Significance of Impact on each Receptor

Source		Onshore cable excavation works.	Sub-station/ switch gear building earthworks for foundations.	Sub-station/ switch gear building construction works.	Ground works associated with the installation of a site access road.	HGV trips to site per day.
Magnitude of Effect		Low	Low	Low	Low	Medium
Receptor	Vulnerability					
HMS Vulcan 1 building (NC 9779 6655)	Medium	Minor	Minor	Minor	Minor	Moderate
HMS Vulcan 3 buildings (NC9976 6661, NC9794 6661 & NC97760 66712)	Low	Minor	Minor	Minor	Minor	Minor
North Caithness Special Protection Area	Low	Minor	Minor	Minor	Minor	Minor
Lapwing Skylark	Medium	Minor	Minor	Minor	Minor	Moderate

Table 26-200 Construction Carbon Dioxide Equivalent Calculations

Source/material	Quantity	Assumption	Conversion Factor	CO2e (tonnes)
Concrete for building foundations.	457.5 m^3 1098 tonnes	Density of 2.4 tonnes/m^3	0.159 tonnes of CO_2e per tonne (Hammond et al, 2006)	174.6
Access Road Tarmac	1,500 m^2 of roads 450 m^3 of tarmac 900 tonnes	300 mm thick Density of 2 tonnes/m^3	0.050 tonnes of CO_2e per tonne (Tarmac, 2009)	45.0
Building Steel Rebar	572 tonnes	1.25 tonnes/m^3 of reinforced concrete volume (457.5 m^3)	1.37 tonnes of CO_2e per tonne (Hammond et al, 2006)	789.2
Building Primary Steel (Hot Rolled)	835 tonnes	Estimate based on scaling from similar buildings.	1.37 tonnes of CO_2e per tonne (Hammond et al, 2006)	1144.0
Purlins and sheeting rails (Cold Formed Steel)	13 tonnes	Estimate based on scaling from similar buildings.	1.10 tonnes of CO_2e per tonne (New Steel Construction, 2010)	14.3
HGV Movements	223 movements 5575 miles 557.5 gallons of diesel	Tarmac and Concrete in 6 m^3 Other materials in 20 tonne loads 25 miles per movement (average) Assume 10 mpg	11.8307 kg of CO_2e per gallon of diesel (DECC, 2015)	6.6
Site Machinery	Assume 15,000 hours 75,000 gallons of diesel	5 gallons of diesel an hour (average)	11.8307 kg of CO_2e per gallon of diesel (DECC, 2015)	887.3
Private Cars to and from the site.	18808 movements 188080 miles	10 miles per movement average 25 cars a day for 18 months with a 5 day working week.	0.31202 kg of CO_2e per mile (DECC, 2015)	5.9
Anchors Steel	480 tonnes	16 x 30 tonne steel Anchors	1.37 tonnes of CO_2e per tonne	657.6

Source/material	Quantity	Assumption	Conversion Factor	CO2e (tonnes)
			(Hammond et al, 2006)	
Platform Steel (Hot Rolled)	4,000 tonnes	Based on current design.	1.37 tonnes of CO_2e per tonne (Hammond et al, 2006)	5480.0
Anchor Handling Tug Supply (AHTS)	Approx. 900 hours 90,000 gallons of diesel	Assume average 100 gallons per hour of fuel. (300gph when steaming, 10-50gph when on site).	11.8307 kg of CO_2e per gallon of diesel (DECC, 2015)	1064.8
Dive Support Vessel	Approx. 300 hours 1,500 gallons of diesel	Assume 5 gallons per hour	11.8307 kg of CO_2e per gallon of diesel (DECC, 2015)	17.7
Cable laying vessel	Approx.170 hours 34,000 gallons	Assume average 200 gallons per hour of fuel	11.8307 kg of CO_2e per gallon of diesel (DECC, 2015)	402.2
Total				**10689.2**

Potential Impacts in the Operation and Maintenance Phase

Carbon

26.46 During operations the wind turbines will produce low carbon power, reducing the need for fossil fuel burning and hence provide a carbon saving. The generation capacity will be between 8 MW -12 MW, with an operational life expectancy of 25 years, assuming 93 % production rate, the total electricity produced will be between 1.63 TWh – 2.45 TWh of electricity.

26.47 Electricity produced from gas gives rise to 3.65 kg CO_2e/MWh (House of Parliament, 2011). Hence if it is assumed that the wind turbines replace electricity produced by natural gas then they will save between 5,949.5 tonnes and 8,942.5 tonnes of CO_2e.

26.48 Maintenance will require visits out to the site approximately 80 times a year assuming 8 hours on site per visit in a small vessel (utilising 5 gallons of fuel per hour), the CO_2e cost will be 37.9 tonnes per year, 946.5 tonnes over the lifetime of the wind turbines.

Potential Impacts in the Decommissioning Phase

Dust

26.49 As during construction there is a potential for dust to be created during the decommissioning of the sub-station/switch gear, especially if the floor is to be removed as it will need to be broken up. Similarly if the onshore cable is to be removed then the excavation of soil could give rise to dust.

Carbon

26.50 The carbon cost of decommissioning will primarily be associated with fuel for vehicle and vessel movements.

26.51 The recycling of materials could help to minimise the lifecycle carbon cost of the Project. Recycling one tonne of steel scrap saves 80 % of the CO_2 emissions produced when making steel from iron ore (Corus Steel 2007). The calculated CO_2e saving associated with recycling the main components at the point of decommissioning is provided in Table 26-11.

Table 26-201 Carbon Saving associated with Recycling Steel Work

Source/material	Construction CO_2e (tonnes) Cost	CO_2e Saving from Recycling
Building Steel Rebar	789.2	631.4
Building Primary Steel (Hot Rolled)	1144.0	915.2
Purlins and sheeting rails (Cold Formed Steel)	14.3	11.4
Anchors Steel	657.6	526.1
Platform Steel (Hot Rolled)	5480.0	4384.0
Total CO_2e Saving		**6468.08**

26.10 Mitigation Measures

Dust

26.52 A Dust Management Plan (DMP) will be developed and included within the Construction Environmental Management Document (see Chapter 4: Project Description, Project Commitments GM2). This will detail both the monitoring and mitigation strategies. The detail of the DMP will take account of best practice included within IAQM Guidance (2014) and Pollution Prevention Guidance (PPG) 6: Working at Construction and Demolition Sites (Scottish Environment Protection Agency, 2010).

26.53 Mitigation measures proposed for the cable route excavation include (Table 26-12):

Table 26-202 Mitigation Measures specific to the Cable Route

Mitigation Measures specific to the cable route		
Ref	**Title**	**Description**
AQ1	Construction Programme	Appropriate planning of construction works to minimise the number of times material is moved and the time material is stored and ground left bare
AQ2	Construction Environmental Management Document	Where practicable and volumes allow, dry materials will be covered
AQ3	Construction Environmental Management Document	Stored bulk materials will be kept moist to avoid dust arising. Mobile water bowsers or equivalent will be utilised in dry weather conditions to damp down potential dust sources and, where possible, they will utilise runoff water (grey water) gathered on the site
AQ4	Construction Environmental Management Document	As soon as the cable route has been infilled the soil will be seeded/planted, to bind the soils so they are no longer a source of dust

26.54 Mitigation measures for substation/switchgear foundations and building construction and the laydown area will include (Table 26-13):

Table 26-203 Mitigation Measures specific to substation and switch gear

Mitigation Measures specific to substation and switch gear		
Ref	**Title**	**Description**
AQ5	Construction Environmental Management Document	Top soil scrapped from the site to facilitate foundation construction will be taken away at the earliest opportunity if not required for use onsite, minimising the time unrequired material it will be stored onsite
AQ6	Construction Environmental Management Document	Building materials stored on site will be minimised where practicable, by utilising a just in time delivery system
AQ7	Construction Environmental Management Document	Aggregates will be stored in dedicated areas and not allowed to dry out, unless this is required for a particular process, in which case appropriate additional control measures such as covers will be used
AQ8	Construction Environmental Management Document	Bulk cement and other fine powder materials if required will be delivered in enclosed tankers and stored in silos with suitable emission control systems, to prevent escape of material and overfilling during delivery
AQ9	Construction Environmental Management Document	Smaller supplies of fine powder materials such as cement in bags will be sealed after use and stored appropriately to prevent dust
AQ10	Construction Environmental Management Document	If any rock is to be processed/crushed on site, then appropriate dust mitigation will be employed including dampening
AQ11	Construction Environmental Management Document	Any cutting, grinding or sawing equipment utilised will be used with a suitable dust suppression technique such as water sprays or localised extraction
AQ12	Construction Environmental Management Document	Good housekeeping across the site will be maintained

26.55 Mitigation measures to be employed during road construction (Table 26-14):

Table 26-204 Mitigation Measures specific to road construction

Mitigation Measures specific to road construction		
Ref	**Title**	**Description**
AQ13	Construction Environmental Management Document	Top soil scrapped from the road route to facilitate construction, not required for use onsite will be taken away at the earliest opportunity, minimising the time it will be stored onsite
AQ14	Construction Environmental	Top soil scrapped from the road route to facilitate construction required for verges etc, will be moved the

Mitigation Measures specific to road construction		
Ref	**Title**	**Description**
	Management Document	minimum number of times and seeded at the earliest opportunity
AQ15	Construction Programme	Good programming will ensure that the road is laid soon after the route is stripped, to minimise the time bare ground is exposed
AQ16	Construction Environmental Management Document	In periods of dry weather areas of exposed ground will be dampened utilising a mobile water bowser

26.56 Mitigation measures to avoid trackout from the site (Table 26-15):

Table 26-205 Mitigation Measures specific to road construction

Mitigation Measures specific to road construction		
Ref	**Title**	**Description**
AQ17	Construction Environmental Management Document	Water-assisted dust sweeper(s) will be utilised on the access and local roads to remove, as necessary, any material tracked out of the site
AQ18	Construction Environmental Management Document	Vehicles entering and leaving sites will be covered to prevent escape of materials during transport
AQ19	Construction Environmental Management Document	A wheel washing system with rumble grids to dislodge accumulated dust and mud prior to leaving the site, will be considered and installed if necessary
AQ20	Construction Environmental Management Document	Private cars routes will be established to avoid the need to drive through construction areas

26.57 A full monitoring plan will be developed taking account of the IAQM Guidance (IAQM, 2012) as part of the DMP, and it will include:

- Directional dust deposit gauges will be installed at least 2 weeks prior to construction works starting to gain an understanding of background dust levels;
- Directional dust deposit gauges will be utilised throughout the construction period, the frequency of change will be proportionate to the risk associated with onsite activities;
- Monitoring results will be reviewed to ensure that mitigation employed is effective and, if not, improvements made;
- Dust Audits will be undertaken by the Environmental Clerk of Works (ECoW). A checklist will be utilised to ensure all issues are covered and recorded. The audit will include: material storage status; use of dust covers by delivery vehicles; inspection of the access road and local roads; and looking for signs of surface soiling on surfaces around site. Dust audits will be carried out more frequently in periods of dry weather and when high risk materials (cement powder) are on site or high risk activities such as rock crushing are being carried out.

26.58 Mitigation measures for decommissioning will be identified at the time and be appropriate for the activities planned, however, it is likely to include similar techniques to that utilised during construction earthworks and construction.

Carbon

26.59 The design of the floating platform and anchoring system to minimise steel requirements and as such the embedded carbon cost is key to minimising the carbon cost of the Project. Constructing the Project efficiency minimising vessel movements will also help to reduce the carbon cost.

26.60 Construction site workers will be encouraged to car share or use organised company transport (minibuses) to reach site, thereby reducing private vehicle mileage and associated CO_2 emissions.

26.61 Maximising the turbine size and their availability will increase the carbon savings associated with the Project.

26.62 At the point of decommissioning the majority of components should be recycled, especially the steel. This will help to offset some of the carbon construction cost.

26.11 Residual Impacts

Dust

26.63 The creation of dust can be effectively mitigated by simple techniques, such as good material management, dampening and road sweeping. The mitigation identified in Section 26.12 will ensure that the magnitude of dust effects is negligible or low. Table 26-16 provides the residual significance of dust impacts taking account of mitigation measures. All impacts are negligible or minor which is not significant.

Table 26-206 Residual Impact

Source		Onshore cable excavation works.	Sub-station/ switch gear building earthworks for foundations.	Sub-station/ switch gear building construction works.	Ground works associated with the installation of a site access road.	HGV trips to site per day.
Magnitude of Effect		Negligible	Negligible	Negligible	Negligible	Low
Receptor	Vulnerability					
HMS Vulcan 1 building (NC 9779 6655)	Medium	Minor	Minor	Minor	Minor	Minor
HMS Vulcan 3 buildings (NC9976 6661, NC9794 6661 & NC97760 66712)	Low	Negligible	Negligible	Negligible	Negligible	Minor
North Caithness Special Protection Area	Low	Negligible	Negligible	Negligible	Negligible	Minor
Lapwing Skylark	Medium	Minor	Minor	Minor	Minor	Minor

Carbon

26.64 The overall calculated CO_2e of the Project is provided in Table 26-17.

Table 26-207 Life Cycle Carbon

Stage	Comment	CO_2e tonne
Construction		-10689.2
Operation	Maintenance	-946.5
Operation	Saving equated to natural gas power production 8-12 MW.	5,949.5 to 8942.5
Decommissioning	Recycling all steel work.	6468.08
Total CO_2e Balance		**781.88 to 3774.88**

26.65 The carbon calculations have utilised numerous assumptions, however they show that at this stage of the design the Project offers a carbon saving when compared to natural gas power production. This is a demonstrator project and if proven to be successful, the concept could be scaled up to produce more energy for lower carbon installation cost, thereby becoming a more carbon beneficial technology.

26.12 Summary

26.66 Unmitigated dust impacts range from minor to moderate significance due to the areas of land being disturbed and the vulnerability of the identified receptors, however with appropriate mitigation measures employed the residual impact significance are negligible or minor.

26.67 The Project provides an overall carbon saving and, as a demonstrator Project, could be important for the future of low carbon energy technologies.

26.68 It is important to understand, that this is a demonstrator and as such does not have benefits of scale, the long-term positives in terms of knowledge gained and data from monitoring a long term floating wind site in situ, will aid in ensuring future developments of this site further contribute towards a reduction in carbon emissions from in the fabrication and installation operations.

27 Landscape and Visual Effects

27.1 Introduction

27.1 This chapter describes the key sensitivities and potential changes to the physical and visual environment arising from the onshore aspects of the Dounreay Trì Project – the 'Project'. The receptors within this chapter are categorised in the following sections: Landscape; and Visual Amenity.

27.2 The chapter describes the areas of landscape and visual amenity of the local area, identifies what the likely effects on these resources will be, indicates measures to avoid, reduce, remedy or compensate for these effects and provides an assessment of the nature and significance of those effects. The effects studied involve both objective and subjective impacts such as changes in perception of the local landscape.

27.3 Landscape impacts are changes in the character and quality of the landscape as a result of a particular development. The process of landscape character assessment (LCA) is used to assess these changes to enable better planning, conservation, restoration, management and enhancement. LCA is based on the principle that all landscapes have a range of features and characteristics which not only give them their appearance, but also contribute to their wider character, for example through historical, artistic and social associations. In combination, these features and characteristics provide landscapes with their 'character' or 'distinctiveness'.

27.4 Visual impacts are a subset of landscape impacts. The assessment is a subjective process as it involves individual perception, aesthetic tastes and visual comprehension. It is possible, however, to bring objectivity to the assessment and treatment of visual impact by considering the factors which influence it, including height, colour, size and associations with nearby features, including, for example, the presence of rock outcrops and existing manmade features. These factors are ultimately influenced by meteorological, topographic position, season and observer characteristics.

27.5 Related issues including the effects on the setting of cultural heritage features are covered in Chapter 25: Onshore Archaeology and Cultural Heritage.

27.2 Study Area

27.6 A study area defined by a 10km radius from the outer edge of the Project site is proposed for the landscape and visual impact assessment (Appendix 27.1 and Figure 27-1). This will provide the focus for the assessment of potential landscape and visual effects and is in line with current EIA best practice including the guidance set out in the recently published Guidance on Landscape and Visual Impact Assessment Third Edition (GLVIA3) (Land Institute (LI) and Institute of Environmental Management and Assessment (IEMA), (LI and IEMA, 2013). The study area is not intended to identify the outer limit of visibility of the Project onshore infrastructure but to focus attention on where 'likely significant impacts' are liable to occur.

27.3 Guidance and Legislation

27.7 The following relevant guidance and legislation relating to Landscape and Visual Effects (LVIA) was used in the preparation of this chapter:

- "Offshore Renewables – guidance on assessing the impact on coastal landscape and seascape" (SNH 2012a);
- "Guidance for Landscape/Seascape Capacity for Aquaculture" (SNH 2008); and

- "Guidelines for Landscape and Visual Assessment 3rd Edition" Landscape Institute and Institute of Environmental Management and Assessment 2013 (GLVIA3).

27.4 Other Sources of Information

27.8 A detailed review was undertaken of the existing literature and data relating to LVIA and was used to give an overview of the existing environment. The major data sources used in the preparation of this chapter are listed below in Table 27-1.

Table 27-208 Key data sources

Source	Content
Caithness and Sutherland Landscape Character Assessment (SNH, 1998)	Landscape Character Areas (Caithness and Sutherland)
Assessment of Highland Special Landscape Areas (THC and SNH, 2014)	Special Landscape Areas Citations

27.9 In addition, the following documents have also been referenced in the preparation of this assessment:

- Information from the project team;
- 1: 50 000 Ordnance Survey (OS) map no. 11 Thurso and Dunbeath;
- 1: 25 000 OS map no. 451;
- Site visits by the team in October and November 2015;
- Feedback from consultees (see Section 27.6); and
- Desk based research including literature review.

27.5 Surveys and Studies Carried out to Date

Desktop surveys

27.10 Sources of information used to inform the assessment are summarised in Section 1.2. In this section further context is provided. Those surveys of the wider area and/or research studies relevant to this assessment include:

- Examination of Zones of Theoretical Visibility maps to 'scope out' receptors which will not be intervisible with the Project.

Field surveys

27.11 The following specific surveys have been undertaken and used to inform this assessment:

- Site visits during October, November and December 2015 and January and February 2016 to identify the visual amenity baseline.
- Site visits during October 2015 to February 2016 to assess the effects of the Project on the LVIA receptors.

27.6 Consultation

Pre-application consultation

27.12 Dounreay Trì Limited hosted a drop-in session to meet with key stakeholders on 2 February 2016 in Thurso for tourism and recreation, commercial fisheries, local industry and community interests. Feedback from consultees is summarised in Chapter 3: Site Selection and Engagement to Date.

Scoping feedback

27.13 The following stakeholder responses have been received specifically relating to this chapter (Table 27-2).

Table 27-209 Summary of Scoping responses

Consultee	Comment	Relevance / Cross Reference
SNH	Methodology to refer to 'Orkney and North Caithness Coastal Character Assessment'.	This document is not yet available.
SNH	Significant effects where a Major or Moderate impact has been assessed to be identified.	Acknowledged. Summarised in Table 27-14
SNH	To inform the consideration of viewpoint locations we request ZTV information in hard copy to a suitable scale, with and without viewpoint locations shown. It would also be useful to have existing and consented development indicated on one of these ZTV to inform the choice of cumulative viewpoints.	Acknowledged.
SNH	Impacts to wild land, in particular WLA 39 East Halladale Flows need to be considered. SNH assessment guidance for wild land is currently being reviewed and is due for publication later this year. Interim guidance is also available.	Acknowledged. Detailed in Table 27-10.
SNH	Cumulative Impact Assessment considerations need to be proportional, both in terms of the study area agreed and the developments to be included (including turbine numbers and heights). See 'Assessing the cumulative impact of onshore wind energy developments' for further guidance.	Acknowledged. Detailed in Section 27.14.

Consultee	Comment	Relevance / Cross Reference
SNH	We would expect any cumulative assessment to provide a robust assessment of cumulative impact, both with any offshore development and those onshore within the study area. Various scenarios of cumulative impacts (offshore, onshore, existing, consented and in planning) exist and should be clearly identified in the assessment of impacts.	Acknowledged. Detailed in Section 27.14.
SNH	Production of visualisations should follow SNH guidance Visual Representation of Wind Farms (December 2014).	Acknowledged. Detailed in Appendix 27.1 and Appendix 27.4
THC	Specific comments on the scoping report have not yet been provided by the Landscape Officer.	Noted.
THC	As outlined in the pre-app pack issued by THC in July 2015, the key issues in this case are the potential for significant adverse impacts on perception of key qualities of landscape character types, seascape character types, designated landscapes and local landscape character. The proposal is located within a sensitive setting, in close proximity to the coast and within relatively close proximity to locations including Farr Bay, Strathy Point and Portskerra Special Landscape Areas and East Halladale Flows are of designated Wild Land, and key tourist routes. This all needs to be addressed in the ES.	Acknowledged. Detailed in Table 27-8, Table 27-9, Table 27-10, Table 27-11 and Table 27-12

27.7 Assessment Methodology

27.14 The methodology for LVIA is contained in Appendix 27.1 and is summarised under 'Methods of Prediction' at Section 27.9) and is consistent with the guidance set out in GLVIA 3.

27.15 The project description is set out in Chapter 4: Project Description. Specific assumptions relevant to the assessment in this chapter relate to 'worst case scenario' and are as follows:

- Cable installation - trenching, horizontal directional drilling or pinning to an existing outfall - the total working width is estimated to be 20m;
- Construction period (cable installation) – 3 months;
- Substation - The entire footprint to the edge of the fence line is likely to be an area of approximately 50 m x 50 m (0.25 hectares). Maximum height – 8m;
- Construction period (substation) – 12 to 18 months.

LVIA design envelope

27.16 As described in Chapter 5: Environmental Impact Assessment Methodology, the Design Envelope approach has been adopted whereby each assessment is undertaken using the worst case scenario for that specific receptor. Specific and key assumptions relevant to the assessment in this LVIA chapter are:

- The footprint of the cable landfall, onshore cable and associated works (during construction and permanently);
- The potential length and route of the onshore cable; and
- The new substation footprint.

27.17 In the case of LVIA the proposed substation has the potential to cause the greatest landscape and visual effects; effects arising from cable installation will be of a temporary nature. To ensure the assessment adequately covers all potential variations in the design, the worst case scenario is assessed which ensures that all other variations within that maximum parameter are assessed by proxy.

27.18 Table 27-3 describes the Design Envelope parameters specific to LVIA.

Table 27-210 Design envelope parameters

Design Envelope Parameter	Value / Description
Largest substation site and any other permanent works (e.g. HDD compound if required)	The entire footprint to the edge of the fence line is likely to be an area of approximately 50 m x 50 m (0.25 hectares). The existing substation measured from satellite imagery is 30m by 17.5m
Longest potential cable trench route across agricultural land	The onshore cable will be installed in a trench along the cable route over a distance of up to 800m. The working width includes the corridor in which the access road, cable trench, excavated material, turf and any other equipment/machinery is placed. The access track would be temporarily fenced off to keep livestock out. It is expected that one cable will be installed in a single trench up to 3 m wide with an associated working corridor width of up to 20 m. This working width would encompass the cable trench, an access track and turf storage and fencing.
Longest potential cable trench route across agricultural land (and greatest construction period for cabling works)	The onshore cable will be installed in a trench along the cable route over a distance of up to 800m. The working width includes the corridor in which the access road, cable trench, excavated material, turf and any other equipment/machinery is placed. The access track would be temporarily fenced off to keep livestock out. It is expected that one cable will be installed in a single trench up to 3 m wide with an associated working corridor width of up to 20 m. This working width would encompass the cable trench, an access track and turf storage and fencing.

Conventional beach trenching for cable and joint transition bay	No trenching. HDD or cable pinning.

Methods of prediction

27.19 For LVIA potential effects are identified and their significance is assessed for each stage of the project lifecycle and significance attributed relative to the baseline conditions.

Sensitivity of receptors

Landscape Sensitivity to Change

27.20 The relative sensitivity of the landscape character within each character area is assessed first, in accordance with paragraph 3.26 of GLVIA and is specific to the proposed change and is assessed in terms of 2 sets of criteria: (GLVIA3):

- Susceptibility to the change; and
- Value of the receptor.

Sensitivity of visual receptors to change

27.21 All visual receptors are people. The relative sensitivity of the visual receptors is assessed first, in accordance with paragraph 3.26 of GLVIA, and is specific to the proposed change and is assessed in terms of two sets of criteria (GLVIA3):

- Susceptibility of visual receptors to the proposed change; and
- Value attached to views experienced by receptors.

Magnitude of change

Magnitude of Landscape Change

27.22 The magnitude of change to landscapes is assessed in terms of 3 sets of criteria: (GLVIA3) (refer to Appendix 27.1).

- Size or scale - the proportion of the landscape unit affected, the proportion of landscape elements affected, and the level of change to key landscape characteristics;
- Geographical extent – the numbers of Landscape Character Types (LCTs) affected, the area of the LCTs affected, the level of change to the site of the project onshore infrastructure and the immediate setting; and
- Duration and reversibility – the time period of the change and the degree of difficulty in returning the site to its original condition.

Magnitude of Change to Views and Visual Amenity

27.23 The magnitude of change to views and visual amenity experienced by the receptor is assessed in terms of 3 sets of criteria (GLVIA3):

- Size or scale – how dominant the Project will be in the view, the proportion of the Project which will be visible, the degree of contrast with the key visual characteristics of the view and whether or not the duration of the view is curtailed by physical parameters;

- Geographical extent – the angle of view to the Project in relation to the existing visual focus, the distance from the viewpoint to the Project, the proportion of the view occupied by the Project; and
- Duration and reversibility -– the time period of the change and the degree of difficulty in returning the view to its original condition.

Significance of effect

27.24 The sensitivity of the receptor and the magnitude of effect are combined to define the environmental consequence of the effect.

27.25 For the purposes of the LVIA methodology, the impact matrix is presented in Table 27-4 below.

Table 27-211 Determination of significance of impact

	Magnitude				
Sensitivity	**Major**	**Moderate**	**Minor**	**Negligible**	**Positive**
Very High	Major	Major	Moderate	Minor	Positive
High	Major	Major	Moderate	Minor	Positive
Medium	Major	Moderate	Minor	Negligible	Positive
Low	Moderate	Minor	Minor	Negligible	Positive

27.8 Description of the Current Environment

Landscape baseline

27.26 The landscape baseline is described in Appendix 27.2 and Landscape Character Types (LCTs) are illustrated on Figure 27-2. A total of 12 Landscape Character Types were identified. It should be noted that 5. Coniferous Woodland Plantation and 13. Inland Loch are not LCTs per se, but are land uses, and no descriptions are available for these. The numbering of the LCTs has been kept consistent with that used in the offshore assessment to avoid potential confusion.

5. Coniferous Woodland Plantation
7. Flat Peatland
10. High Cliffs and Sheltered Bays
13. Inland Loch
16. Long Beaches, Dunes and Links
19. Mixed Agriculture and Settlement
21. Moorland Slopes and Hills
22. Open Intensive Farmland
25. Small Farms and Crofts
26. Strath
27. Sweeping Moorland
28. Town

National Scenic Areas

27.27 There are no National Scenic Areas (NSAs) within, or partially the study area as shown on Figure 27-3.

Special Landscape Areas

27.28 There is one Special Landscape Area (SLA) partially within the study area as shown on Figure 27-3. This is described in the following extract from The Highland Council's Assessment of

Highland Special Landscape Areas report, 2011 (THC SLA Report). The full citation is contained in Appendix 27.3.

27.29 SLA No 3 – Farr Bay, Strathy and Portskerra is 46.75km^2 in extent and lies to the west of the Project more than 8 km distant. It lies partially (approximately 3km^2) within the 10km study area and is described in the following extract from THC SLA Report.

> *'This area is characterised by its dramatic, deeply indented coastline of rocky headlands and sheltered bays, backed by a colourful and diverse mosaic of moorland and crofting landscapes. Big skies, combined with the ever-changing effects of the northern coastal light, create the impression of great space and dynamism. Fine weather allows impressive and extensive views, including northwards across the sea to Orkney and along the coast to Cape Wrath and Dunnet Head.'*

27.30 The special qualities of Farr Bay, Strathy and Portskerra are identified as:

Dramatically Intricate Coastline and Forceful Sea

- This is a distinctive stretch of rocky coastline which is typically viewed from the cliff tops and enclosed sandy beaches or from the sea by passing vessels. It is deeply eroded by the sea to form a complex assemblage of headlands, cliffs, promontories, stacks, arches, caves and ravines which combine to form unique features along the coastal edge.
- This coast can be an awe-inspiring, particularly during extreme weather or heavy oceanic swells. Access to the cliffs and coastline is readily available and allows opportunities to experience the sea's force and scale at close proximity.
- By contrast the sandy bays which alternate with the harsher cliffs and headlands provide a more focussed and tranquil setting due to their low lying location and the shelter afforded by flanking cliffs.
- The lighthouse at Strathy Point is a popular attraction to visitors and is approached via the minor road which serves the string of crofts and houses along the eastern side of the promontory.
- Traditional netting stations now largely abandoned elsewhere in Highland are still notable around Strathy Point whilst the sheltered harbour at Portskerra is still well-used by local fishermen.

Moorland and Crofting Mosaic

- Rolling landforms trending towards the coast and opening out over bays provide a distinctive contrast of sequential views and experience of the landscape - enclosed or exposed, framed or open, intimate or expansive.
- There is a rich tapestry of moorland and crofting settlements with the pattern of buildings and various land cover creating a diverse mix of colour, texture, and form.

Big Skies and Extensive Views

- There is a distinct perception and experience of immense space and dynamism, strongly influenced by the combination of big skies, and the distinctive coastal light, and the constantly changing influence of the weather. Fine conditions allow impressive and extensive views to Orkney and along the coast to Cape Wrath and Dunnet Head while in contrast poor weather restricts views and highlights the sense of remoteness of the landscape. The buildings and structures at Dounreay form prominent features in views from Strathy Point.

Historical Dimension

- The remains of Borve Castle situated on a natural promontory with a defensive bank built across the neck and with some ramparts and some masonry from the keep walls still visible, is one of the few surviving medieval (c.16th-17th century) defended promontory forts in this part of the north coast.

Gardens and Designed Landscapes

27.31 An Inventory of Gardens and Designed Landscapes (GDLs) in Scotland identifies, in five volumes, specific gardens and designed landscapes of importance in terms of their artistic, historical, architectural, scenic and nature conservation value. Additional volumes identify Candidate Sites, which are considered worthy of inclusion in the Inventory. Planning policies generally provide a framework for the continued protection, conservation and use of these areas that does not prejudice their scenic or cultural value in accordance with national policy. Historic Scotland also provides a wide range of web-based information on these sites which has been used to establish the current baseline information on which to undertake the assessment of impact.

27.32 Reference to the Inventory confirms that no GDLs lie within the study area.

Wild Land Areas

27.33 Wild Land can be described as extensive areas where the quality of wildness is best expressed. Scottish Planning Policy 2014 states:

> *'200. Wild land character is displayed in some of Scotland's remoter upland, mountain and coastal areas, which are very sensitive to any form of intrusive human activity and have little or no capacity to accept new development. Plans should identify and safeguard the character of areas of wild land as identified on the 2014 SNH map of wild land areas.'*
>
> *'215. In areas of wild land (see paragraph 200), development may be appropriate in some circumstances. Further consideration will be required to demonstrate that any significant effects on the qualities of these areas can be substantially overcome by siting, design or other mitigation.'*

27.34 SNH published a new map of wild land areas in June 2014. This supersedes earlier maps which identified 'Search areas for wild land' in 2002 and 'Core areas of wild land in 2013.

27.35 Wild land areas are the most extensive areas of high wildness. They are identified as nationally important in Scottish Planning Policy, but are not a statutory designation.

27.36 There is one Wild Land Area which lies partly within the study area as shown on Figure 27-3. At present there are no citations available for the Wild Land Areas.

WLA 39 – East Halladale Flows

27.37 This WLA which is lies to the south of the Project at a distance of between around 2 km and 10 km. It is approximately 159 km^2 in extent with around 56km^2 lying within the Study Area. The 2012 mapping of relative wildness indicates the following:

- Remoteness from roads and ferries: generally high degree of wildness with areas of medium on the fringes;
- Ruggedness: generally low relative wildness with fragmented areas of high relative wildness in some glens and on some summits;
- Perceived naturalness: generally high relative wildness;

- Absence of modern artefacts: High relative wildness in the interior with medium relative wildness on the fringes; and
- Overall relative wildness: High relative wildness in the interior with medium relative wildness on the fringes

Visual amenity baseline

27.38 A total of six viewpoints were identified from examination of initial ZTVs. The locations of these are shown on Figure 27-4. These are numbered to correspond to the numbering in the offshore assessment to avoid potential confusion. Viewpoint 10 is an additional viewpoint assessed for the onshore development only. The baseline conditions for these are described in Table 27-5.

Table 27-212 Information about the Viewpoints

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for Selection	Description of Existing Visual Amenity
1	Ben Ratha	295438, 961157	251m	Hill Walkers	This viewpoint is located on the summit of the hill and is a view seen by hill walkers. The immediate foreground is occupied by gently undulating moorland vegetation which gives way to a mid-ground coastal shelf of mixed landuses including agricultural grazings, rough grassland, forestry and mixed woodland plantations, and scattered settlement. The buildings and structures at Dounreay are prominent features in views to the north-north east. The moving turbines at Forss, to the north east, are seen against a backcloth of the Pentland Firth while those at Baillie Hill, to the east-north east, are seen against a backcloth of mixed land use. In clear conditions, the island of Hoy can be seen across the Pentland Firth.
3	Portskerra / Melvich	287821, 966172	25m	Residents Visitors, tourists Local and regional road users on key coastal road A836 Representative of Farr Bay, Strathy Point and Portskerra SLA	This viewpoint is situated in the car park adjacent to the memorial on the minor road east of the settlement of Portskerra. It is a view seen by visitors and residents. The direction of view is north and east. The immediate foreground is occupied by the waters of Melvich Bay backed by cliffs and the promontory at Rubha an Tuir, and the sandy beach at the mouth of Halladale River. Just beyond the cliffs, Dounreay is clearly visible with a backcloth of rising grassland and moorland. Further along the coast, the existing turbines at Forss and Bailie Hill are visible. Dunnet head is visible in the distance and, in clear visibility conditions, the island of Hoy can be seen across the Pentland Firth.

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for Selection	Description of Existing Visual Amenity
4	Drum Holliston Car Park	293257, 964500	90m	Local and regional road users on key coastal road A836 Cyclists on NCR1	This location is adjacent to the car park at Drum Holliston Moss and is representative of the view seen by road users. The foreground of the view is occupied by moorland and rough grass enclosed by deer fencing. The localised area of high ground at Cnoc na Moine is a notable landform feature to the east. Localised high ground south of the road screens views of the coastline to the west. To the right of the view, wood pole mounted overhead lines run approximately parallel to the A836 and draw the eye towards the mixed woodland plantation and the settlement of Reay. Beyond this, the hinterland is characterised by rough grazings and moorland on gently rising terrain. On the coast, Dounreay is a prominent feature. Beyond Dounreay, the existing turbines at Forss are clearly visible on the skyline. Baillie Hill wind farm also forms a prominent feature on the skyline behind Hill of Shebster. Hoy is also visible in clear conditions.
5	Sandside Harbour Car Park	295750, 965904	10m	Residents Local road users Visitors, tourists	This viewpoint is located at the harbour car park on the minor road to Fresgoe and the pier at Sandside. The view is representative of that seen by residents and local road users to and from the pier, as well as tourists and visitors. Views to the north are generally curtailed by landform, by the presence of Reay Harbour and by its associated buildings. Views east across Sandside Bay to Dounreay and the settlement at Reay are bordered by the road as it follows the coastline. Man-made elements in the view include drystone walls, post and wire fences, telegraph poles, pylons and overhead lines, benches and signage, two domestic buildings in the foreground and a scattering of domestic and agricultural buildings in the distance. The power station at Dounreay and existing turbines are dominant elements. The island of Hoy forms a more distant focal point to the north east. The existing turbines at Forss are seen as a dispersed group of three overlapping turbines and Baillie Hill wind farm is also visible.

VP	Name	Approx. OS ref	Approx. Elevation	Key Reasons for Selection	Description of Existing Visual Amenity
6	St Mary's Chapel , Forss	02437, 970119	11m	Visitors, tourists	This location is on the footpath approaching the chapel from the east. This viewpoint offers a 360 degree panorama, for visitors to the chapel, which comprises the coast and seascape to the north and west, Crosskirk Bay and cliffs to the east with the cluster of dwellings and agricultural buildings around Crosskirk. A drystone wall snakes across the grassland to the south east. The existing wind turbines at Forss Technology Park are a less than 500 metres distant and dominate foreground views of the hinterland to the east and south. The Baillie Hill wind farm turbines are also seen in the mid ground of the view. Strathy Point and the peninsula to its south are prominent distant features to the west.
10	Dounreay Road End	990099, 966269	25m	Local road users Visitors, tourists	This viewpoint is located at the southern access to the Dounreay Establishment and the view is experienced by local road users, visitors and tourists as well as employees at Dounreay. The foreground of the view is occupied by agricultural fields bounded by post and wire fences with the large scale buildings ta Dounreay in the background partially obscuring views of the Pentland Firth. The overhead lines and lattice towers to the west of Dounreay are also prominent features in the view to the west and north west. Looking along the access road, there are some views of the Pentland Firth between the buildings and structures at Dounreay. Looking to the east south east, the moving turbines at Baillie Hill are prominent features in the view.

Sequential visual amenity baseline

27.39 A total of three routes were identified for the assessment of sequential visual effects as shown on Figure 27-5. The existing visual amenity of each of these is described below.

A897 Northbound (Achiemore to Melvich)

27.40 At Achiemore the road curves eastwards, and the valley sides become steeper, with occasional craggy outcrops, again restricting more distant views. North of the farm of Calgarry Beg the OHL leaves the strath at a new substation, to run north eastwards towards Dounreay. A small single turbine is visible near Loch Earacha, where views become focused along a canalised section of river towards the coast, with the Melvich Bay dune system and Bighouse now prominent. High ground to the east of the strath continues to restrict views eastwards until the junction with the A836 is reached.

A897 Southbound (Melvich to Archiemore)

27.41 This route would have no view of Project as road users travelling south would be heading away from the Project. The existing visual amenity is therefore not described.

A836 Eastbound (Melvich –Reay)

27.42 The A836 in this section is also part of National Cycle Route 1.

27.43 On the approach to Melvich the first panoramic views to the east render Dounreay, Baillie Hill wind farm, and beyond the Forss wind farm, briefly visible. Sparsely populated moorland continues after Melvich, while Dounreay and the Forss turbines direct travellers’ views along the coast when entering Caithness. Baillie Hill wind farm also directs views along the coast before guiding the eye to the southeast and south the closer to it one becomes. Views of the coast continue on the approach to Reay, where moorland starts to give way to areas of mixed farming. Dispersed woodland occasionally obstructs views of Dounreay. Both Dounreay and Forss Wind farm continue to be visually significant on the route between Reay and Borrowston Mains.

A836 Westbound (Forss to Melvich)

27.44 As the road descends to Bridge of Foss, dense woodland obscures views. The road rises again passing the Forss wind farm and technology park, where the Dounreay complex begins to dominate the coastal landscape. Baillie Hill wind farm also forms a prominent visual feature on the skyline to the south and southwest. The route descends gently to the junction with the minor road to Shebster and Westfield at Isauld, with views seaward towards Sandside Head, and continues through Reay where views seaward are typically obscured by woodland until reaching more open terrain at the access to Reay Golf Club. Further roadside buildings and woodland again obscure views to the north for a section extending to just beyond Sandside House. West of here, high ground intervenes between the road and the coast, and the road begins to climb towards the bend and viewpoint at Drum Hollistan. Here oblique views eastward back along the coastline are possible, although these are partially obscured by a prominent knoll (spot height 101m). The route then traverses a section of more elevated open moorland, heading away from the Project, before descending to Melvich Bay.

27.45 West of Thurso the recycling centre draws attention, after which, an existing OHL leading from Dounreay draws the eye west. Undulating farmland continues in the foreground after Westfield, while large scale forestry is visible in the distance to the south. On passing Shebster, Dounreay becomes visually significant, while the existing OHL becomes more and more prominent as it draws nearer before heading back to Dounreay. The NCR 1 continues to the west where the landscape changes to moorland and open peatland with rocky outcrops and seaward views, before joining the A836 at Isauld.

NCR 1 Eastbound (Isauld/Sandside bay to Thusater Farm)

27.46 On the approach to Melvich the first panoramic views to the east render Dounreay, Baillie Hill wind farm, and beyond the Forss wind farm, briefly visible. Sparsely populated moorland continues after Melvich, while Dounreay and the Forss turbines direct travellers' views along the coast when entering Caithness. Baillie Hill wind farm also directs views along the coast before guiding the eye to the southeast and south the closer to it one becomes. Views of the coast continue on the approach to Reay, where moorland starts to give way to areas of mixed farming. Thereafter there would be no views of the Project as cyclists would be travelling away from the Project.

27.9 Summary of Specifics Not Taken Forward to the Assessment Phase

27.47 The following receptors have not been taken forward to the assessment phase for the reasons set out in Table 27-6 below:

Table 27-213 Receptors scoped out of the assessment

Receptor	Reason not taken forward to the assessment phase
LCT 5. Coniferous Woodland	This is a landcover/landuse rather than a LCT – although the bare ground ZTV indicates theoretical visibility, there would be no visibility from within the plantation.
LCT 7. Flat Peatland	No theoretical visibility.
LCT 13. Inland Loch	This is a landcover/landuse rather than a LCT – no theoretical visibility.
LCT 26. Strath	No theoretical visibility.
LCT 28. Town	No theoretical visibility.
Viewpoint 5 – Sandside harbour	No theoretical visibility (ZTV produced during the design iteration)
Viewpoint 6- St Mary's Chapel, Forss	No theoretical visibility (ZTV produced during the design iteration)
A897 North Bound	No theoretical visibility.
A897 Southbound	Heading away from the Project/no theoretical visibility.

27.10 Summary of Specifics Taken Forward to the Assessment Phase

27.48 The following receptors have been taken forward to the assessment phase:

- LCT10 – High Cliffs and Sheltered bays;
- LCT16 – Long beaches, dunes and links;
- LCT19 – Mixed agriculture and Settlement;
- LCT21 - Moorland Slopes and Hills;
- LCT22 - Open Intensive Farmland;
- LCT25 – Small Farms and Crofts;
- LCT27 – Sweeping Moorland;
- SLA no 3 – Farr Bay, Strathy and Portskerra;
- WLA 39 – East Halladale Flows;

- VP1 - Ben Ratha;
- VP3 - Portskerra/Melvich;
- VP4 - Drum Holliston Car Park;
- VP10 - Dounreay Road End;
- A836 Eastbound (Melvich -Reay);
- A836 Westbound (Forss to Melvich); and
- NCR 1 West and Eastbound (Thusater Farm to Isauld/Sandside Bay).

27.11 Identification of Potential Effects

27.49 This section sets out the key potential effects of the onshore proposals on the landscape resource and visual amenity. Photomontanges are included in Appendix 27.4.

Potential effects on the landscape resource - Overview

27.50 The Project site straddles LCTs 16. Long Beaches, Dunes and Links, 19. Mixed Agricultural and Settlement, and 22. Open Intensive Farming.

Potential landscape effects in the construction phase

27.51 Changes would commence with the introduction of materials, labour force, vehicles and plant, and the establishment of construction compounds and site accommodation into a localised area where no such features or activity currently exist although there are similar features and activity nearby at the Dounreay Facility. These changes would be of a temporary nature.

27.52 The Project would result in direct temporary changes to the existing detailed landform character of the site during excavations for the substation platform, foundations and other works. Any permanent changes to the detailed landform character of the site would be of a relatively limited physical extent and would not change or adversely affect the landform character of the site, nor the overall landform pattern of the study area.

27.53 The Project would introduce a new section of access track into the site, although the overall length (approximately 0.8 km) of this would be very limited in the context of the extent of the study area.

27.54 The Project would result in the direct temporary loss of small areas of agricultural due to the introduction of construction compounds, lay-down areas etc. These would be reinstated to their existing condition on completion of the construction period, and would therefore have no effect on the overall land-use and landscape character of the study area. Construction effects associated with the substation would last between 12 and 18 months with those associated with the cable installation likely to be of 1-2 months' duration.

Potential landscape effects in the operation and maintenance phase

27.55 The Project would introduce one large-scale, man-made object comprising the substation building into the landscape of the study area, where currently there are similar and larger scale buildings and structures at the Dounreay Complex adjacent. The introduction of the Project would result in a change to the physical characteristics and appearance of approximately 0.25 Ha of the Project site and would result in direct and permanent changes to the existing landscape resource of the site.

27.56 Buildings would be clad in a pre-fabricated insulated metal panel and are proposed to be olive green in colour (RAL 6003), in order to assist in reducing their visual prominence in relation to the backcloth of buildings at Dounreay.

27.57 A direct permanent loss of a small area of agricultural land would result from the introduction of the substation platform and associated access track, although this would have no effect on the overall land use and landscape character of the wider study area.

Potential landscape effects in the decommissioning phase

27.58 Effects during decommissioning would be similar to those arising during the construction period with the landscape resource being returned to the baseline conditions.

Potential effects on visual amenity - overview

27.59 Although there is widespread visibility out to sea, the ZTV indicates relatively limited theoretical visibility from the surrounding landscape. There are concentrations of extensive theoretical visibility on the eastern half of the Project site and out to around 3km to the east and south east as far as Loch of Skail and Hill of Shebster. Further east, there is fragmented theoretical visibility from areas of high ground around Hill of Forss.

27.60 The ZTV indicates fragmented theoretical visibility to the south but this would be much reduced by the screening effects of the commercial forest at Milton Moss and would be limited to areas of high ground to the immediate south and within 2 km of the Project Site.

27.61 To the south west, there is a band of more or less continuous theoretical visibility from elevated areas to the west of Sandside Burn at Beinn Ràtha (251m AOD), Sean Airigh (231m AOD), Clachgeal Hill (219m AOD), and from Beinn Ruadh (185m AOD) and Cnoc na Tobaireach (201m AOD) further to the west. There are also distant elevated areas to the south with theoretical visibility at Mid Hill, Cnoc Maol Donn and Beinn nam Bad Mòr.

27.62 To the west, there is theoretical visibility from Sandside Head and areas to the north west and west of Reay including a stretch of the A836 to the east of Drum Hollistan Moss. Further west there is fragmented theoretical visibility around Rubha an Tuir and north and west of Portskerra.

27.63 The Project would be seen predominantly within expansive views along the coast and out to sea. Existing built development is concentrated predominantly at the adjacent Dounreay Facility immediately adjacent to the Project site, at Baillie Hill Wind Farm, some 3km to the east, and at Forss, some 4 km to the north east. There are settlements and scattered structures and buildings along the road network parallel to the coast. There are several overhead electricity lines within the Study Area.

27.64 The Project would be theoretically visible from less than 40.79 % (bare ground ZTV) of the study area; therefore its overall visual effect is likely to be relatively limited. Additionally, where the Project would be visible, many locations would not view it in its entirety, due to the intervening presence of buildings and structures, woodland and forestry, and localised landform features (39.74 % - 'with screening' ZTV), with many areas only having visibility of the building roof line.

Potential visual effects in the construction phase

27.65 Construction operations would introduce man-made elements and activities into existing views, where the Dounreay Facility, the operational wind farms at Forss and Baillie Hill, and overhead lines on steel lattice towers are currently seen.

27.66 Likely effects would be temporary lasting between 12 and 18 months.

Potential visual effects in the maintenance phase

27.67 The Project would introduce one building into a range of views which predominantly comprise expansive and extensive panoramas of a moorland and coastal landscape, containing large scale buildings and structures at Dounreay, wind turbines, overhead lines, and numerous scattered smaller-scale dwellings, farm steadings and outbuildings along the coastal strip.

Potential visual effects in the decommissioning phase

27.68 Effects during decommissioning would be similar to those arising during the construction period with the landscape resource and visual amenity being returned to the baseline conditions.

27.12 Mitigation Measures

27.69 This section describes the various mitigation proposals associated with the Project which aim to avoid or minimise significant adverse landscape and visual effects on the surrounding area, through the adoption of an integrated approach to the siting, layout and design of the Project. Table 27-7 outlines the various mitigation measures included within the design proposal as well as those related to the operation of the Project.

Table 27-214 Mitigation measures specific to LVIA

Mitigation Measures specific to LVIA		
Ref	**Title**	**Description**
LVIA1	Strategic site selection	The siting of the Project has, where feasible, been completed in accordance with the Horlock Rules to avoid or limit adverse landscape and visual effects.
LVIA2	Merging with surrounding Backdrop(s).	Buildings would be clad in a recessive material. The detailed colour selection would be agreed with the Planning Authority.
LVIA3	Reflect the surrounding level topography.	No introduction of screen mounds.
LVIA 4	Reflect the surrounding vegetation pattern.	No introduction of screen planting.

27.13 Residual Effects

27.70 This section describes the effects taking into account mitigation measures proposed.

Effects on the landscape resource

27.71 Table 27-8 describes the effects on Landscape Character Types.

Table 27-215 Effects on Landscape Character Types

LCT / Designation	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
10. High Cliffs and Sheltered Bays This LCT occupies less than 1 % of the study area. There are 3 incidences of this LCT at distances of: A: >8 km to the west; B: <1 km; and C: >7 km to the east.	**Sensitivity: Medium/High** **Susceptibility:** **A, B and C: High** High Quality and Condition **Value:** **A: High** Special Landscape Area **B and C: Medium** Locally valued	Construction	**Minor** **Size or scale: Minor** No direct changes. Key characteristics unaffected. Minor proportion (20 %) of LCT with views of cable installation and substation construction in the context of Dounreay and Baillie Hill wind farm. The Project construction will be a minor component of the view. **Geographical extent: Minor**. A and B will have oblique views eastwards along the coast. C will be unaffected. **Duration and reversibility: Minor** Short-term change to view (up to 18 months).	**Minor indirect** Note that this judgement does not accord with the matrix in Appendix 27.1 Table 5. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen in the context of Dounreay and Baillie Hill wind turbines when looking east along the coast. **The significance of the effect is Not Significant.**
		Operation	**Minor** **Size or scale: Minor** No direct changes. Key characteristics unaffected. Minor proportion (20 %) of LCT with views of the Project in the context of Dounreay and Baillie Hill wind farm. The Project will be a minor component of the view **Geographical Extent: Minor** A and B will have oblique views eastwards along the coast. C will be unaffected. This LCT covers less than 3 % of the Study Area. **Duration and Reversibility** Long-term change (25 years).	**Minor indirect** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen in the context of Dounreay and Baillie Hill wind turbines when looking east along the coast. **The significance of the effect is Not Significant.**

LCT / Designation	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
16. Long Beaches, Dunes and Links This LCT occupies less than 1 % of the study area. There are two incidence of this LCT at distances of: A: >8 km to the west; and B: immediately adjacent and overlapping to site.	**Sensitivity: High** **Susceptibility: High** High Quality and Condition **Value: High** Valued for natural heritage, recreational activity and cultural associations (SAMs and A,B and C listed buildings clustered around bays)	Construction	**Minor** **Size or scale: Minor** Small proportion of LCT affected. Landcover key characteristics over a small area changed during cable installation. Direct changes to the north east corner of this LCT during cable installation **Geographical Extent: Minor** One of two incidences of LCT affected. This LCT covers 1 % of the study area. **Duration and reversibility: Minor** Short-term change to view (up to 2 months).	**Moderate direct and indirect** **The significance of the effect is Significant.**
		Operation	There is no theoretical visibility of the Project from this LCT.	**None**
19. Mixed Agriculture and Settlement This LCT occupies approximately 18 % of the study area. There is one large incidence of this LCT which partially overlaps the site and extends to 10 km distant.	**Sensitivity: Medium** **Susceptibility: Medium** Moderate Quality and Condition **Value: Medium** Dominated by agricultural land uses and other man-modified land uses.	Construction	**Minor** **Size or scale: Minor** Direct change to a small proportion of this LCT in the north west corner. Key characteristics unaffected. Indirect change to approximately 12 % of this LCT with views at relatively close range (up to 2.5 km) and from areas of more distant high ground. **Geographical Extent: Minor** Small part of study area covered by this LCT affected. **Duration and Reversibility: Minor** Short-term change (up to 18 months)	**Minor direct and indirect** **The significance of the effect is Not Significant**

LCT / Designation	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
		Operation	**Minor** **Size or scale: Minor** No direct change. Key characteristics unaffected. Indirect change to a small proportion (12 %) of this LCT in the north west corner with views at relatively close range (up to 2.5 km) and from areas of more distant high ground in the context of Dounreay and Baillie Hill wind turbines. **Geographical Extent: Minor** Small part of study area covered by this LCT affected. This LCT covers just over 70 % of the study area. **Duration and Reversibility: Major** Long-term change (25 years)	**Minor indirect** **The significance of the effect is Not Significant**
21. Moorland Slopes and Hills This LCT occupies just over 1 % of the study area. There are two incidences of this LCT at distances of: A: >3 km to the south; and B: >9 km to the south.	**Sensitivity: High** **Susceptibility: High** High Quality and Condition **Value: Medium** Wild Land Area	Construction	**Minor** **Size or scale: Moderate** No direct changes. Key characteristics unaffected. Indirect changes due to theoretical visibility from areas of high ground (around 50 % of this LCT) at distanced of >3 km (area A) and >9 km (area B). **Geographical Extent: Minor** Both incidences of this LCT (which covers less than 5 % of the study area) affected with theoretical visibility at >3 km and >9 km. **Duration and Reversibility: Minor** Short-term change (up to 18 months)	**Minor indirect** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen at distances in excess of 3 km **The significance of the effect is Not Significant.**

LCT / Designation	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
		Operation	**Minor** **Size or scale: Moderate** No direct changes. Key characteristics unaffected. The substation element of the Project is theoretically visible from approximately half of this LCT. **Geographical Extent: Minor** Both incidences of this LCT affected (theoretical visibility from >3 km and >9 km) with theoretical visibility from approximately half of this LCT. The Project will be a minor component in the view and will be seen in the context of Dounreay. **Duration and Reversibility: Major** Long-term change (up to 25 years)	**Minor indirect** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen at distances in excess of 3 km **The significance of the effect is Not Significant.**
22. Open Intensive Farmland This LCT occupies just over 3 % of the study area. There are three incidences of this LCT at distances of: A: >immediately adjacent to the west; B: immediately adjacent to the north west and overlapping the site; and C: >6 km to the north east.	**Sensitivity: Medium/High** **Susceptibility:** **A, and C: High** High Quality and Condition **B: Medium** Moderate Quality and Condition **Value: Medium** Dominated by agricultural land uses and other man-modified land uses.	Construction	**Minor** **Size or scale: Moderate** Direct changes to a small portion of area B immediately to the south of Dounreay substation and part of cable route construction). Indirect changes to most of the south western portion of this area and to parts of area A. No changes to area C. **Geographical Extent: Minor** Small part of area B directly affected. Two of the 3 incidences of this LCT indirectly affected in the context of a backcloth / foreground of buildings and structures at Dounreay. **Duration and Reversibility: Minor** Short-term change (up to 18 months)	**Minor direct and indirect** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen in the context of Dounreay. **The significance of the effect is Not Significant.**

LCT / Designation	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
		Operation	**Moderate** **Size or scale: Moderate** Direct changes due to presence of permanent presence of the substation. Addition of man-made features adjacent to Dounreay. Theoretical visibility from approximately 30 % of this LCT. **Geographical Extent: Minor** Small part of area B directly affected immediately adjacent to Dounreay. Two of the 3 incidences of this LCT indirectly affected in the context of a back-cloth / foreground of buildings and structures at Dounreay. **Duration and Reversibility: Major** Long-terms change (25 years)	**Moderate direct and indirect** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen in the context of Dounreay. **The significance of the effect is Significant.**
25. Small Farms and Crofts This LCT occupies just over 2 % of the study area. There are three incidences of this LCT at distances of: A: >8 km to the west; B: >6 km to the south east; and C: >8 km to the south	**Sensitivity: Medium** Susceptibility: Medium Moderate Quality and Condition Value: Medium Dominated by agricultural land uses and other man-modified land uses.	Construction	**Negligible** **Size or scale: negligible** No direct changes. Very small proportion of the LCT indirectly affected **Geographical Extent: Negligible** Only one of three incidences affected (B and C unaffected). Area A with some easterly views in the context of Dounreay and at >8km distant. **Duration and Reversibility: Minor** Short-term change (up to 18 months)	**Negligible indirect** **The significance of the effect is Not Significant**

LCT / Designation	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
east.		Operation	**Negligible** **Size or scale: Negligible** No direct changes. Very small proportion of the LCT indirectly affected (approximately 2 %). **Geographical Extent: Negligible** Only one of three incidences affected (B and C unaffected). Area A with come easterly views in the context of Dounreay. **Duration and Reversibility: Major** Long-term change (25 years)	**Negligible indirect** **The significance of the effect is Not Significant**
27. Sweeping Moorland This LCT occupies just under 25 % of the study area. There are three incidences of this LCT at distances of: A: >7 km to the west; B: less than 1 km and up to 10 km to the west and south;	**Sensitivity: Medium/High** **Susceptibility: Medium/High** Moderate/High Quality and Condition Value: Medium/High Wild Land Area Presence of man modified land uses	Construction	**Minor** **Size or scale: Minor** No direct changes. Small proportion (13 %) of LCT affected **Geographical Extent: Minor** Theoretical visibility from Area A at >9km distant, Area B from areas of high ground at 1-8km distant and Area C at >3 km distant. No theoretical visibility from area D. **Duration and Reversibility: Minor** Short-term change (up to 18 months)	**Minor direct and indirect** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen in the context of Dounreay. **The significance of the effect is Not Significant.**

LCT / Designation	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
C: >3 km to the south east; and D >8 km to the south east.		Operation	**Minor** **Size or scale: Minor** No direct changes. Small proportion (13 %) of LCT affected. **Geographical Extent: Minor** Very limited theoretical visibility from Areas A and C (>9 km and > 3km distant) and from area B (1-8 km distant). **Duration and Reversibility: Minor** Short-term change (up to 18 months)	**Minor direct and indirect** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance together with the fact that the Project will be seen in the context of Dounreay. **The significance of the effect is Not Significant**

Effects on Special Landscape Areas

27.72 The Special Landscape Area 3: Farr Bay, Strathy and Portskerra is deemed to have a high sensitivity to change due to the fact that it is a landscape designated at regional level. The key sensitivities to change listed in the citation contained in Appendix 27.3 are as follows:

- Development on or near the exposed cliff top landscape could interrupt the linear nature and open views or compromise the intricate nature of the coast.
- Infrastructure within and around existing settlements (e.g. street lighting, kerbs, signs, pavements) could individually erode their inherently rural character and collectively have a widespread impact on the area.
- Visitor facilities, other than very low-key elements, within sheltered bays could erode the existing tranquillity and sense of remoteness.
- Tall vertical structures or large-scale buildings could be visible in views along the coast and could be inappropriate in scale in relation to the domestic scale of existing buildings and settlements.
- Marine developments could affect existing views from the coastal cliffs to an uninterrupted expanse of sea below.

27.73 The Project would not interrupt the linear nature and open views along the coast from this SLA as these are already interrupted by the buildings and structures at Dounreay. It would have no effect on the inherently rural character of settlements and, although theoretically visible, would be seen in the context of Dounreay.

27.74 It is concluded that the magnitude of landscape change for this SLA would be negligible during both construction and operation as the changes arising from the Project would not be discernible, would not affect the integrity of the SLA and would have an imperceptible change to the immediate setting.

27.75 On this basis, the effect of the Project on the SLA is considered to be negligible. While this judgement does not accord with the matrix in Appendix 27.1, Table F, the reason for this is that the magnitude of change is considered to be the primary determinant in this instance, with the long separation distance and small proportion of views affected being considered particularly important. **The significance of the effect is Not Significant**

27.76 The effects on the special qualities listed in the citation are assessed in Table 27-9 below.

Effects on Wild Land Areas

27.77 There is no citation available for Wild Land Area 39: East Halladale Flows. As the proposed Project will not be located within the WLA, there will be no physical effects. Perceptual effects are addresses in Table 27-10.

Residual effects on the visual amenity

27.78 Table 27-11 describes the effects on the viewpoints.

Table 27-216 Effects on Special Landscape Areas special qualities

Special Quality	Construction Effects	Operation Effects
Dramatically Intricate Coastline and Forceful Sea		
This is a distinctive stretch of rocky coastline which is typically viewed from the cliff tops and enclosed sandy beaches or from the sea by passing vessels. It is deeply eroded by the sea to form a complex assemblage of headlands, cliffs, promontories, stacks, arches, caves and ravines which combine to form unique features along the coastal edge.	The Project would have no direct effect on the physical features of this SLA. The Project would not be seen in simultaneous views from the cliffs, beaches or from the sea.	
This coast can be an awe-inspiring, particularly during extreme weather or heavy oceanic swells. Access to the cliffs and coast line is readily available and allows opportunities to experience the sea's force and scale at close proximity.	None	None
By contrast the sandy bays which alternate with the harsher cliffs and headlands provide a more focussed and tranquil setting due to their low lying location and the shelter afforded by flanking cliffs.	None	None
The lighthouse at Strathy is a popular attraction to visitors and is approached via the minor road which serves the string of crofts and houses along the eastern side of the promontory.	None	None
Traditional netting stations now largely abandoned elsewhere in Highland are still notable around Strathy Point whilst the sheltered harbour at Portskerra is still well-used by local fishermen.	None	None
Moorland and Crofting Mosaic		
Rolling landforms trending towards the coast and opening out over bays provide a distinctive contrast of sequential views and experience of the landscape - enclosed or exposed, framed or open, intimate or expansive.	None	None
There is a rich tapestry of moorland and crofting settlements with the pattern of buildings and various land cover creating a diverse mix of colour, texture, and form.	None	None
Big Skies and Extensive Views		
There is a distinct perception and experience of immense space and dynamism, strongly influenced by the combination of big skies, and the distinctive coastal light, and the constantly changing influence of the weather. Fine conditions	The Project while theoretically visible from around Portskerra would be seen at a distance approaching 10 km and in the context of the existing prominent features at Dounreay.	

Special Quality	Construction Effects	Operation Effects
allow impressive and extensive views to Orkney and along the coast to Cape Wrath and Dunnet Head while in contrast poor weather restricts views and highlights the sense of remoteness of the landscape. The buildings and structures at Dounreay form prominent features in views from Strathy Point.		
Historical Dimension		
The remains of Borve Castle situated on a natural promontory with a defensive bank built across the neck and with some ramparts and some masonry from the keep walls still visible, is one of the few surviving medieval (c.16th-17th century) defended promontory forts in this part of the north coast.	None	None

Table 27-217 Effects on Wild Land

Perceptual Responses - WLA39: East Halladale Flows					
Attributes	**A Sense of Sanctuary, Solitude or Refuge**	**Risk of Anxiety - Hazard**	**Arresting/Inspiring Qualities, Sense of Awe - Prospect**	**Physically Challenging**	**Significance of Effect**
Presence/ absence of Attribute at Baseline	Yes	Yes	Yes	Yes	
Magnitude of Change	Minor/Negligible The Project will introduce visibility of additional structures from areas of higher ground, from where the buildings and structures at Dounreay are already visible. Size or scale: Negligible The proportion of the WLA affected will be minor/negligible (c.11 % bare ground / c. 4 % with screening). The attribute will not be discernibly altered. Geographical Extent: Minor/Negligible Changes affecting a small geographical area (c.7 km^2) Indirect changes through visibility only Short to medium distance from affected parts of Designated Area to Project (c. 3-9 km).	No Change	Minor/Negligible The Project will introduce visibility of additional structures from areas of higher ground, from where the buildings and structures at Dounreay are already visible. Size or scale: Negligible The proportion of the WLA affected will be minor/negligible (c.11 % bare ground/c. 4 % with screening). The attribute will not be discernibly altered. Geographical Extent: Minor/Negligible Changes affecting a small geographical area (c.7 km^2) Indirect changes through visibility only Short to medium distance from affected parts of Designated Area to Project (c. 3 -9 km).	No change	Sensitivity: Very High Overall Magnitude: Minor/ Negligible Level of Effect: Minor **Not Significant**

Table 27-218 Effects Viewpoints

Viewpoint	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
1: Ben Ratha	**High** **Susceptibility: High.** The receptors are mainly visitors / tourists using the car park to access the coast, to enjoy an outdoor recreational experience, for whom the landscape / seascape setting is important. The view will also be seen by local residents using the minor road, for whom the views contribute to the landscape setting of the area. **Value: High** The viewpoint is within the Farr Bay, Strathy Point and Portskerra SLA, a landscape designated at regional level.	Construction	**Minor** **Size or scale: Minor** The Project will be a very minor component of the view; There will be no contrast and conflict with the key characteristics of the baseline view, including its dominant horizontality, and there are only favourable potential scale comparison issues as the construction operations would be views in the context of Dounreay. Receptors can experience the view from the summit, or on foot descending the hill, so that the duration of the view will not be curtailed by physical parameters. **Geographical extent: Minor**. The Project coincides to an extent with one of the focal points of the view, towards Dunnet Head. The distance from viewpoint to Project is short - medium (circa 5 km); and The Project will occupy only a small part of the view (less than 10 % of a 90° Field of View). **Duration and reversibility: Minor** Long-term change to view (18-24 months).	**Minor** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance, with the small proportion of the view affected and the context of the backcloth of existing buildings and structures at Dounreay being considered particularly important. **The significance of the effect is Not Significant**

Viewpoint	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
		Operation	**Minor** **Size or scale: Minor** The Project will be a very minor component of the view; There will be no contrast and conflict with the key characteristics of the baseline view, including its dominant horizontality, and the buildings and structures at Dounreay; and Receptors can experience the view while stationary from the summit, or on foot descending the hill, so that the duration of the view will not be curtailed by physical parameters. **Geographical extent: Negligible** The Project coincides to an extent with one of the focal points of the view, towards Dunnet Head in the context of Dounreay's buildings and structures. The distance from viewpoint to Project is short to medium (circa 5 km); and The Project will occupy only a very, very small part of the view (1.0 % of the 90° Field of View). **Duration and reversibility: Major:** Long-term change to view (25 years).	**Minor** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance, with the small proportion of the view affected and the context of the backcloth of existing buildings and structures at Dounreay being considered particularly important. **The significance of the effect is Not Significant**

Viewpoint	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
3. Portskerra/ Melvich	**High** **Susceptibility: High/ Medium** The receptors include visitors/ tourists using the car park to access the coast, for whom the landscape setting is important. The view will also be seen by local residents in Portskerra, for whom the views contribute to the landscape setting of the area. The susceptibility is somewhat reduced as the view is also representative of travellers on the A836. **Value: High** The viewpoint is within the Farr Bay, Strathy Point and Portskerra SLA, a landscape designated at regional level.	Construction	**Negligible** Changes would not be discernible at approximately 10 km with theoretical visibility of construction operations being limited to 0.4 % of a 90 degree panorama.	**Negligible** **The significance of the effect is Not Significant**
		Operation	**Negligible** Changes would not be discernible at approximately 10 km with theoretical visibility of the proposed Project being limited to 0.4 % of a 90 degree panorama.	**Negligible** **The significance of the effect is Not Significant**

Viewpoint	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
4: Drum Holliston Car Park	**Medium/High** **Susceptibility to proposed change: Medium/High** The majority of receptors of this view are local and regional road users on the A836/NCR. A proportion of the receptors will be visitors/tourists who may use the car park to stop briefly to enjoy the view. For these receptors the landscape setting is more important. A small proportion of the receptors will be cyclists on NCR 1, for whom susceptibility to change is regarded as Very High. **Value: Medium/High** Although this is not a recognised viewpoint marked on maps, there is some evidence of value placed on the view, in that the car park provides the opportunity to enjoy it; and The view is from a designated	Construction	**Minor** **Size or scale: Minor** Construction operations will be a minor component of the view and will be seen in the context of the Dounreay Complex and the moving turbines at Baillie Hill and Forss with overhead lines in the mid ground. Operations associated with the cable routes will be visible in the fields west of Dounreay. Operations associated with the substation will be seen backclothed by buildings and structures at Dounreay. For the majority of travellers, the time to absorb the view will be relatively short. A proportion of the receptors can experience the view while stationary within the car park, or on foot, so that the duration of the view will not be curtailed by physical parameters. **Geographical extent: Minor** The angle of view coincides with the focus of the view from the car park, which is located adjacent to the eastbound carriageway, with the view oriented towards the Project along the coastline to the east. The distance from viewpoint to Project is moderate (in excess of 3.8 km). The Project will occupy only a very small part of the view (approximately 10 % of the 90° Field of View) and progressive restoration of the cable trench would reduce the extents of visibility at any one time. **Duration and reversibility: Minor**	**Minor** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance, with the limited geographical extent being considered particularly important, together with the context of the buildings, structures and activity at Dounreay. **The significance of the effect is Not Significant**

Viewpoint	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
	tourist route (NCR 1).		Short-term change to view (12-18 months). Change with can be fully removed and reinstated.	
		Operation	**Minor** **Size or scale: Minor** The Project will be a minor component of the view. The Project is compatible with key visual characteristics of the baseline view in terms of composition, being situated close to the buildings and structures at Dounreay. The substation will be seen in the context of the moving wind turbines at Baillie Hill and Forss. For the majority of travellers, the time to absorb the view will be relatively short. A proportion of the receptors can experience the view while stationary within the car park, or on foot, so that the duration of the view will not be curtailed by	**Minor** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance, with the limited geographical extent being considered particularly important, together with the back clothing by structures and buildings at Dounreay. **The significance of the effect is**

Viewpoint	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
			physical parameters. **Geographical extent: Minor** The angle of view to the Project coincides with the focus of the view from the car park, which is located adjacent to the eastbound carriageway, with the view oriented away from the Project along the coastline to the east. The distance from viewpoint to Project is moderate (in excess of 5km km). The Project will occupy only a very small part of the view (approximately 1 % of the 90° Field of View) **Duration and reversibility: Major** Long-term change to view (25 years).	**Not Significant**
10: Dounreay Road End	**Medium/Low** **Susceptibility: Medium/Low** Travellers on the A836. People at work, whose attention may be focussed on their activity rather than an appreciation of the wider landscape; **Value: Medium** No evidence of value placed on the view.	Construction	**Minor** **Size or scale: Minor** The Project will be a minor component of the view. Construction activity associated with the substation would be visible but not the cable route. There will be no contrast or conflict with the characteristics of the baseline view which is dominated by the buildings and structures at Dounreay. **Geographical extent: Moderate/Minor** The distance from viewpoint to Project is short (<1 km); and The Project will occupy only a small part of the view (5 % of the 90° Field of View).	**Minor** **The significance of the effect is Not Significant**

Viewpoint	Sensitivity	Phase	Magnitude Of Visual Change	Determination of Likely Visual Effect
			Duration and reversibility: Minor Long-term change to view (19-24 months).	
		Operation	**Moderate/Minor** **Size or scale: Minor** The Project will be a minor component of the view. There will be no contrast or conflict with the characteristics of the baseline view which is dominated by the buildings and structures at Dounreay. **Geographical extent: Moderate/Minor** The distance from viewpoint to Project is short (<1km); and The Project will occupy only a small part of the view (<2% of the 90° Field of View). **Duration and reversibility: Major** Long-term change to view (25 years).	**Moderate/Minor** Note that this judgement does not accord with the matrix in Appendix 27.1, Table F. The reason for this is that the magnitude of change is considered to be the primary determinant in this instance, with the limited geographical extent being considered particularly important, together with the back clothing by structures and buildings at Dounreay. **The significance of the effect is Not Significant**

Sequential Effects

27.79 Road users are deemed to have a medium sensitivity to change. Users of National Cycle Routes are deemed to have a high sensitivity to change.

A836 Eastbound (Melvich - Reay)

27.80 The visual amenity on the approach to Drumholistan Moss will remain as existing. Between Drumholistan Moss and west Reay, the Proposed Project, including construction operations, would be likely to be seen more or less continuously from distances of between around 1-3 km. The magnitude of change would be minor as the Proposed Project would be a minor component in views, the duration transient in terms of the length of this route passing through the study area. It would be seen in the context of the Dounreay infrastructure and activity on that site and would be unlikely to be discernible from existing buildings, structures and associated activity. It would also be seen in the context of Baillie Hill and Forss wind farms. The resultant effect would be minor and not significant.

A836 Westbound (Reay to Melvich)

27.81 The visual amenity of this route would remain as existing until reaching the minor road to Achremie at which point the Proposed Project would be visible to the immediate south of the buildings and structures at Dounreay. Baillie Hill wind farm would remain a prominent visual feature on the skyline to the south and south west. On the gentle descent to the junction with the minor road to Shebster and Westfield at Isauld, with views seaward towards Sandside Head, construction operations would be visible in passing at just under 1 km to the north. Beyond this point, the road user would be heading away from the Proposed Project although construction works associated with cable installation would be visible until reaching Reay. The magnitude of change would be minor as the Proposed Project would be a minor component in the view with a backcloth of Dounreay and it is unlikely that it would be discernible from existing buildings and structures. The resultant effect would be minor and not significant.

NCR 1 Westbound (Thusater Farm to Isauld/Sandside Bay)

27.82 The Proposed Project would not be visible from the NCR until just west of Shebster where it would be briefly visible in the context of the OHL and Dounreay itself. West of Achnabust there would be another very short period of visibility beyond which point there would be no visibility. The magnitude of change is considered to be minor due to the fact that the Proposed Project would be a minor component in the view and seen fleetingly in the context of other buildings ad structures. The resultant effect would be minor and not significant.

NCR1 Eastbound (Isauld/Sandside Bay to Thusater Farm)

27.83 Views would be similar to those for the A836 described above. Although users of the NCR are considered to have a higher sensitivity to change than other road users, it is considered that the resultant effects would be minor adverse and significant due, in the main to the fact that the proposed Project would be seen with a backcloth of the existing buildings and structures at Dounreay.

Core Paths

27.84 There are 15 Core paths within the study area. These are deemed to have a high sensitivity to change. Table 27-12 described the effects of the proposed Project.

Table 27-219 Effects on Core Paths

Core Path	Phase	Magnitude Of Visual Change	Likely Visual Effect
CA09.01 - Westfield to Achnavast	Both	No Theoretical Visibility	None
CA09.02	Both	No Theoretical Visibility	None
CA 11,01 – Broubster Hill Area	Both	No Theoretical Visibility	None
CA 11.02 – Achvarsdal	Both	No Theoretical Visibility	None
CA 11.03 – Milton Moss	Both	No Theoretical Visibility	None
CA 11.04 – Sandside Head	Construction	**Minor** **Size or scale: Minor** The construction operations will be a minor component in the view. Project visible only when heading south and looking east **Geographical extent: Moderate** Short distance to Project >1 km. Occupying part of the view and only when heading south and looking east. Seen in the context of Dounreay. **Duration and reversibility: Major** Short-term change to view (18-24 months).	Minor
	Operation	**Minor** **Size or scale: Minor** The construction operations will be a minor component in the view. Project visible only when heading south and looking east	Minor

Core Path	Phase	Magnitude Of Visual Change	Likely Visual Effect
		Geographical extent: Moderate Short distance to Project >1 km. Occupying part of the view and only when heading south and looking east. Seen in the context of Dounreay. **Duration and reversibility: Major:** Long-term change to view (25 years).	
CA 11.05 - Achins	Construction	**Minor** **Size or scale: Minor** The construction operations will be a minor component in the view. Project visible only when heading north. Partially screened by buildings. **Geographical extent: Moderate** Short distance to Project >1 km. Occupying part of the view and only when heading north and looking north east. Seen in the context of Dounreay and buildings at Reay **Duration and reversibility: Major** Short-term change to view (18-24 months).	Minor
	Operation	No Theoretical Visibility	None
CA 11.06 - Reay	Construction	**Minor** **Size or scale: Minor** The construction operations will be a minor component in the view. Project visible only when heading east. Partially screened by buildings. **Geographical extent: Moderate** Short distance to Project >1 km. Occupying part of the view and only when heading east and looking north east. Seen in the context of Dounreay and buildings at Reay	Minor

Core Path	Phase	Magnitude Of Visual Change	Likely Visual Effect
		Duration and reversibility: Major Short-term change to view (18-24 months).	
	Operation	No Theoretical Visibility	None
CA 11.07 Dunes, Sandside Bay	Construction	**Moderate** **Size or scale: Minor** The construction operations will be a minor component in the view. Geographical extent: Moderate Short distance to Project >1 km. Occupying part of the view and only when and looking north east. Seen in the context of Dounreay and buildings at Reay Duration and reversibility: Major Short-term change to view (18-24 months).	Moderate
	Operation	No Theoretical Visibility	None
CA 11.08 – Reay to Sandside Bay	Construction	**Moderate** **Size or scale: Minor** The construction operations will be a minor component in the view. **Geographical extent: Moderate** Short distance to Project >1 km. Occupying part of the view and only when and looking north east. Seen in the context of Dounreay and buildings at Reay **Duration and reversibility: Major** Short-term change to view (18-24 months).	Moderate
	Operation	No Theoretical Visibility	None

Core Path	Phase	Magnitude Of Visual Change	Likely Visual Effect
CA 11.09 – Reay to Borlum House	Construction	**Minor** **Size or scale: Minor** The construction operations will be a minor component in the view. Project visible only when heading north. Partially screened by buildings. **Geographical extent: Moderate** Short distance to Project >1 km. Occupying part of the view and only when heading north and looking north east. Seen in the context of Dounreay and buildings at Reay **Duration and reversibility: Major** Short-term change to view (18-24 months).	Minor
	Operation	No Theoretical Visibility	None
CA 13.15 – Brims Castle	Both	No Theoretical Visibility	None
CA 13.16 – Bridge of Forss	Both	No Theoretical Visibility	None
CA 13.25 – St Mary's Well	Both	No Theoretical Visibility	None
CA 13.16 – Forss Wind farm	Both	No Theoretical Visibility	None

27.14 Cumulative Effects

27.85 Cumulative effects are the summation of effects which result from changes caused by the Proposed Project in conjunction with other reasonably foreseeable actions.

27.86 In determining other suitable developments to include within the cumulative impact assessment, consideration has been given to other proposed developments which are considered to represent the extent of landscape change which is likely to occur within the area surrounding the Proposed Project.

27.87 The list of projects to be included within the cumulative assessment is provided in Appendix 27.4 which also summarises the theoretical visibility of these other developments in relation to viewpoints 1, 4 and 10 which have been assessed as accruing more than negligible effects as a result of the Proposed Project.

27.88 Those developments with theoretical visibility are listed in Table 27-13 below:

Table 27-220 Cumulative Theoretical Visibility

Site Name	VP1	VP4	VP10
Operational Effects	Minor	Minor	Moderate/Minor
Approved Wind Turbines			
Berriedale	Suc c.60 km	Suc 60 km	x
Lybster Road	Sim c.11 km	Sim c.10 km	Suc 4 km
In Planning			
Strathy Forest	Suc c.15 km	x	x
Strathy South	Suc c.15 km	x	x
Other Developments in Planning/In preparation			
Dounreay Substation Extension	x	x	Sim <1 km
LT22 – Dounreay to Mybster 275 kV OHL	sim c.6 km	Suc c.5 km	Sim <1 km
Dounreay Trì Offshore	Sim c.5 km	Sim c.3.8 km	Sim
X = No theoretical visibility Grey = scoped out suc = Theoretical visibility in successive views with the Proposed Project sim = Theoretical visibility in simultaneous views with the Proposed Project			

27.89 Berriedale Wind Turbine has been scoped out due to the fact that the recommended ZTV for this size of development (67 m to blade tip) is 20 km beyond which distance significant effects are not likely to occur: the 20 km ZTV would not overlap with a 20 km ZTV for the Proposed Project.

27.90 Lybster Road, a single turbine proposal of 79 m to blade tip would be visible from each of the three view viewpoints. The addition of the Proposed Project is considered to be unlikely to result in significant cumulative effects greater than those assessed for it in isolation.

27.91 Strathy Forest and Strathy South Wind Farms would be visible in successive views from viewpoint 1. Given the scale of these developments in relation to the Proposed Project, it is considered that the addition of the Proposed Project would not give rise to any effects greater than those arising from either or both wind farms.

27.92 The Proposed Project would be visible from viewpoint 10 along with the Dounreay substation extension. Given the context of the baseline view with buildings and structures at the Dounreay facility, it is not considered that any significant cumulative effects would be likely to arise from the addition of the Proposed Project to the Dounreay substation extension.

27.93 The Proposed Project would be visible in conjunction with the proposed 275 kV OHL and associated lattice towers. The OHL will replace an existing OHL, albeit with taller towers, and it will be seen in the context of the buildings and structures at Dounreay. It is considered that the addition of the Proposed Project to the OHL will not be likely to give rise to any effects greater than those arising from the OHL for any of the three viewpoints.

27.94 The operational effects of the proposed Dounreay Offshore have been assessed as follows:

- Viewpoint 1 - Beinn Ratha: Minor/Moderate – **Not significant**
- Viewpoint 4 – Drum Hollistan Moss: Minor – **Not significant**
- Viewpoint 10 – not an offshore viewpoint but likely to be similar to viewpoint 2 – Portskerra/Melvich which is assessed and Minor/Moderate – **Not significant**.

27.95 Given the scale of the Proposed Project, its location immediately adjacent to the Dounreay facility and the levels of effects predicted for the offshore development, it is considered that the addition of the Proposed Project would be unlikely to result in effects:

- Greater than those arising from the offshore development for viewpoints 1 and 4; and
- Greater than those arising from either development in isolation for viewpoint 10.

27.96 There would therefore be no significant cumulative effects arising from the addition of the Proposed Project to any other development in isolation or in-combination.

27.15 Summary and Conclusions

Effects on the landscape resource

27.97 The Project will result in limited significant effects on the landscape resource as set out in Table 27-2.

Effects on the visual amenity

27.98 The Project will not result in any significant effects on people at static viewpoints or on roads or cycle routes. There will be significant temporary visual effects during installation of the cable route for people on the two core paths in immediate proximity to Sandside Bay.

Table 27-221 Summary of Significant Landscape and Visual Effects

Potential Effect	Sensitivity	Magnitude	Overall Significance
Construction			
Effects on LCT 16: Long Beaches, Dunes and Links during construction;	High	Minor	Moderate direct and indirect
Effect s on Core Path CA 11,07	High	Moderate	Moderate
Effects on Core Path CA 11.08	High	Moderate	Moderate
Operations and Maintenance			
Effects on LCT 22: Open Intensive Farmland	Medium / High	Moderate	Moderate direct and indirect
Decommissioning			
Effects on LCT 16: Long Beaches, Dunes and Links during construction;	High	Minor	Moderate direct and indirect

28 Mitigation and Summary of Residual Impacts - Onshore

28.1 Mitigation summary

28.1 The following mitigation summary should be read in conjunction with the embedded mitigation identified in Section 4.3.

Chapter 21: Geology and Hydrology

Ref	Title	Description
GH1	Ground contamination	A targeted intrusive ground investigation will be undertaken within the Project area to characterise ground conditions, including groundwater. This will inform the routeing of the cable and identify the most appropriate locations for the substation / switchgear. As part of this investigation, a programme of soil and groundwater sampling and monitoring will be undertaken to identify if existing ground and groundwater based contaminants are present and to assist in development of the detailed design of aspects such as surface and groundwater drainage. In the event that existing contaminants are identified, a Remedial Strategy will be prepared for agreement with the relevant authorities.
GH2	Best practice in pollution management	With specific reference to the SEPA 'Guidelines for Water Pollution Prevention from Civil Engineering Contracts' and 'Special Requirements', the Contractor will produce a Construction and Environmental Management Document (CEMD) which contains a construction method statement that includes: • a detailed breakdown of the phasing of construction activities; • a detailed plan showing the extent of permitted working areas and the routes of internal construction haul roads; • a pollution risk assessment of the site and the proposed activities; • identification of all water environment receptors that may be affected by the works and temporary discharge points to these water bodies; • planning and design of appropriate pollution control measures during earthworks and construction; • management of the pollution control system, including dewatering of excavations away from watercourses; • contingency planning and emergency procedures; and on-going monitoring of construction procedures to ensure management of risk is maintained.
GH3	Earth movement	All earth moving works or similar operations will be carried out in accordance with BSI Code of Practice for Earth Works BS6031:2009.

Ref	Title	Description
GH4	ollution management in wet weather	Site management will check the local weather forecast daily and prime all site staff to ensure that everyone is aware of their responsibilities to maintain the pollution control system during wet weather.
GH5	On-site drainage	Where topography dictates that working platforms are needed, these will be formed to ensure that surface water drains away from ditches on-site and watercourses/bodies in the vicinity including Burn of Isauld and Pentland Firth.
GH6	Best practice fuel storage	All fuel and other chemicals will be stored in accordance with best practice procedures, including in a designated fuelling site located at a safe distance from existing watercourses and in appropriate, impermeable, bunded containers/areas which will be defined within the CEMP. These will be designed to capture any leakage, whether from a tank or from associated equipment such as filling and off-take points, sighting gauges etc., all of which will be located within the bund.
GH7	Emergency pollution control	Oil booms and soakage pads will be maintained in all work areas and spill kits kept in all vehicles to enable a rapid and effective response to any accidental spillage or discharge. All construction staff will be trained in the effective use of this equipment.
GH8	Vehicle maintenance	Construction vehicles and plant will be regularly maintained and all maintenance, fuelling and vehicle washing will be undertaken on appropriate impermeable surfaces away from watercourses in order to minimise risks of leaks to soil and surface waters.
GH9	Best practice management of concrete	The Contractor will develop a method statement to address the transport, transfer, handling and pouring of liquid concrete at substation / switchgear foundations.
GH10	Concrete transfer	Cement, grout and unset concrete will not be allowed to enter the water environment. No operations involving concrete transfer between vehicles or into vehicles will take place within 50 m of watercourses and waterbodies.
GH11	Cement washout	All vehicles used for delivery of concrete will only be washed out at locations to be agreed with SEPA. Excess concrete or wash-out liquid will not be discharged to drains or watercourses on site or at compounds. Drainage from washout facilities will be collected and treated or removed to an appropriate treatment point/licensed disposal site.
GH12	Minimise dewatering	The requirement for dewatering, for example for the substation foundation, will be minimised by timely and efficient excavation of the foundation void and subsequent concrete pouring and backfilling.

Ref	Title	Description
GH13	Groundwater management	Appropriate drainage management measures, as detailed in the CEMP, will be implemented to help minimise modifications to near surface groundwater flows and levels. Water ingress will be monitored and limited during excavation works using temporary interceptor (cut-off ditches) and toe drains around the base of excavations.
GH14	Drainage Strategy	Prior to construction, a detailed Drainage Strategy (DS) for the operational phase of the onshore Project will be prepared and agreed with SEPA and THC. The DS would detail the site drainage design, including any necessary ponds, swales, cross drains and bunds, to ensure that runoff from hard surfaces within the substation / switchgear will be controlled and managed. The DS will also detail how groundwater flows will be maintained around sub-surface structures such as substation foundations and cable duct.

Chapter 22: Agriculture, Soils and Land Use

Mitigation Measures Specific to Land Use, Agriculture and Soils		
Ref	**Title**	**Description**
LA1	Land take	The land take for the proposals and disturbance to soil and agricultural land will be kept to the minimum required for safe construction and permanent development of the onshore works.
LA2	Temporary storage and laydown area	The area of existing hard standing ground close to the south west corner of the Dounreay Nuclear Facility will be used for temporary storage and laydown to minimise land take and compaction of productive agricultural land during construction.
LA3	Cable route position	The cable route will be aligned as far as possible with existing field boundaries to minimise disruption to agriculture and long-term damage to agricultural soils.
LA4	Good practice construction measures to protect soils	Construction works will be undertaken in accordance with all relevant good practice guidance for the protection of soils and agricultural land in particular to prevent compaction, mixing of topsoils and subsoils and erosion from wind and water.
LA5	Soil stripping in wet conditions	Soil stripping, handling and storage activities will be avoided during periods of very wet weather.

Mitigation Measures Specific to Land Use, Agriculture and Soils		
Ref	**Title**	**Description**
LA6	Measures to protect soils from compaction	Construction works on arable agricultural land will employ appropriate soil protection techniques including, where necessary, the use of geogrids and low ground pressure vehicles along the cable route to reduce the effects of compaction on soils and in other working areas to limit compaction effects of storage of plant and materials and temporary buildings.
LA7	Containment of fuels and oils on site	Fuels, oils and chemicals will be stored in designated and appropriately bunded locations within the site construction compound(s) in accordance with all relevant regulatory requirements and good site environmental management. Mobile fuel and oil storage and all plant will be regularly checked to ensure risks to soils are minimised.
LA8	Soil Resource Plan	A Soil Resource Plan will be developed in detail prior to construction as part of the Construction Environmental Management Document (CEMD) to ensure that soil resources are managed in accordance with legislation and good practice and that soil mitigation measures are fully implemented and audited on site.
LA9	Wheel washing of plant and vehicles	Plant and vehicles which are used to track and work across areas of arable land will be subject to wheel washing and disinfecting procedures to avoid the introduction or spread of agricultural pests.
LA10	Temporary storage of soils	Temporary spoil and topsoil bunds will be managed to minimise compaction, erosion by rainfall and wind and mobilisation of sediment. Topsoil storage areas will not exceed 1.5 m in height.
LA11	Management of contaminated soils	If any suspected contaminated soil is encountered during construction this will be dealt with in accordance with regulatory requirements and good industry practice.
LA12	Access to properties during construction	Access to all residential and commercial properties will be maintained during construction.
LA13	Use of existing access tracks	The existing access track to the A836 shall be used to avoid additional land take and compaction of productive agricultural land.
LA14	Field accesses	Gated access into agricultural fields will be provided in the fences along either side of the route of the proposed temporary and permanent access track to the onshore infrastructure.

Mitigation Measures Specific to Land Use, Agriculture and Soils		
Ref	**Title**	**Description**
LA15	Construction access routes	Access by construction vehicles and plant to the cable landfall and coastal working areas will be taken from the access tracks in the Study Area to avoid additional disruption to properties in Reay.
LA16	Temporary closure of access routes	Any required closure of the farm and utility tracks between Isauld House, the Dounreay Nuclear Facility (substation) and the A836 during construction to walkers and cyclists would be minimised by the contractor and public access reinstated when safe to do so (e.g. after the busiest phase of works).
LA17	Protection for people taking access to the shoreline area during construction	Method statements for the construction of the cable landfall which crosses the rocky shore will take account of the health and safety of people walking in these areas, including the use of temporary fencing or exclusion of working areas where access restrictions are required.
LA18	Services and utilities searches	A full search for all utilities will be undertaken by the Contractor to ensure that the location of any existing services and supplies are identified and safeguarded, prior to construction.
LA19	Protection of utilities during construction	Any utilities which could be affected by construction will be protected (or diverted) to ensure that there will be no loss of services to affected properties/facilities. Any short-term disruption to utility services will be notified in advance to relevant properties/facilities.
LA20	Maintenance of agricultural water supplies	Water supplies for livestock will be maintained during construction and permanently or alternative provision made.
LA21	Maintenance and restoration of agricultural drainage	Disruption to field drains will be minimised through careful alignment of the cable route and the integrity of all drains to be intercepted during construction will be secured in advance through installation of temporary cut-off drains. All field drainage will be fully reinstated following cable installation.
LA22	Lighting of construction works	The onshore Project construction working areas will be lit as required for safe construction and taking account of the effects of light spill on nearby residential properties.
LA23	Fencing of construction working areas from livestock	Construction working areas will be fenced from adjacent agricultural land used for grazing to exclude livestock from the site but allowing for temporary access across the cable corridor and other working areas for agricultural operations (e.g. moving stock between fields, farm vehicle access).

Mitigation Measures Specific to Land Use, Agriculture and Soils		
Ref	**Title**	**Description**
LA24	Restoration of land, tracks, paths and fences following construction	The site and construction compound including any field boundary features will be restored making sure that agricultural land, access tracks and paths are restored to a condition as near as reasonably practicable to that existing before the start of construction works.

Chapter 23: Terrestrial Ornithology

Mitigation Measures Specific to Terrestrail Ecology		
Ref	**Title**	**Description**
Construction		
TO1	Timing of works	Where possible, construction works should take place outside the main breeding season for most bird species that may nest within the current onshore project area and nearby surroundings (March to August inclusive).
TO2	Pre-construction breeding bird survey	Where construction works are required during the breeding bird season, the area within 500 m of works should be surveyed ahead of any operations, by a suitably experienced and qualified Ecological Clerk of Works (ECoW), to check for active nests or breeding colonies.
TO3	Protection of nesting birds	If any nests or breeding bird colonies are identified, works in the area should cease immediately (or as soon as it is safe to do so) and an appropriate exclusion zone around the nest/colony should be established (with the distance appropriate to the species and agreed through consultation with SNH). No works should be permitted within exclusion zones and no personnel or vehicles should be allowed to enter or pass through until the ECoW has confirmed that the chicks have fledged or the breeding attempt has failed. Where this is not feasible, SNH would need to be contacted and further mitigation measures agreed to ensure that nesting birds are not disturbed. This could involve, for example, limiting the number of site personnel accessing the relevant area to the minimum number required to complete the works, restricting working hours, and employment of an ECoW to undertake a watching brief.

Mitigation Measures Specific to Terrestrail Ecology		
Ref	**Title**	**Description**
TO4	Minimising disturbance from construction vehicles	Where construction works are required during the breeding bird season, in order to minimise disturbance to any birds breeding near the access track or the A836, the number of vehicles accessing the current onshore project area via these roads should be limited to the minimum number required to complete the works effectively, and the number of vehicle movements along roads should be minimised as far as possible. In addition, a maximum speed limit of 15 mph should be adhered to along the access track in order to minimise noise disturbance.
Operation		
TO5	Mitigation during operation	Routine maintenance required during operation of the Project is expected to be minimal, involving only small areas and of a temporary duration. However, should significant works be required during the operational phase, it is recommended that the mitigation outlined above for the construction phase is implemented to protect breeding birds.
Decommissioning		
TO6	Mitigation during decommissioning	As decommissioning works are likely to be of a similar nature and duration as construction activities, the mitigation outlined above for construction works should also be implemented during the decommissioning phase in order to protect nesting birds.

Mitigation Measures Specific to Terrestrial Ecology		
Ref	**Title**	**Description**
Construction		
TE1	Onshore cable corridor route habitat reinstatement	Where habitat is to be reinstated, turfs will be removed to a suitable storage point where they will be maintained during works. Topsoil and subsoil will also be stored separately, and excavations backfilled with these materials to maintain the original stratification as well as is practical. Turfs will then be replaced as close to their original location as possible. Due to the temporary and short-term nature of most construction activities, this method will allow the reinstatement of habitat immediately after works are completed in a given area. This method will be suitable for the majority of habitats, although is not appropriate for sand dune habitats which may require specific measures as discussed below.
TE2	Measures to protect watercourses and sensitive coastal and wetland habitats	An Environmental Management Plan (EMP) will be developed prior to construction to ensure that all watercourses and sensitive coastal and wetland habitats connected with the current onshore project area are protected during construction. This will include a Pollution Incident Response Plan to minimise potential pollution effects. Further details are provided in Chapter 22: Geology and Hydrology and Hydrogeology.
TE3	Measures to protect GWDTEs	Where possible, the following buffers between GWDTEs and excavations will be implemented: 250 m for the onshore cable corridor route and any other excavations greater than 1 m in depth; and 100 m for excavations less than 1 m in depth. If the onshore cable corridor route is located within 250 m of any GWDTEs, clay stoppers will be included in the cable trench to prevent them from acting as preferential pathways for drainage.
TE4	Pre-construction Scottish primrose survey	It is recommended that a pre-construction survey for Scottish primrose is undertaken to identify any plants present in the vicinity of construction works. Should any plants be identified, appropriate mitigation would need to be considered and agreed with appropriate stakeholders, such as SNH. This could involve, for example, an exclusion zone around the plants or, where this is not feasible, translocation.

Mitigation Measures Specific to Terrestrial Ecology		
Ref	**Title**	**Description**
TE5	Measures to prevent harm to protected mammals and reptiles	It is recommended that pre-construction surveys for protected mammal and reptile species are undertaken to identify any species making use of the current onshore project area (e.g. badger setts or potential reptile hibernacula). Should any protected species be identified, appropriate mitigation would need to be considered in consultation with SNH. This could involve, for example, an exclusion zone around the area in use. It is recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid animals becoming trapped during the construction phase. It is recommended that any piping is capped to avoid its potential use as refugia by animals. Construction works should be overseen by a suitably experienced and qualified Ecological Clerk of Works.
Operation		
TE6	Mitigation during operation	Routine maintenance required during operation of the Project is expected to be minimal, involving only small areas, and of a temporary duration. However, should significant works be required during the operational phase, it is recommended that the mitigation outlined above is implemented to protect important ecological features.
Decommissioning		
TE7	Mitigation during decommissioning	As decommissioning works are likely to be of a similar nature and duration to construction activities, the mitigation outlined above for construction works should also be implemented during the decommissioning phase in order to protect important ecological features.

Ref	Title	Description
OACH01	Avoidance	It is best to manage the presence of cultural heritage assets by locating development footprints and export cables as well as the construction of building footprints and other infrastructure to avoid them. This strategy is best employed where it is easy to avoid the site with little or permanent infrastructures, for example construction laydown areas, to avoid known archaeological sites. The export cable landfall area should be routed to best avoid any known archaeological features. If avoidance of cultural heritage assets cannot be assured, then features should be recorded thus ensuring preservation by record
OACH02	Archaeological Monitoring of Geotechnical Works	Archaeological monitoring of will help to inform the presence and extent of any archaeological deposits or sites within the onshore site boundary. No archaeological monitoring is needed for the excavation of boreholes, if undertaken; however, an inspection of any geotechnical cores, as well as an assessment of the borehole logs should be undertaken by an archaeologist in order to determine if there is any potential archaeology present, if boreholes are used.
OACH03	Archaeological evaluation	Non-intrusive evaluation methods such as geophysical survey could be conducted in the onshore study area to help inform final location of the onshore elements and any groundbreaking works within this area. Depending on the results of any geophysical surveys conducted in the proposed landfall, substation and cable study area, intrusive evaluations may be required.
OACH04	Archaeological Watching Brief	This will be conducted during ground-breaking construction works if there is a significant potential for, but no conclusive proof of, archaeological remains, or as a precautionary measure if a site has been identified nearby. This work will allow for opportunity for appropriate recording and excavation of any unknown sub-surface archaeological features or those that cannot be avoided.

Mitigation Measures specific to the cable route		
Ref	**Title**	**Description**
AQ1	Construction Programme	Appropriate planning of construction works to minimise the number of times material is moved and the time material is stored and ground left bare
AQ2	Construction Environmental Management Document	Where practicable and volumes allow, dry materials will be covered
AQ3	Construction Environmental Management Document	Stored bulk materials will be kept moist to avoid dust arising. Mobile water bowsers or equivalent will be utilised in dry weather conditions to damp down potential dust sources and, where possible, they will utilise runoff water (grey water) gathered on the site
AQ4	Construction Environmental Management Document	As soon as the cable route has been infilled the soil will be seeded/planted, to bind the soils so they are no longer a source of dust

Mitigation Measures specific to substation and switch gear		
Ref	**Title**	**Description**
AQ5	Construction Environmental Management Document	Top soil scrapped from the site to facilitate foundation construction will be taken away at the earliest opportunity if not required for use onsite, minimising the time unrequired material it will be stored onsite
AQ6	Construction Environmental Management Document	Building materials stored on site will be minimised where practicable, by utilising a just in time delivery system
AQ7	Construction Environmental Management Document	Aggregates will be stored in dedicated areas and not allowed to dry out, unless this is required for a particular process, in which case appropriate additional control measures such as covers will be used
AQ8	Construction Environmental Management Document	Bulk cement and other fine powder materials if required will be delivered in enclosed tankers and stored in silos with suitable emission control systems, to prevent escape of material and overfilling during delivery
AQ9	Construction Environmental Management Document	Smaller supplies of fine powder materials such as cement in bags will be sealed after use and stored appropriately to prevent dust

Mitigation Measures specific to substation and switch gear		
Ref	**Title**	**Description**
AQ10	Construction Environmental Management Document	If any rock is to be processed/crushed on site, then appropriate dust mitigation will be employed including dampening
AQ11	Construction Environmental Management Document	Any cutting, grinding or sawing equipment utilised will be used with a suitable dust suppression technique such as water sprays or localised extraction
AQ12	Construction Environmental Management Document	Good housekeeping across the site will be maintained

Mitigation Measures specific to road construction		
Ref	**Title**	**Description**
AQ13	Construction Environmental Management Document	Top soil scrapped from the road route to facilitate construction, not required for use onsite will be taken away at the earliest opportunity, minimising the time it will be stored onsite
AQ14	Construction Environmental Management Document	Top soil scrapped from the road route to facilitate construction required for verges etc, will be moved the minimum number of times and seeded at the earliest opportunity
AQ15	Construction Programme	Good programming will ensure that the road is laid soon after the route is stripped, to minimise the time bare ground is exposed
AQ16	Construction Environmental Management Document	In periods of dry weather areas of exposed ground will be dampened utilising a mobile water bowser

Mitigation Measures specific to road construction		
Ref	**Title**	**Description**
AQ17	Construction Environmental Management Document	Water-assisted dust sweeper(s) will be utilised on the access and local roads to remove, as necessary, any material tracked out of the site
AQ18	Construction Environmental	Vehicles entering and leaving sites will be covered to prevent escape of materials during transport

Mitigation Measures specific to road construction		
Ref	**Title**	**Description**
	Management Document	
AQ19	Construction Environmental Management Document	A wheel washing system with rumble grids to dislodge accumulated dust and mud prior to leaving the site, will be considered and installed if necessary
AQ20	Construction Environmental Management Document	Private cars routes will be established to avoid the need to drive through construction areas

Chapter 27: Landscape and Visual Amenity

Mitigation Measures specific to LVIA		
Ref	**Title**	**Description**
LVIA1	Strategic site selection	The siting of the Project has, where feasible, been completed in accordance with the Horlock Rules to avoid or limit adverse landscape and visual effects.
LVIA2	Merging with surrounding Backdrop(s).	Buildings would be clad in a recessive material. The detailed colour selection would be agreed with the Planning Authority.
LVIA3	Reflect the surrounding level topography.	No introduction of screen mounds.
LVIA 4	Reflect the surrounding vegetation pattern.	No introduction of screen planting.

28.2 Summary of Onshore Residual Impacts

Chapter 21: Geology and Hydrology

Potential Impact	Magnitude	Vulnerability	Overall significance
Construction Phase			
Pollution of watercourses from silt-laden runoff	Medium	Medium	Minor
Pollution of watercourses from chemical contaminated runoff	Medium	Medium	Minor
Disruption to drainage characteristics and groundwater flow	Medium	Low	Minor

Mobilisation of ground contamination	Medium	Medium	Minor
Operations and Maintenance Phase			
Alteration of surface drainage	Medium	Low	Minor
Increase in downstream flooding	Medium	Low	Minor

Chapter 22: Agriculture, Soils and Land Use

Potential Impact	Magnitude	Vulnerability	Overall significance
Construction			
Temporary occupation of agricultural land by construction plant and works affecting agricultural activities	Medium	Medium	Minor
Temporary occupation of areas of landfall and restrictions to access tracks across the Study Area for construction works	Low to Medium	Medium to High	Minor to Moderate (for short periods)
Permanent changes in land use including impacts on agricultural operations from development of the substation, access track and cable	Low	Medium	Minor
Long-term effects on agricultural land and soils following construction and restoration of the cable corridor	Low to Medium	Medium	Minor
Operations and Maintenance			
Changes in access to the Study Area (e.g. for pedestrian and cycle use of access track to substation)	Negligible to Low	Medium	Minor
Vehicular and personnel access to substation, cable route and joint bays for maintenance	Negligible to Low	Medium	Minor
Contamination of agricultural soils from leaks or spills from the substation	Low	Medium	Minor
Decommissioning			
Potential impacts arising during the decommissioning phase are expected to be similar to, but not exceeding, those arising during the construction phase	Medium	Medium	Minor to Moderate (for short periods)

Chapter 23: Terrestrial Ornithology

No residual effects exist.

Chapter 24:Terrestrial Ecology

No residual effects exist.

Chapter 25: Onshore Archaeology and Cultural Heritage

Impact	Heritage Value/ Sensitivity	Sensitivity of Setting	Magnitude of Effect	Pre-Mitigation Significance	Mitigation	Residual Significance
Direct Impact on known Archaeological features	Low to Negligible	N/A	Low to High	Uncertain to Major	Avoidance	Negligible
Damage to as yet unrecorded sub-surface features within the onshore site boundary	Unknown	N/A	Unknown	Negligible to Moderate	Preservation in situ or preservation through recording	Minor to Negligible

Chapter 26. Air Quality

Source		Onshore cable excavation works.	Sub-station/ switch gear building earthworks for foundations.	Sub-station/ switch gear building construction works.	Ground works associated with the installation of a site access road.	HGV trips to site per day.
Magnitude of Effect		**Negligible**	**Negligible**	**Negligible**	**Negligible**	**Low**
Receptor	**Vulnerability**					
HMS Vulcan 1 building (NC 9779 6655)	**Medium**	Minor	Minor	Minor	Minor	Minor

Source		Onshore cable excavation works.	Sub-station/ switch gear building earthworks for foundations.	Sub-station/ switch gear building construction works.	Ground works associated with the installation of a site access road.	HGV trips to site per day.
Magnitude of Effect		Negligible	Negligible	Negligible	Negligible	Low
Receptor	Vulnerability					
HMS Vulcan 3 buildings (NC99766661, NC97946661 & NC9776066712)	Low	Negligible	Negligible	Negligible	Negligible	Minor
North Caithness Special Protection Area	Low	Negligible	Negligible	Negligible	Negligible	Minor
Lapwing Skylark	Medium	Minor	Minor	Minor	Minor	Minor

Chapter 27: Landscape and Visual Amenity

Potential Effect	Sensitivity	Magnitude	Overall Significance
Construction			
Effects on LCT 16: Long Beaches, Dunes and Links during construction;	High	Minor	Moderate direct and indirect
Effects on Core Path CA 11,07	High	Moderate	Moderate
Effects on Core Path CA 11.08	High	Moderate	Moderate
Operations and Maintenance			
Effects on LCT 22: Open Intensive Farmland	Medium / High	Moderate	Moderate direct and indirect
Decommissioning			

Effects on LCT 16: Long Beaches, Dunes and Links during construction;	High	Minor	Moderate direct and indirect

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