Scottish Hydro Electric Power Distribution plc.

SHEPD Mainland Orkney - Hoy Cable Replacements

Marine Environmental Appraisal

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ABBREVIATIONS

the 2010 Act	The Marine (Scotland) Act 2010
µPA	Micro Pascal
AA	Appropriate Assessment
AONB	Areas of Outstanding Natural Beauty
BGS	British Geological Society
BWM	Ballast Water Management
CBA	Cost Benefit Analysis
CEMP	Construction Environmental Management Plan
CFLO	Company Fisheries Liaison Officer
CLV	Cable Lay Vessel
CPSP	Cable Protection and Stabilisation Plan
dB re 1 µPA	Decibels relative to 1 Micro Pascal
DD	Decimal Degrees
DDM	Degrees and Decimal Minutes
DECC	Department of Energy & Climate Change
DMS	Degrees Minutes Seconds
EC	European Community
EEC	European Economic Community
EPS	European Protected Species
EU	European Union
EUNIS	European Union Nature Information System
FCS	Favourable Conservation Status
FIR	Fisheries Industry Representative
FLMAP	Fishing Liaison Mitigation Action Plan
FLO	Fisheries Liaison Officer
HF	High Frequency
HMPA	Historic Marine Protected Area
HRA	Habitats Regulations Appraisal
HWDT	Hebridean Whale and Dolphin Trust
Hz	Hertz
IAMMWG	International-Agency Marine Mammal Working Group
IMO	International Marine Organization
IRPCS	International Regulations for the Prevention of Collision
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
kHz	Kilohertz
KIS-ORCA	Kingfisher Information Service – Offshore Renewable and Cable Awareness
km	Kilometres

km^2	Kilometres Squared
kV	Kilo-Vaults
LF	Low Frequency
LSE	Likely Significant Effects
m	Metres
m^2	Metres Squared
MARPOL	International Convention for the Prevention of Pollution from Ships
MBES	Multi-Beam Echo Sounder
MEA	Marine Environmental Appraisal
MEPC	Marine Environmental Protection Committee
MHWS	Mean High Water Spring
MLWS	Mean Low Water Springs
MPA	Marine Protected Area
MSFD	Marine Strategy Framework Directive
MS-LOT	Marine Scotland Licensing Operations Team
MU	Management Unit
NCMPA	Nature Conservation Marine Protected Area
NM	Nautical Miles
NMP	National Marine Plan
NMPi	National Marine Plan interactive
NNMS	Non-Native Marine Species
NOAA	National Oceanic and Atmospheric Administration
NSA	National Scenic Area
OIMD	Operation, Inspection, Maintenance and Decommissioning Strategy
PAC	Public Accounts Committee
PAD	Protocol for Archaeological Discoveries
PLGR	Pre-Lay Grapnel Run
PMF	Priority Marine Features
pSPA	Proposed Special Protection Area
PW	Phocid Carnivores in Water
ROV	Remotely Operated Vehicle
RSPB	Royal Society for the Protection of Birds
SAC	Special Areas of Conservation
SBP	Sub Bottom Profiler
SCANS	Small Cetaceans Abundance in the North Sea
SCOS	Special Committee on Seals
SEPA	Scottish Environmental Protection Agency
SHEPD	Scottish Hydro Electric Power Distribution plc
SMWWC	Scottish Marine Wildlife Watching Code

SSSI	Sites of Special Scientific Interest
SNH	Scottish Natural Heritage (now NatureScot)
SOLAS	Safety of Life at Sea
SOPEP	Shipboard Oil Pollution Emergency Plans
SPA	Special Protection Area
SSS	Side-Scan Sonar
TDM	Touch Down Monitoring
TJP	Transition Joint Pit
UK	United Kingdom
UKBAP	United Kingdom Biodiversity Action Plan
UKCS	United Kingdom Continental Shelf
UKHO	United Kingdom Hydrographic Office
UNCLOS	United Nations Convention on the Law of the Sea
UNESCO	United Nations Economic and Social Council
USBL	Ultra-Short Baseline
VHF	Very High Frequency
WCA	Wildlife and Countryside Act
WFD	Waste Framework Directive
WFD	Water Framework Directive
WHS	World Heritage Site

1 Introduction

Scottish Hydro Electric Power Distribution plc (SHEPD) holds a licence under the Electricity Act 1989 for the distribution of electricity in the north of Scotland including the Islands. It has a statutory duty to provide an economic and efficient system for the distribution of electricity and to ensure that its assets are maintained to ensure a safe, secure and reliable supply to customers.

There are currently three 33 kV cables (North, Centre and South) connecting the mainland of Orkney with the Island of Hoy. SHEPD have identified the need to replace the existing North and Centre submarine power cables after asset integrity inspections.

The North and Centre cables will be replaced on a like-for-like basis with approximate length of 5 km and 5.5 km, respectively. The estimated duration of the cable replacement activities is 86 days for the north cable and 97 days for the centre cable. This anticipated duration includes onshore, nearshore and offshore works, cable pull-in and re-instatement.

The installation of replacement cables is a licensable activity under Part 4 Section 21 of The Marine (Scotland) Act 2010, and as such a Marine Licence will be required to conduct the works. SHEPD have carried out Pre-Application Consultation and a PAC report summarising stakeholder engagement supports this application.

The cables will be assessed under two separate cable installation corridors; however, these corridors overlap. Due to the close proximity of the two submarine cables, SHEPD is planning to undertake the replacement of both of these cables as a single campaign. For licensing purposes, they are being treated as one joint activity and therefore one licence application (for each Marine Licence, European Protected Species (EPS) licence and Basking Shark derogation Licence) will be submitted to cover both cables. This Marine Environmental Appraisal (MEA) provides an assessment of the potential environmental impacts which may result from the Orkney - Hoy cable replacement activities and will be used to inform the licence applications. The mitigation requirements identified by this MEA will be included in the accompanying Marine Construction Environmental Management Plan (CEMP) Ref: A-303128-S00-TECH-013, in order to ensure they are effectively disseminated to, and implemented by SHEPD and the cable installation contractor during the proposed works.

This MEA should be read in conjunction with the following documents:

- Project Description: Orkney – Hoy (North) Cable Replacement and Orkney – Hoy (Centre) Cable Replacement;
- Cost Benefit Analyses (CBA);
- Fishing Liaison Mitigation Action Plan (FLMAP) North Coast and Orkney (covering all legitimate sea users);
- CEMP;
- Operation, Inspection, Maintenance and Decommissioning (OIMD) Strategy;
- Marine Licence Application Form;
- EPS Licence Application Form; and
- Basking Shark Derogation Licence Application Form.

1.1 Project Need

The Mainland Orkney to Hoy North and Centre subsea cables were inspected in late 2018 where they were observed to be in poor condition with damage to the external armour. The North and Centre cable were installed in 1977 and 1982, respectively. In light of their age and condition, these cables are considered to be at the end of

their economic life. The Mainland Orkney to Hoy South cable was inspected at the same time and is also operational but is not proposed for replacement within this programme of work.

Electricity is considered to be an essential service for communities, particularly on remote islands. SHEPD's first priority is to provide a safe and reliable network for the supply and distribution of electricity to domestic, commercial and industrial customers in the north of Scotland and the Islands. It is responsible for maintaining, repairing and improving the electricity network in these regions. The proposed cable replacement activities are essential to maintaining this service. The Orkney - Hoy cables distribute electricity to domestic and business customers, providing a long term economic and social benefit to the communities.

The replacement of these cables will enable continued delivery and assured efficiency of electricity distribution in Orkney, providing social and economic benefits.

1.2 Consideration of Alternatives

SHEPD holds a licence under the Electricity Act 1989 for the distribution of electricity in the north of Scotland including the Islands. SHEPD therefore has a statutory duty to provide an economic and efficient system for the distribution of electricity and to ensure that its assets are maintained to ensure a safe, secure and reliable supply to domestic and business customers.

As detailed above, recent inspections of the Orkney - Hoy North and Centre cables identified that they have reached the end of their economic life. The cables are however still operational at the time of this application and therefore the following options represent the alternative options available:

- Option 1 – Do nothing at this time. Under this scenario the existing cables in conjunction with the Mainland Orkney to Hoy South cable would continue to provide the grid network connection between the mainland of Scotland and Mainland Orkney and Hoy. At some point in the future it would be expected that these cables would fail, potentially within a short time of each other, and at this point require either repair or replacement. For a repair option to be progressed, the cable must be in good mechanical condition because cable recovery and jointing results in significant mechanical stresses and fatigue within the cable. On this basis a future offshore piece in repair is considered unlikely to be either successful or represent best value for consumers due to the condition of the cables and the low confidence in a successful repair being achieved. The most likely future outcome of this option would be end to end replacement of the cable(s).
- Option 2 – Proactive cable replacement in proximity to the existing cables. This option would see new cables installed before any of the existing cables fail in order to ensure network integrity and security of supply for customers. The replacement cables would be installed in proximity to / within the existing cable corridor.
- Option 3 - Proactive cable replacement in a location remote from the existing cables. This option would see new cables installed before the existing cable(s) fails in order to ensure network integrity and security of supply for customers. The replacement cable(s) would be installed in a new location remote from the existing cables. A suitable subsea crossing location would require to be identified and new onshore infrastructure installed in order to connect the new cable(s) to the existing network on both Mainland Orkney and Hoy.

SHEPD is progressing on the basis of Option 2 as it reduces environmental effects to a minimum and is the option that most closely aligns with our statutory duty for these specific cables. Reference should also be made to the accompanying Project Descriptions for North route (3234-GO-O-TB-0002-02) and Centre route (3234-GO-O-TB-0004-03) where details regarding the cable route selection process are presented.

The replacement cables would be on a like-for-like basis, surface laid within the installation corridors in proximity to the existing cables. In order to provide additional protection and stabilisation it is proposed that the cables will be protected at all landfalls with split pipe protection fitted directly around the cables, and through installation of rock bags and concrete mattresses in the subsea sections.

Further details of the specific project descriptions for each cable is discussed in Section 3 and outlined in greater detail within the associated Project Description Orkney – Hoy (North) Cable Replacement and Orkney – Hoy (Centre) Cable Replacement documents.

1.3 Exclusions from the Scope of Assessment

Since the Cable Route replacement works will be a like for like replacement of the existing cables, the operational aspects (such as snagging risk, electromagnetic fields, and sediment heating effects) of this project will not constitute a change from baseline conditions. Therefore, only the installation phase is considered by this MEA. This appraisal only covers the marine cable installation activities, below Mean High Water Spring (MHWS).

SHEPD also recognise the need to consider options regarding the future of the existing cables and this is covered in the accompanying OIMD Strategy document which outlines why SHEPD do not propose to remove the existing cables once these are deenergised. As such decommissioning is out-with the scope of this MEA.

Geophysical survey operations including, pre, during and post installation will be conducted as part of the proposed cable replacement works. However, these survey operations are subject to existing licences held by SHEPD, specifically:

- An EPS Licence Reference – MS EPS 02 2020 0; and
- A Basking Shark Derogation Licence Reference – MS BS 01 2020 0.

As such no geophysical survey operations are included within the scope of this MEA.

2 Legislative Context

This section presents the key UK and Scottish policies which are applicable to the proposed cable replacement works and explains how and where these have been considered in the production of this MEA. This includes adherence to statutory legislation as well as to the policies presented in Scotland's National Marine Plan (NMP) (Scottish Government, 2015). Where necessary, additional mitigation measures have been presented in topic specific chapters to ensure that the proposed cable replacement works adhere to relevant legislation and policies and comply with the conditions required when granting applicable licences. The information is provided in table form for ease of reference, as shown in Table 2-1.

Table 2-1 Key UK and Scottish Policies Pertinent to the Proposed Cable Replacement Works

Legislation or Policy	Key Requirements	Relevant Section (where applicable)
Marine (Scotland) Act 2010	The Marine (Scotland) Act 2010 applies to Scottish territorial waters and makes provisions in relation to functions and activities in the Scottish marine area. The following regulations are pertinent to the Project: • Under Section 21 of the act a marine licence is required for any activity which involves: o deposit of any substance or object in the sea or on or under the seabed o construct, alter or improve works in or over the sea or on or under the seabed o remove substances or objects from the seabed o carry out dredging o deposit or use explosives o incinerate substances or objects • Under section 82 of the Marine (Scotland) Act 2010, Marine Scotland Licensing Operations Team (MS-LOT) is required to consider whether a licensable activity is capable of affecting (other than insignificantly) a protected feature of a Nature Conservation Marine Protected Area (NCMPA) or a marine historic asset in a Historic Marine Protected Area (HMPA). • Under Section 107 of the 2010 act, it is an offence to kill, injure or take a live seal; and • The seal haul-out sites, designated under The Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 (as amended), are protected under Section 117 of the act.	SHEPD will submit a Marine Licence Application for each of the cable replacement works. Section 5 – Designated Sites assesses the potential impacts on NCMPAs in the vicinity of the Installation Corridor. This concluded that no effects on NCMPAs were expected. Section 7 – Marine Megafauna assessed the potential for the Project activities to injure seals or disturb seals at designated seal haul-outs. This assessment concluded there should be no injury to seals and no disturbance at designated seal haul-outs. Section 10 – Marine Archaeology assesses the impact of the cable installation on HMPAs This concluded that no impacts were expected.
Conservation (Natural Habitats, &c) Regulations 1994 (as amended in Scotland) (also known as 'The Habitats Regulations') and the revision to The Conservation (Natural Habitats) (EU Exit) (Scotland) (Amendment) Regulations 2019	The Conservation (Natural Habitats, &c) Regulations 1994 (as amended in Scotland) transpose the European Habitats Directive (92/43/EEC (European Economic Community)) and Birds Directive (79/409/EEC) into Scottish Law. In addition, the Conservation (Natural Habitats) (European Union (EU) Exit) (Scotland) (Amendment) Regulations 2019 make provision for the selection, designation, registration and notification of sites to be protected under the European Community (EC) Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. The Habitats Regulations Appraisal (HRA) process forms part of these regulations. The HRA process requires that any proposal which has the potential to result in a negative Likely Significant Effect (LSE) to a European site or its designated features, to be subject to an HRA by the Competent Authority, and if necessary, an Appropriate Assessment (AA). The Conservation (Natural Habitats, & c) Regulations 1994 as amended make it an offence to deliberately or recklessly capture, kill, injure, harass or disturb an EPS. When EPS are present, licences to permit works that will affect them can only be granted when: • there is no satisfactory alternative, and • the action authorised will not be detrimental to the maintenance of the population of the species concerned at a Favourable Conservation Status (FCS)_ in their natural range. The 2019 Regulations make amendments to the existing instruments that transpose the habitats and wild birds' directives so that they are operable.	Section 5 – Designated Sites concluded that no LSE was expected on any designated site in the vicinity of the Installation Corridors. Section 7 – Marine Megafauna assessed the potential impacts on EPS which have a potential connectivity with the proposed activities (cetaceans and otters). This concluded that there will be no injurious impacts to these receptors, however, as disturbance could not be ruled out, an EPS licence application will be submitted to Marine Scotland.
Wildlife and Countryside Act 1981 (as amended) and the	Basking sharks are protected under Schedule 5 of the Wildlife and Countryside Act (WCA) (1981 as amended) which prohibits the killing, injuring or taking by any method of those wild animals listed on Schedule 5 of the Act. The Nature Conservation (Scotland) Act 2004, Part 3 and Schedule 6 make amendments to the WCA,	Section 7 – Marine Megafauna concluded that there is not likely to be any impacts on basking sharks.

Legislation or Policy	Key Requirements	Relevant Section (where applicable)
Nature Conservation (Scotland) Act 2004	strengthening the legal protection for threatened species to include 'reckless' acts, and specifically makes it an offence to intentionally or recklessly disturb or harass basking sharks. A derogation licence under the WCA will therefore be required for any activity which may result in disturbance or injury to basking sharks. In addition, the primary legislation for the protection of birds in the UK is the WCA in combination with the Nature Conservation (Scotland) Act 2004. Under these acts, it is an offence to harm wild bird species, their eggs and nests. Additional protection is provided for certain bird species listed on Schedule 1 of the WCA, and it is an offence to disturb those species at their nest while it is in use. Licensing for wild birds does not cover development purposes, so any activity that could result in disturbance of a nesting Schedule 1 species should not proceed unless out-with the breeding season. In addition, the Conservation (Natural Habitats) (EU Exit) (Scotland) (Amendment) Regulations 2019 also instrument an amendment to Section 27 of the WCA 1981 to ensure that existing protections continue.	Section 9 – Ornithology concluded that no impacts to birds were expected from the activities.
Scottish National Plan Policy GEN 2 Economic benefit	Sustainable development and use which provides economic benefit to Scottish communities is encouraged when consistent with the objectives and policies of this Plan.	Section 1 – Introduction outlines the potential benefits of the cable replacement activities. This will restore a reliable power source to residents on the remote islands of Orkney which will inherently provide the potential for social and economic benefit for the communities on the Island.
Scottish National Plan Policy GEN 5 Climate change	Marine Planners and decision makers must act in the way best calculated to mitigate and adapt to climate change.	Section 3 - Project Description outlines how failure to complete the replacement works would result in an increased reliance on fossil fuels.
Scottish National Plan Policy GEN 6 Historic environment	Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance.	Section 10 – Marine Archaeology concluded that no impacts are expected on protected marine assets
GEN 7 Landscape/seascape	Marine planners and decision makers should ensure that development and use of the marine environment take seascape, landscape and visual impacts into account.	The submarine cables will have no long term landscape/seascape effects.
Scottish National Plan Policy GEN 8 Coastal process and flooding	Developments and activities in the marine environment should be resilient to coastal change and flooding, and not have unacceptable adverse impact on coastal processes or contribute to coastal flooding.	No impacts to coastal change and flooding are expected from the cable replacement works.

Legislation or Policy	Key Requirements	Relevant Section (where applicable)
Scottish National Plan Policy GEN 9 Natural Heritage	Development and use of the marine environment must: • Comply with legal requirements for protected areas and protected species. • Not result in significant impact on the national status of Priority Marine Features (PMF). • Protect and, where appropriate, enhance the health of the marine area.	Section 5 – Designated Sites concluded that no impacts on protected areas are expected. Section 7 – Marine Megafauna concluded that no adverse impacts on protected marine megafauna were expected. Section 8 – Benthic and Intertidal Ecology concluded that no adverse impacts on protected benthic or intertidal features were expected. Section 9 – Ornithology concluded that no adverse impacts on birds was expected.
Scottish National Plan Policy GEN 10 Invasive non-native species	Opportunities to reduce the introduction of invasive non-native species to a minimum or proactively improve the practice of existing activity should be taken when decisions are being made.	Section 8 – Benthic and Intertidal Ecology concluded that the likelihood of invasive species being introduced as part of the Project activities is low.
Scottish National Plan Policy GEN 12 Water quality and resource	Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive (WFD), Marine Strategy Framework Directive (MSFD) or other related Directives apply.	Section 6 – Seabed and Water Quality concluded that no deterioration in water quality in the vicinity of the Installation Corridors is expected.
Scottish National Plan Policy GEN 13 Noise	Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects.	Section 7 – Marine Megafauna concluded that no adverse impacts to marine mammals are anticipated from underwater noise generated from the activities.
Scottish National Plan Policy GEN 18 Engagement	Early and effective engagement should be undertaken with the general public and all interested stakeholders to facilitate planning and consenting processes.	See FLMAP SHEPD have also consulted key stakeholders and considered their views within this MEA.
Scottish National Plan Policy Sea Fisheries – Fisheries 1	Taking account of the Habitats Directive, Birds Directive and MSFD, marine planners and decision makers should aim to ensure: • Existing fishing opportunities and activities are safeguarded wherever possible; • Protection for vulnerable stocks (in particular for juvenile and spawning stocks through continuation of sea area closures where appropriate); • That other sectors take into account the need to protect fish stocks and sustain healthy fisheries for both economic and conservation reasons; and • Mechanisms for managing conflicts between fishermen and/or between the fishing sector and other users of the marine environment.	See: • FLMAP North Coast and Orkney; and • How SHEPD co-exists with Other Marine Users.

Legislation or Policy	Key Requirements	Relevant Section (where applicable)
Scottish National Plan Policy Sea Fisheries – Fisheries 2	The following key factors should be taken into account when deciding on uses of the marine environment and the potential impact on fishing: • The cultural and economic importance of fishing, in particular to vulnerable coastal communities; • The potential impact (positive and negative) of marine developments on the sustainability of fish and shellfish stocks and resultant fishing opportunities in any given area; • The environmental impact on fishing grounds (such as nursery, spawning areas), commercially fished species, habitats and species more generally; and • The potential effect of displacement on fish stocks, the wider environment, use of fuel, socio-economic costs to fishers and their communities and other marine users.	See Cost Benefit Analysis Model (one for each cable). The impact submarine electricity cables have on fuel poverty (including associated increased health service and social care costs for island communities), commercial fishing and planned renewable electricity generation projects on the islands is considered within socio-economic impact of the Cost Benefit Analysis Model.
Scottish National Plan Policy Sea Fisheries – Fisheries 3	Where existing fishing opportunities or activity cannot be safeguarded, a Fisheries Management and Mitigation Strategy should be prepared by the proposer of the development or use, involving full engagement with local fishing interests (and other interests as appropriate) in the development of the Strategy. All efforts should be made to agree with those interests. Those interests should also undertake to engage with the proposer and provide transparent and accurate information and data to help complete the Strategy. The Strategy should be drawn up as part of the discharge of conditions of permissions granted. • The content of the Strategy should be relevant to the particular circumstances and could include: • An assessment of the potential impact of the development or use on the affected fishery or fisheries, both in socio-economic terms and in terms of environmental sustainability; • A recognition that the disruption to existing fishing opportunities/activity should be minimised as far as possible; • Reasonable measures to mitigate any constraints which the proposed development or use may place on existing or proposed fishing activity; and • Reasonable measures to mitigate any potential impacts on sustainability of fish stocks (e.g. impacts on spawning grounds or areas of fish or shellfish abundance) and any socioeconomic impacts.	See Cost Benefit Analysis Model (one for each cable). The impact submarine electricity cables have on fuel poverty (including associated increased health service and social care costs for island communities), commercial fishing and planned renewable electricity generation projects on the islands is considered within the socio-economic impact of the Cost Benefit Analysis Model. Section 8 – Benthic and Intertidal Ecology concluded that no impacts on fish are expected.
Scottish National Plan Policy Recreation and Tourism 2	The following key factors should be taken into account when deciding on uses of the marine environment and the potential impact on recreation and tourism: • The extent to which the proposal is likely to adversely affect the qualities important to recreational users, including the extent to which proposals may interfere with the physical infrastructure that underpins a recreational activity. • The extent to which any proposal interferes with access to and along the shore, to the water, use of the resource for recreation or tourism purposes and existing navigational routes or navigational safety. • Where significant impacts are likely, whether reasonable alternatives can be identified for the proposed activity or development; and • Where significant impacts are likely and there are no reasonable alternatives, whether mitigation, through recognised and effective measures, can be achieved at no significant cost to the marine recreation or tourism sector interests.	See: • FLMAP North Coast and Orkney; and • How SHEPD co-exists with other marine users.
Scottish National Plan Policy Transport 1	Navigational safety in relevant areas used by shipping now and in the future will be protected, adhering to the rights of innocent passage and freedom of navigation contained in United Nations Convention on the Law of the Sea (UNCLOS). The following factors will be taken into account when reaching decisions regarding development and use: • The extent to which the locational decision interferes with existing or planned routes used by shipping, access to ports and harbours and navigational safety. This includes commercial anchorages and defined approaches to ports; • Where interference is likely, whether reasonable alternatives can be identified; and • Where there are no reasonable alternatives, whether mitigation through measures adopted in accordance with the principles and procedures established by the International Maritime Organization can be achieved at no significant cost to the shipping or ports sector.	See: • FLMAP North Coast and Orkney; and • How SHEPD co-exists with other marine users.

Legislation or Policy	Key Requirements	Relevant Section (where applicable)
Scottish National Plan Policy Transport 6	Marine planners and decision makers and developers should ensure displacement of shipping is avoided where possible to mitigate against potential increased journey lengths and associated fuel costs, emissions and impact on journey frequency) and potential impacts on other users and ecologically sensitive areas.	See: • FLMAP North Coast and Orkney; and • How SHEPD co-exists with other marine users.
Scottish National Plan Policy Cables 1	Cable and network owners should engage with decision makers at the early planning stage to notify of any intention to lay, repair or replace cables before routes are selected and agreed. When making proposals, cable and network owners and marine users should evidence that they have taken a joined-up approach to development and activity to minimise impacts, where possible, on the marine historic and natural environment, the assets, infrastructures and other users. Appropriate and proportionate environmental consideration and risk assessments should be provided which may include cable protection measures and mitigation plans. Any deposit, removal or dredging carried out for the purpose of executing inspection or repair works to any cable is exempt from the marine licensing regime with approval by Scottish Ministers. However, cable replacement requires a Marine Licence. Marine Licensing Guidance should be followed when considering any cable development and activity.	SHEPD have consulted with stakeholders prior to the replacement works commencing. This MEA has indicated how impacts on the marine environment have been minimised. A Marine Licence application will be submitted for each cable replacement.
Scottish National Plan Policy Cables 2	The following factors will be taken into account on a case by case basis when reaching decisions regarding submarine cable development and activities: • Cables should be suitably routed to provide sufficient requirements for installation and cable protection; • New cables should implement methods to minimise impacts on the environment, seabed and other users, where operationally possible and in accordance with relevant industry practice; • Cables should be buried to maximise protection where there are safety or seabed stability risks and to reduce conflict with other marine users and to protect the assets and infrastructure; • Where burial is demonstrated not to be feasible, cables may be suitably protected through recognised and approved measures (such as rock or mattress placement or cable armouring) where practicable and cost-effective and as risk assessments direct; and • Consideration of the need to reinstate the seabed, undertake post-lay surveys and monitoring and carry out remedial action where required.	The Orkney – Hoy (North) and Orkney – Hoy (Centre) Project Descriptions outlined the protective measures for each Cable Route. This MEA has concluded that no likely significant impacts are expected from the cable installation works, once relevant mitigation measures have been implemented. Neither cable will be buried (aside from the landfall site below MHWS) as the area is comprised of large areas of shallow sediments and rocky seabed.
Scottish National Plan Policy Cables 3	A risk-based approach should be applied by network owners and decision makers to the removal of redundant submarine cables, with consideration given to cables being left in situ where this would minimise impacts on the marine historic and natural environment and other users.	The removal of the current cables has not yet been considered. Consideration and evaluation of options relating to potential removal of the existing cables would be undertaken as a separate process.

3 Project Description

3.1 Overview

This section provides an overview of the proposed project activities which will be conducted during the replacement of the Orkney Hoy Centre and North cables. A detailed project description is provided in the Orkney – Hoy (North) Cable Replacement Project Description and the Orkney – Hoy (Centre) Cable Replacement Project Description. These project descriptions should be read in conjunction with this MEA. The supporting project descriptions have been updated subsequent to the environmental assessment presented in this report and may state lower numbers of protection and stabilisation deposits being required than have been assessed in this MEA. This MEA therefore presents a worst case assessment of potential development effects.

The proposed activities are planned to be undertaken between December 2021 and June 2022 with the installation of the Orkney – Hoy (North) cable taking apporximately 86 days and the Orkney – Hoy (Centre) taking approximately 97 days. This anticipated duration includes onshore, nearshore and offshore works, cable pull-in and re-instatement. The completion date is anticipated to be the 30th June 2022. This end date includes contingency to allow for potential unforeseen operational and/or weather delays.

The cables are located in the Orkney Islands off the north coast of Scotland. The project is to install 33 kV HVAC cables between mainland Orkney and the island of Hoy. The North and Centre cables will be replaced on a like-for-like basis with approximate lengths of 5 km and 5.5 km, respectively. The intention is to surface lay the cables within their respective installation corridors, in proximity to the existing North and Centre cables with additional stabilisation and protection provided by a combination of articulated split pipe, rock bags and concrete mattresses. The intertidal sections at the landfall locations at Hoy and Orkney will be buried by land-based excavators. Route engineering will be completed based on the offshore survey data between the existing landing points. Routing will be selected to avoid sensitive environmental receptors and technical constraints (significant rocky outcrops or complex bedforms) if possible, to reduce environmental impact and prevent cable suspensions and abrasion following the installation.

The proposed North cable replacement route starts at Quoyness on Hoy and ends at the designated landing point on mainland Orkney (south of Clestrain). The priority for routing the Hoy-Orkney North cable was to avoid the very shallow regions along the route, namely Fleshes Bank and the skerries to the southeast of Graemsay, whilst also maintaining a minimum 50 m separation from the North cable. The proposed North cable replacement route is not expected to cross the existing submarine power cables. The proposed Centre cable replacement route starts at the same Transition Joint Pit (TJP) as the proposed North cable at Quoyness on Hoy and ends at the same landing point on the Orkney mainland. Unlike the proposed North cable replacement, the proposed Centre cable replacement crosses the existing North cable near the Hoy landfall site before continuing northeast towards Orkney. The proposed Centre cable is then expected to cross the existing North cable again as it approaches the Orkney landfall site.

In order to allow sufficient flexibility for detailed route engineering, two 500 m wide installation corridors, centred on each of the proposed cable replacement routes, will be licensed and considered by this MEA. The location of the installation corridors are shown in Figure 3-1, with coordinates of the bounding points provided in Table 3-1.

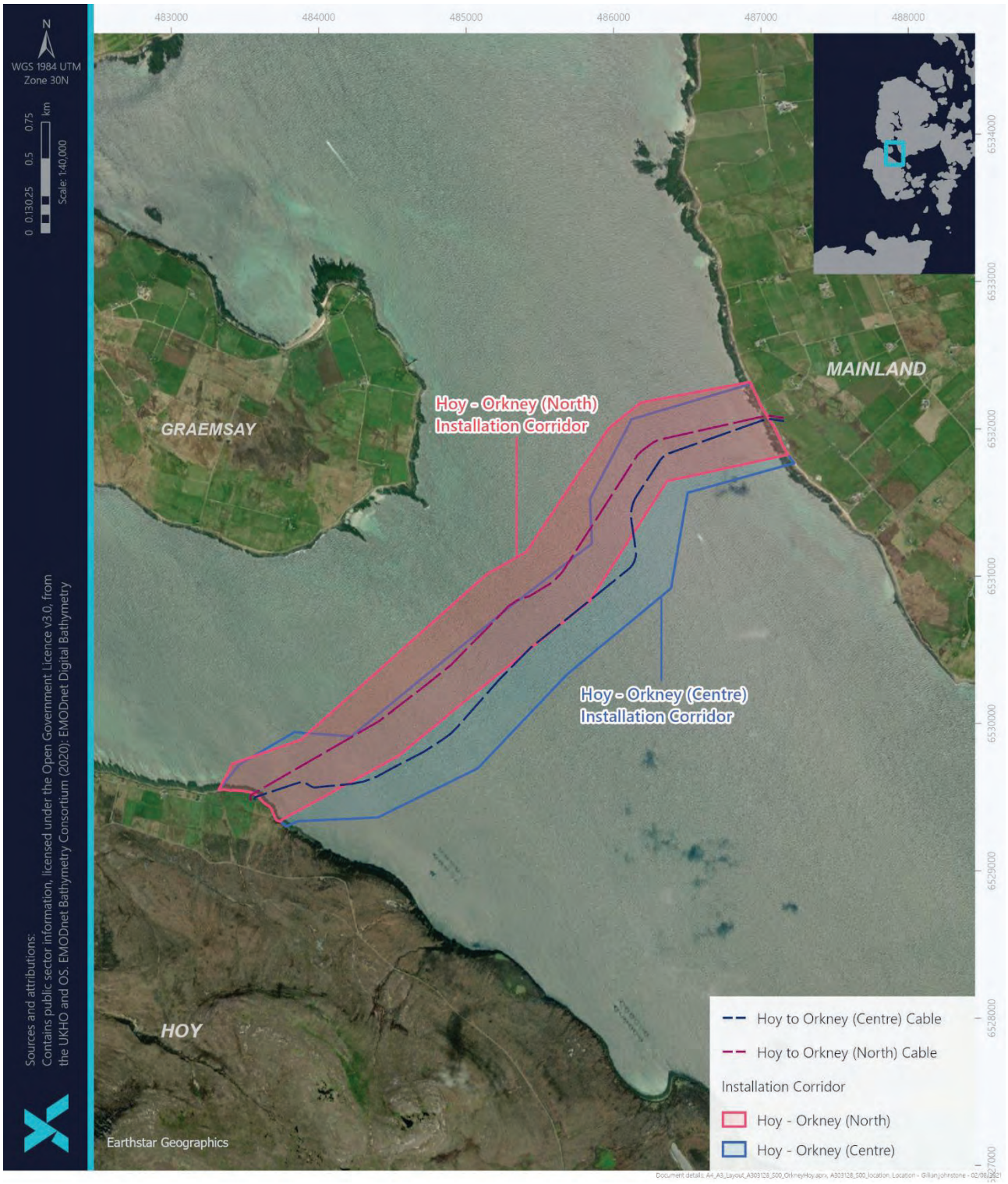


Figure 3-1 Location of the Proposed Replacement Cable Installation Corridors for Orkney – Hoy North and Centre

Table 3-1 Cable Installation Corridors Coordinates in Degrees, Minutes and Seconds (DMS), Degrees and Decimal Minutes (DDM) and Decimal Degrees (DD).

Cable Installation Corridor Coordinates (WGS84)					
Latitude DMS	Longitude DMS	Latitude DDM	Longitude DDM	Latitude DD	Longitude DD
Orkney – Hoy (North)					
58° 55' 27.933" N	3° 13' 5.781" W	58° 55.466' N	3° 13.096' W	58.924425	-3.218272
58° 55' 21.514" N	3° 14' 2.412" W	58° 55.359' N	3° 14.040' W	58.922642	-3.234003
58° 54' 56.597" N	3° 14' 33.528" W	58° 54.943' N	3° 14.559' W	58.915721	-3.242646
58° 54' 6.794" N	3° 16' 44.203" W	58° 54.113' N	3° 16.737' W	58.901887	-3.278945
58° 54' 19.622" N	3° 17' 40.316" W	58° 54.327' N	3° 17.672' W	58.905450	-3.294532
58° 54' 30.357" N	3° 17' 28.953" W	58° 54.506' N	3° 17.483' W	58.908432	-3.291375
58° 55' 12.670" N	3° 15' 38.724" W	58° 55.211' N	3° 15.645' W	58.920186	-3.260756
58° 55' 43.703" N	3° 14' 48.798" W	58° 55.728' N	3° 14.813' W	58.928806	-3.246888
58° 55' 48.230" N	3° 14' 38.879" W	58° 55.804' N	3° 14.648' W	58.930063	-3.244132
58° 55' 51.346" N	3° 14' 28.549" W	58° 55.856' N	3° 14.476' W	58.93092	-3.241263
58° 55' 57.662" N	3° 13' 37.156" W	58° 55.961' N	3° 13.619' W	58.932683	-3.226987
Orkney – Hoy (Centre)					
58° 55' 57.045" N	3° 13' 36.354" W	58° 55.951' N	3° 13.606' W	58.932512	-3.226764
58° 55' 27.128" N	3° 13' 4.926" W	58° 55.452' N	3° 13.082' W	58.924202	-3.218035
58° 55' 17.458" N	3° 13' 55.694" W	58° 55.291' N	3° 13.928' W	58.921516	-3.232137
58° 55' 4.766" N	3° 13' 52.974" W	58° 55.079' N	3° 13.883' W	58.917990	-3.231381
58° 54' 58.420" N	3° 14' 3.249" W	58° 54.974' N	3° 14.054' W	58.916227	-3.234235
58° 54' 20.344" N	3° 15' 23.027" W	58° 54.339' N	3° 15.384' W	58.905651	-3.256396
58° 54' 5.537" N	3° 16' 11.680" W	58° 54.092' N	3° 16.195' W	58.901537	-3.269911
58° 54' 4.026" N	3° 16' 37.970" W	58° 54.067' N	3° 16.633' W	58.901118	-3.277213
58° 54' 19.739" N	3° 17' 39.013" W	58° 54.329' N	3° 17.650' W	58.905483	-3.294170
58° 54' 32.129" N	3° 17' 22.694" W	58° 54.535' N	3° 17.378' W	58.908924	-3.289637
58° 54' 36.964" N	3° 16' 55.799" W	58° 54.616' N	3° 16.930' W	58.910267	-3.282166
58° 54' 41.497" N	3° 16' 13.493" W	58° 54.692' N	3° 16.225' W	58.911526	-3.270414
58° 55' 20.178" N	3° 14' 59.154" W	58° 55.336' N	3° 14.986' W	58.922271	-3.249765
58° 55' 29.243" N	3° 14' 57.945" W	58° 55.487' N	3° 14.966' W	58.924789	-3.249429
58° 55' 47.375" N	3° 14' 34.374" W	58° 55.790' N	3° 14.573' W	58.929826	-3.242881
For the avoidance of doubt, the landward boundaries of all survey corridors covered by this MEA shall be MHWS. The landfall boundaries defined by the coordinates within this document should be considered approximations, due to the requirement to limit the number of vertices.					

3.2 Cable Protection and Stabilisation

In addition to the installation of the cables, external protection measures may also be required such as rock bags, concrete mattresses and grout bags. Cable Protection and Stabilisation Plans (CPSP) have been developed to support the Marine Licence applications, these are located within the associated project descriptions. It should be noted that there are currently no pre-installation plans for grout bags to be used, however these may be required to rectify any cable free spans that are observed following cable installation. Therefore, an assessment of these has been included as part of this MEA along with the other deposits of stabilisation and protection materials (outlined in Section 8.4.1). In addition to this, where concrete mattress installation is required, a Multicat type vessel may be used carry out the installation. During the installation, the Mulitcat may need to hold position by means of clump weight mooring system. These clump weights will be removed on completion of the works and are therefore a temporary deposit.

Where the cables approach the landfalls, above Mean Low Water Spring (MLWS), articulated (split pipe) / uraduct protection will be fitted around the cables for additional protection. A maximum of 507 m and 524 m of split pipe or uraduct protection will be required for the North and Centre cables, respectively. This is installed directly from the Cable Lay Vessel (CLV), by divers or via land based access and protects the cable in the nearshore and intertidal section of the cable route.

Sea Earths may also be installed in order to provide protection from surges and lightning strikes to the electrical circuit provided by the newly installed Orkney – Hoy North and Centre cables. If required, Sea Earths would be installed at all landfall sites of the North and Centre cable. The earth wire is typically installed into the same trench as the marine cable (although some cable manufactures may stipulate a separate trench) with a minimum separation of 200 mm. Should a separate trench be required, the trench would remain within the consented installation corridor of each respective cable. The sea earth would be trenched to a maximin depth of 1.5 m and a width of 1 m.

It should also be noted that during the laying of the cable below MLWS, a Remotely Operated Vehicle (ROV) will be used for Touch Down Monitoring (TDM). This will capture seabed information at the contact point and will help observe the lay tension that is applied to the cable from the vessel. An ROV will also be used during the installation of any external protection measures (i.e. rock bag placement) following cable laying activities. During all ROV operations, Ultra Short Baseline (USBL) positioning systems will be used to monitor the underwater position of the subsea equipment.

A summary of the activities considered by this assessment, is provided below. Please refer to the respective Project Descriptions for further details.

- Prior to cable installation, a work class ROV or Pre-Lay Grapnel Run (PLGR) may be used to remove debris from the proposed routes;
- The submarine power cables will be surface laid using a CLV below MLWS;
- Placement of rock bags, concrete mattresses and potentially grout bags may be used to pin the cable to the seabed below MLWS. In addition, there will also be temporary use of clump weights;
- It is proposed to install the cable by using an open-cut trench method of installation between MLWS to MHWS at the landfall locations. An open cut trench will be excavated to install and bury the cable, and split pipe may be used; and
- Associated vessel presence.

4 Assessment Methodology

This MEA supports SHEPD's applications for authorisation to complete the required works, by providing an assessment of potential impacts on sensitive environmental receptors. Where potentially significant adverse effects are identified, appropriate mitigation will be prescribed in order to reduce the magnitude of effect to an acceptable level.

An assessment of environmental impacts has been undertaken to support the submission of Marine Licence and associated EPS Licence and Basking Shark Derogation Licence applications. The scope of this assessment is exclusively focused on impacts to receptors pertaining to the proposed cable installation activities below MHWS. Data sources used to input into the subsequent assessment have been derived from:

- Relevant studies and reports available for the Cable Route locations as supplied by SHEPD;
- Publicly available literature; and
- Previous reports relating to SHEPD operations within close proximity to the area.

Potential impacts have been evaluated to determine how the cable route replacement activities could affect the environment and the corresponding significance of those impacts. Where potential impacts are likely to be significant, specific mitigation measures have been identified for implementation.

4.1 Marine Surveys

Fugro were contracted to conduct marine geophysical and environmental surveys along the proposed cable route between mainland Orkney and Hoy in 2021. Figure 4-1 illustrates the location of the survey corridor and associated transects. The surveys involved the sampling and analysis of both offshore and nearshore areas and includes the following:

- Fugro (2021a). On the instruction of Global Marine Group, Fugro performed a site survey including geophysical and environmental data acquisition along the Orkney to Hoy proposed cable routes (North and Centre). Fugro performed an intertidal survey at the proposed landfall locations, which were located on the Orkney and Hoy foreshores. Operations were conducted over low water during the survey period 25 to 27 February 2021. Subtidal operations were conducted using the MV Valkyrie on 8 January 2021.

  The geophysical survey was carried out to provide information on seabed bathymetry, topography and to identify any seabed features and potential obstructions which may impede the proposed cable route.

  The habitat assessment was required to describe all habitats within the survey area and to identify the presence and extent of any Annex I habitats, as well as any other habitats or species of conservation interest. The purpose of the Hoy and Orkney benthic intertidal ecology surveys were to provide a robust baseline characterisation of the survey areas and to supplement the existing benthic ecology data from within the area of interest. The intertidal survey recorded intertidal sediments and associated conspicuous species, in addition to classification and mapping of intertidal biotopes within the survey area.

- Fugro (2021b). Fugro was commissioned by Global Marine Group to undertake a geophysical survey for the proposed Orkney – Hoy power cable system connecting the Isle of Orkney to Hoy. The survey was comprised of the collection of multibeam bathymetry (MBES), side scan sonar (SSS), magnetometer, and sub-bottom profiler (SBP) data within the cable corridor; utilising the Valkyrie survey vessel.

  The survey aimed to identify all features or items that lie within the cable route corridor and highlight those that pose a threat to the security of the cable, such as man-made features, wrecks or third party pipeline/cable crossings, or seabed features such as rock outcrops, areas of high mobility or steep slopes which may impact engineering methods.

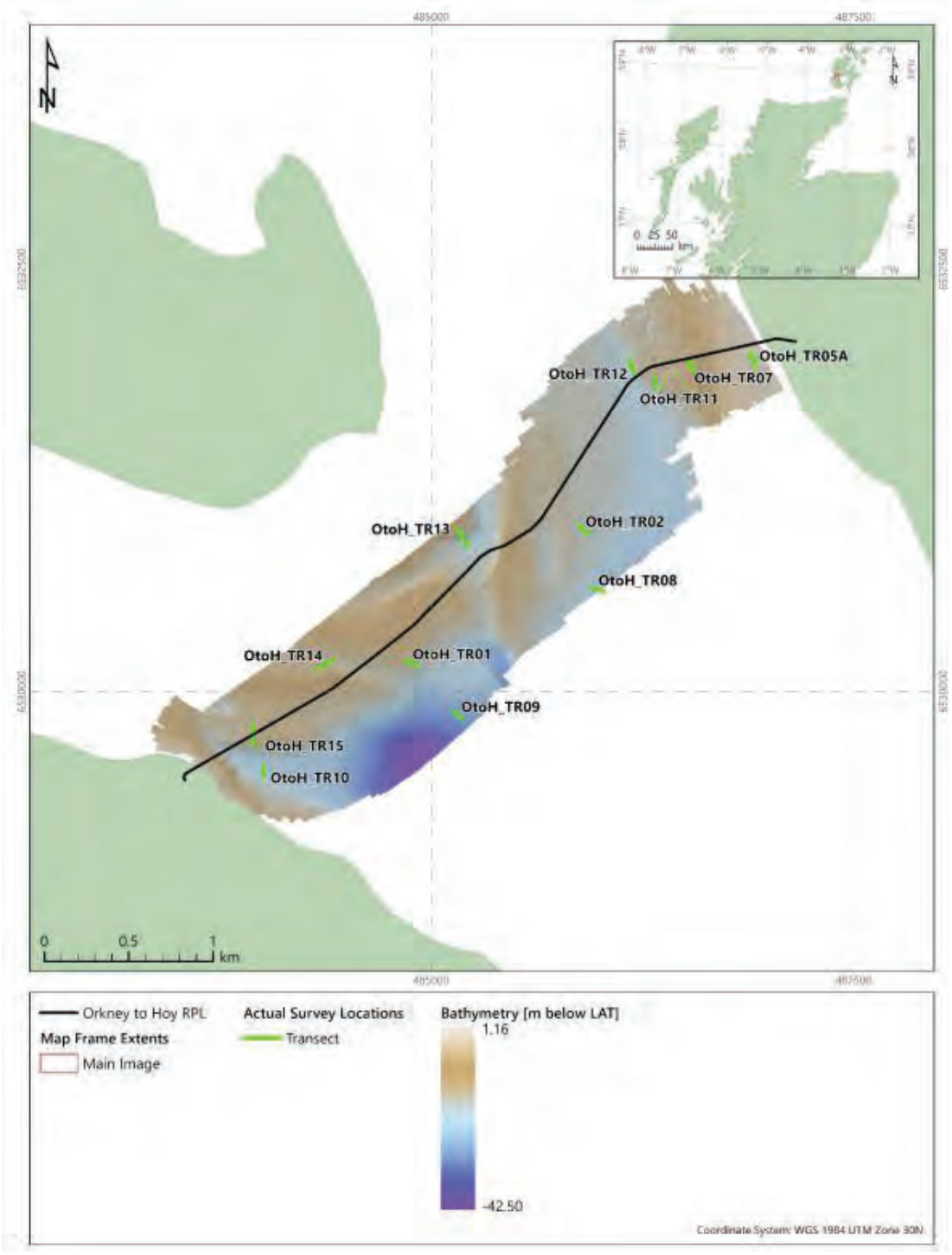


Figure 4-1 Bathymetry and Location of the Environmental Surveys – Orkney to Hoy (Fugro, 2021a)

4.2 Assessment Criteria

This MEA provides an assessment of potential impacts resulting from the effects of the cable route replacement activities on environmental receptors. The terms effect and impact are different, as one drives the other. Effects are measurable physical changes in the environment (e.g. volume, time and area) arising from project activities, while impacts consider the response of a receptor to an effect. Impacts can be defined as direct or indirect, beneficial or adverse.

In order to implement a systematic assessment of impacts between the different receptors an overall approach to the assessment of impacts in order to determine their significance has been implemented. The process considers:

- Sensitivity and value of a receptor;
- Magnitude of effect; and
- Determination and qualification of the significance of the impact.

4.2.1 Sensitivity and Value

The sensitivity of a receptor is a function of its capacity to accommodate change and reflects its ability to recover if it is impacted. Sensitivity of a receptor is based on the following factors:

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

The scale of sensitivity is as follows; negligible, low, medium, high, very high.

4.2.2 Magnitude of Impact

The magnitude of an effect can be characterised by considering the following factors:

- Duration of the impact;
- Size and scale;
- Timing/seasonality; and
- Frequency.

Categorisation of the magnitude of impact will vary for specific topics. The magnitude categories used are negligible, minor, moderate and major.

4.2.3 Significance of Impact

The significance of potential effects has been determined by a combination of the sensitivity and value of a receptor and the magnitude of an effect. The general framework for assessing the significance of potential effects is outlined below (Table 4-2).

Table 4-2 Significance of Impact

Magnitude	Sensitivity/Value				
	Negligible	Low	Medium	High	Very high
Negligible	Negligible	Negligible	Negligible	Minor	Minor
Minor	Negligible	Negligible	Minor	Minor	Moderate
Moderate	Negligible	Minor	Moderate	Moderate	Major
Major	Minor	Minor	Moderate	Major	Major

In general, moderate or major impacts are classified as significant and will require additional mitigation in order to reduce the magnitude of effect to an acceptable level. Where a range of significant effects are determined, expert judgement will be used to consider the final impact.

4.3 Mitigation Requirements

Certain measures are incorporated into the project design as adherence to standard industry best practices or embedded mitigation which is fundamental to how the project will be executed. Details of the embedded mitigation which SHEPD are committed to implementing, and hence has be considered by this MEA presented in Table 4-3. All embedded mitigation will be included within the CEMP.

Additional mitigation has been suggested on a receptor specific basis informed by the impact assessments. During the assessment of impacts in the receptor specific assessment chapters, all proposed mitigation is considered when assessing the significance of an impact.

Table 4-3 Embedded Mitigation and Best Practice Relevant to the Proposed Activities

Measure	Details
Production of a CEMP.	Measures will be adopted to ensure environmental impacts are minimised, and to reduce the potential for release of pollutants from installation works. This will be informed by the results of this MEA.
All project personnel will be trained and informed of their responsibility to implement the environmental and ecological mitigation outlined in the CEMP.	Toolbox talks, inductions, and awareness notices will be used to disseminate this information among all relevant personnel.
Pre-construction surveys will be conducted to inform detailed route engineering.	Appropriate pre-construction surveys and visual inspection will be conducted to confirm the locations of potentially sensitive features. Any obstructions or debris will be removed, if possible. A work class ROV or PLGR will be undertaken to remove debris from the proposed route. In the nearshore area, a diver may be required to remove debris.
Environmental planning.	The final cable routes, and positioning of protective deposits will be optimised to avoid impacts on sensitive environmental features, including Annex 1 habitats and wrecks.
Scottish Marine Wildlife Watching Code (SMWWC)	All vessels will adhere to the provisions of the SMWWC during installation works. NatureScot developed the Code as part of its duties under the Nature Conservation (Scotland) Act 2004. The Code was first published in 2006 and was revised in 2017. The code aims to minimise disturbance to marine wildlife.
Lighting on board installation vessels will be kept to a minimum	Lighting on-board the cable installation vessel will be kept to the minimum level required to ensure safe operations. This will minimise disturbance to seabird species.
Deployment of anchor chains on the seabed will be kept to a minimum	Reduces the potential for disturbance to benthic habitats and species including those which utilise the seabed.
Vessels will be travelling at a slow speed during installation works.	The slow speed of installation vessels will minimise the risk of disturbance and injury impacts to seabird, basking shark and marine mammal receptors.
Production of an Emergency Spill Response Plan	An Emergency Spill Response Plan will help to ensure that the potential for release of pollutants from cable installation works is minimised.

Measure	Details
Control measures and Shipboard Oil Pollution Emergency Plans (SOPEP) will be in place and adhered to under MARPOL Annex I requirements for all vessels. In the event of an accidental fuel release occurring appropriate standard practice management procedures will be implemented accordingly.	As per the MARPOL 73/78 requirement under Annex I, all ships with 400 gross tonnage and above must carry an oil prevention plan as per the norms and guidelines laid down by International Maritime Organization under Marine Environmental Protection Committee (MEPC) Act. Production of this plan will help to ensure that the potential for release of pollutants from construction, operation and decommissioning is minimised.
Vessels will be equipped with waste disposal facilities (sewage treatment or waste storage) to International Marine Organisation (IMO) MARPOL (International Convention for the Prevention of Pollution from Ships) Annex IV Prevention of Pollution from Ships standards.	Measures will be adopted to ensure that the potential for release of pollutants from installation vessels is minimised.
The Waste Framework Directive (WFD) provides the legislative framework for the collection, transport, recovery and disposal of waste, and includes a common definition of waste. The Environment Agency (in England and Wales) and the Scottish Environment Protection Agency (SEPA) (in Scotland) are responsible for administering and enforcing the waste management controls A Waste Management Strategy Plan documenting and mapping each step in the process (i.e. location and company managing waste) and define individual roles and responsibilities.	A Waste Management Plan will be developed and implemented to ensure the waste hierarchy is followed and all waste is sent onward to recycling or disposal via a licenced waste route.
Ballast water discharges from vessels will be managed under International Convention for the Control and Management of Ships' Ballast Water and Sediments, 2004 (Ballast Water Management (BWM) Convention).	The BWM Convention, adopted in 2004, aims to prevent the spread of harmful aquatic organisms from one region to another, by establishing standards and procedures for the management and control of ships' ballast water and sediments. Measures will be adopted to ensure that the risk of Non-Native Marine Species (NNMS) introduction during cable installation works is minimised.
Use of clean materials.	Only clean stone (free from organic contaminants) shall be used in filter bags to reduce the risk of NNMS.

Measure	Details
A Fisheries Liaison Officer (FLO) will be employed to manage interactions between cable installation vessels, personnel, equipment and fishing activity. This will be managed through the FLMAP.	Employment of a FLO will ensure all commercial fisheries operators in the vicinity of the proposed activities will be proactively and appropriately communicated with in terms of proposed Project operations.
Notice to Mariners (including local), Kingfisher bulletins, Radio Navigational Warnings, and/or broadcast warnings will be promulgated in advance of any proposed works. The notices will include the time and location of any work being carried out, and emergency event procedures.	Ensure navigational safety and minimise the risk and equipment snagging.
Compliance with International Regulations for the Prevention of Collision at Sea (IRPCS) (IMO, 1972) and the International Regulations for the Safety of Life at Sea (SOLAS).	IRPCS are the international standards designed to ensure safe navigation of vessels at sea. All installation vessels will adhere to these rules, including displaying appropriate lights and shapes. SOLAS is an international maritime treaty which sets minimum safety standards in the construction, equipment and operation of merchant ships. The convention requires signatory flag states to ensure that ships flagged by them comply with at least these standards. In relation to the Project its compliance will ensure navigational safety.
As built survey data will be provided to the United Kingdom Hydrographic Office (UKHO) and Kingfisher for inclusion on Admiralty Charts and the Kingfisher Information Service – Offshore Renewable and Cable Awareness (KIS-ORCA) charts.	Ensure navigational safety and minimise the risk and equipment snagging.

4.4 Cumulative Impact Assessment

The Current Marine Projects list on Marine Scotland's website (Marine Scotland, 2021) was reviewed to identify other projects with the potential to result in cumulative effects. However, considering the extremely localised nature of the effects likely to be associated with the proposed cable installation activities, no potential cumulative effects were identified, and no further assessment is required.

5 Designated Sites

5.1 Introduction

This chapter will provide the information required to support the HRA process. As such, the project activities will be assessed as to whether they are likely to constitute an LSE on a designated site, in line with the HRA process. Therefore, magnitude and significance of impact will not be discussed within this chapter and these will be determined in the topic-specific receptors impact chapters.

LSE on Natura 2000 sites which include Special Protection Areas (SPA), Special Areas of Conservation (SAC) and Ramsar Sites will be determined. In addition to this, the potential impact on NCMPAs and Designated Seal Haul-outs will also be assessed as per section 82 and 117 of the 2010 Act..

There are no Ramsar sites within 40 km of the proposed works and therefore, no LSE on Ramsar sites are expected. Moreover, an overview of those present within the wider area (Sitelink, 2021) revealed that none were designated for features which have any ecological connectivity with the proposed cable replacement works. As such, impacts on Ramsar sites have not been considered for further assessment.

The following criteria has been used to select those designated sites where potential impacts need to be assessed:

- SACs and NCMPAs (including proposed and candidate sites) with cetaceans or basking sharks as qualifying features within 50 km of the Installation Corridors;
- SACs (including proposed and candidate sites) with harbour seal interests within 50 km of the proposed cable installation corridor and breeding grey seal within 20 km of the proposed cable installation corridors;
- Designated seal haul-outs or grey seal breeding sites that overlap with or located within 500 m of the installation corridors;
- SACs and NCMPAs (including proposed and candidate sites) with otter interests that overlap with or located within 500 m of the installation corridors;
- SPAs and NCMPAs (including proposed and candidate sites) with birds as qualifying features that overlap with or are located within 2 km of the installation corridors;
- SACs and NCMPAs (including proposed and candidate sites) with seabed / benthic protected features that overlap with the installation corridors; or
- Other sites of importance, including Sites of Special Scientific Interest (SSSI), National Scenic Area (NSAs) and World Heritage Sites (WHS) which transect the installation corridors.

It should be noted that all distances to associated sites have been calculated on a straight-line basis. For marine mammal designations, the travel distances of species to the Installation Corridors may be significantly greater than this in reality. Where no LSE is predicted on a Natura 2000 site, NCMPA or designated seal haul-out, the site has been screened out for further assessment in this report. Where an LSE cannot be ruled out, a more detailed assessment has been carried out. Details of mitigation measures have then been presented where necessary. Further details on impacts to qualifying features will also be assessed in the topic-specific chapters in Section 7 – Marine Megafauna, Section 8 – Benthic and Intertidal Ecology and Section 9 – Ornithology.

5.2 Data Sources

This section draws on a number of data sources including published papers and industry-wide surveys. A key data source available for Scottish waters (within 12 nautical miles (NM) and offshore) is the National Marine Plan interactive (NMPi) website (NMPi, 2021) which underpins the Scottish NMP (Scottish Government, 2015).

Identification of designated sites within the vicinity of the Installation Corridors have been obtained using publicly available geospatial data.

5.3 Baseline and Receptor Identification

The designated sites located in the vicinity of the proposed cable replacement installation corridors which have the potential to be impacted by the activities subject to the selection criteria above are outlined in the following sections and in Figure 5-1 and Table 5-1

.

5.3.1 SACs and NCMPAs with Cetaceans or Basking Sharks as Qualifying Features

Although cetaceans are present in the area, the proposed installation corridors do not lie within 50 km of any NCMPA or SACs designated for cetaceans and/or basking sharks. Therefore, no LSE is expected for designated sites with basking shark or cetacean species as qualifying features. As such, no further assessment regarding sites designated for cetaceans or basking sharks is required.

5.3.2 SACs with Harbour or Grey Seal as a Qualifying Feature and Seal Haul-out Sites

As outlined in Section 5.1, the criteria sets out that designated sites with harbour seal qualifying features within 50 km and/or breeding grey seal within 20 km of the proposed cable installation corridors should be considered for discussion.

There are no SACs with grey seals as their qualifying feature within a 20 km distance. However, there is a SAC designated for the protection of harbour seals within 50 km. This site is the Sanday SAC which is located approximately 46 km to the northeast of the installation corridors (JNCC, 2021a).

It is noted that the East Sanday Coast Site of SSSI designated in part for harbour seals are also located within 50 km of the installation corridors. However, this SSSI is wholly encompassed by the Sanday SAC and hence does not require specific assessment within this MEA.

5.3.3 Designated Seal Haul-Outs or Grey Seal Breeding Sites

There are no designated seal haul outs or breeding sites within 500 m of either of the cable installation corridors. The closest site is Hoy which is approximately 1.6 km from the North cable installation corridor and 1.2 km from the Centre cable installation corridor. This distance is from the boundary of the site, and not from the shoreline where hauled out seals will be located. It is not expected that seals utilising the haul out will be disturbed by the proposed cable installation works. Therefore, no ecological connectivity is expected for these designated sites, and as such they have not been considered further in this assessment.

5.3.4 SACs and NCMPAs with Otter Interests

The Eurasian otter *Lutra lutra* are listed in Annex IV of the Habitats Directive as EPS. They are small, semi-aquatic mammals which inhabit riverine, brackish and coastal environments throughout the United Kingdom (UK). Although land mammals, otters depend on both freshwater and marine environments for food. Their marine habitat comprises low, peat-covered coastlines with shallow, seaweed rich waters and a consistent freshwater supply (DECC, 2016).

There are no SACs or NCMPAs located within 500 m of the installation corridors which are designated for the conservation of otters. Therefore, no adverse impacts to otter are expected and further assessment of these features have not been carried out. As part of the scope of work relating to the onshore works otter surveys have been commissioned in consultation with NatureScot and any further licensing requirements will be informed by the outcome of these surveys.

5.3.5 SPAs and NCMPAs with Birds as Qualifying Features

As detailed in Section 5.1, the criteria set-out is to include sites which state birds as their qualifying feature and are located within 2 km of the proposed cable replacement works. Two such sites fall within this criterion which are the Scapa Flow proposed (p)SPA and the Hoy SPA. These sites transect both installation corridors and are discussed below.

The Scapa Flow pSPA covers an area of 371 km^2 which transects the whole area of the Hoy Sound and thereby both the proposed North and Centre cable installation corridors are wholly located within this site. The Scapa Flow pSPA is an enclosed sea area, sheltered by Orkney Mainland to the north, Hoy, South Walls and Flotta to the west and south and Burray and South Ronaldsay to the east. This site is of particular importance to European species including great northern diver *Gavia immer*, red-throated diver *Gavia stellata*, black-throated diver *Gavia arctica* and Slavonian grebe *Podiceps auritus*. The site also supports migratory populations of European importance including European shag *Phalacrocorax aristotelis*, common eider *Somateria mollissima*, long-tailed duck *Clangula hyemalis*, common goldeneye *Bucephala clangula* and red-breasted merganser *Mergus serrator* (SNH, 2016; JNCC, 2021b).

The Hoy SPA covers an area of 182 km^2 which transects the both proposed cable installation corridors over the approaches to Hoy. Approximately 48.2% of this site covers a marine area, with the remaining 51.8% covering land mass. This site is protected for various seabird assemblages (approximately 120,000) of which a variety are Annex II bird species and therefore a designated feature of the site. These species include: great skua *Catharacta skua*, Peregrine falcon *Falco pereginus*, Atlantic puffin *Fratercula arctica*, Northern fulmar *Fulmarus glacialis*, red-throated diver, great black-backed gull *Larus marinus*, black-legged kittiwake *Rissa tridactyla*, Parasitic jaeger *Stercorarius parasiticus* and common guillemot *Uria aalge* (JNCC, 2015, JNCC, 2021b).

Of particular importance to the Hoy SPA is the protection of peregrine falcons. During the breeding season this site supports 0.5% of the Great Britain population. Overall, currently, Peregrine falcons are classified as Least Concern (LC) on the International Union for Conservation of Nature (IUCN) Red List and their numbers today remain stable. Peregrine falcons play an important role in their ecosystem; due to their diet habits, these birds control populations of their prey such as pigeons, doves, ptarmigan, and ducks. Peregrine falcons are highly migratory in the temperate and Arctic parts of its range, moving from North America to South America, Europe to Africa, and northern Asia to southern Asia and Indonesia. The global population is estimated to number 140,000 individuals (IUCN, 2021). The population size is extremely large, and hence does not approach the thresholds for Vulnerable under the population size criterion (<10,000 mature individuals with a continuing decline estimated to be >10% in 10 years or three generations, or with a specified population structure). Due to the species preference to higher remits (from sea level up to 4,000 m (IUCN, 2021), it is expected that the species will not be impacted by the proposed cable replacement activities.

5.3.6 SACs and NCMPAs with Seabed / Benthic Protected Features

There are no SACs or NC MPAs within either of the installation Corridors which are designated for seabed and/or benthic protected features. Therefore, further assessment and consideration of potential impacts to these features have not been carried out. However, it should be noted that some Annex I habitats may feature within the area of the Installation Corridors and have therefore been considered and discussed in Section 8.

5.3.7 Other Sites of Importance

The Hoy and West Mainland NSA transects both cable installation corridors. Legislation defines an NSA as an area "of outstanding scenic value in a national context". The designation's purpose is both to identify finest scenery and to ensure its protection from developments. This is achieved through the planning system. Scotland's planning system safeguards the special qualities of NSAs, with NatureScot acting in an advisory capacity. NSAs are broadly equivalent to the Areas of Outstanding Natural Beauty (AONB) found in England, Wales and Northern Ireland. The Hoy and West Mainland NSA covers an area of 244 km^2 and incorporates parts of the Island of Hoy and Orkney mainland in Scotland, as well as parts of the surrounding sea. Hoy and West Mainland includes one of the six Wold Heritage Sites (WHS) in Scotland, and there are several SACs and SPAs within the NSA (NatureScot, 2020). It is one of 40 such areas in Scotland, which are defined so as to identify areas of exceptional scenery and to ensure its protection by restricting certain forms of development. A few important things to note about this NSA are:

- The entire Hoy portion of the NSA is designated as a SAC, primarily for its upland and coastal habitats.
- 638 ha of heath and coast to the northwest of Stromness is designated as a SAC due to its fens, heaths and vegetated sea cliffs.
- The Loch of Stenness is designated as a SAC due to its marine species (including marine mammals).
- The Hoy portion of the NSA, along with much of the adjoining sea area, is designated as a SPA due to its importance for nine breeding bird species: arctic skua, fulmar, great black-backed gull, great skua, guillemot, black-legged kittiwake, peregrine falcon, puffin and red-throated diver. The area is important for its seabird assemblage, which regularly supports 120,000 individual seabirds during the breeding season (as discussed in Section 5.3.5).

These sites are wholly or partially encompassed by associated SACs and/or SPAs, and hence do not require specific ecological assessment within this MEA, they have been noted here and in Table 5-1 for reference only. There is no overlap with the WHS which is located onshore, to the northeast of the mainland Orkney landfall and hence is out of scope of this assessment. It is expected that the cable installation activities will not cause significant adverse impacts to the features of The NSA, since all elements of the proposed infrastructure will be located subsea, and buried within the intertidal areas, as such no further considerations is required.

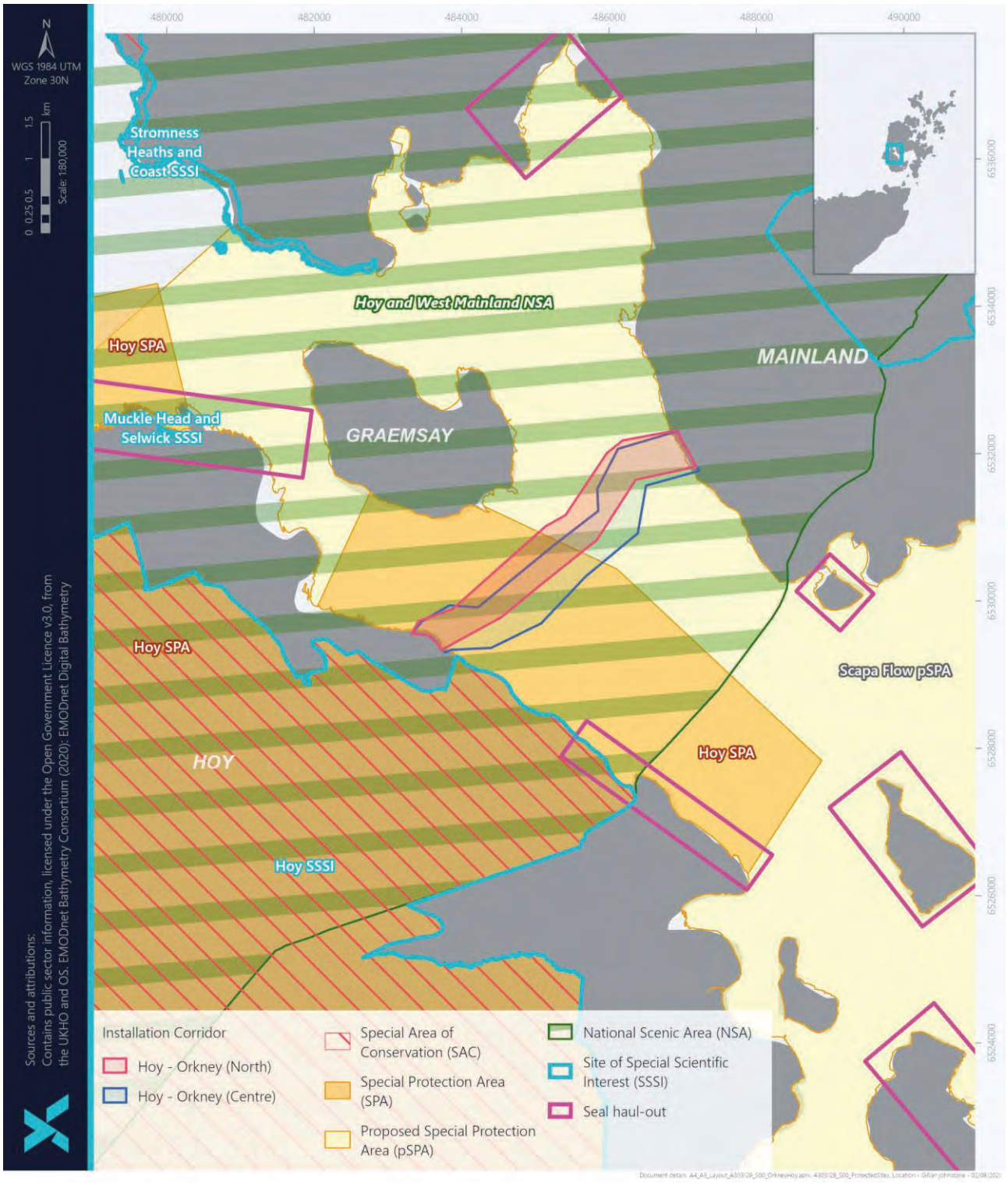


Figure 5-1 Protected Sites in the Vicinity of the Installation Corridors

5.4 Potential Connectivity with Designated Sites

Although there are designated sites within relatively close proximity to the proposed Installation Corridors, for a likely significant effect to arise, there has to be potential ecological connectivity between the installation activities and the qualifying features of a designated site. An initial consideration has been provided within Table 5-1 identifying whether particular designated sites or particular impacts require a more detailed investigation of whether there is a potential LSE. Those sites or impacts for which no LSE is expected are not considered for further assessment.

*Table 5-1 Protected Sites in the Vicinity of the Installation Corridors as per the Assessment Criteria (*Criteria outlined in Section 5) *(JNCC, 2021a; 2021b; NatureScot, 2020; UNESCO, 2021)*

Designated Site (Name and Designation)	Reason for Selection	Distance to Orkney – Hoy Installation Corridors (km)*	Relevant Qualifying features of Designated Site	Potential Impact from Cable Installation Activities	Requirement for Further Assessment
Sanday SAC	This designated site is within 50 km of the Installation Corridor.	46	• Harbour seal	• Underwater noise; and • Vessel presence.	The intervening distance between the Installation Corridors and this designated site means that disturbance at seal haul outs is not anticipated and as such this impact is not considered for further assessment. However, due to the mobile nature of harbour seals further assessment for this qualifying feature is required for the potential impacts at sea.
Hoy SPA	This designated site is < 2 km of the Installation Corridor.	0	This site is protected for various seabird assemblages (approximately 120,000) of which a variety are Annex II bird species. These species include: • Great skua; • Peregrine falcon; • Atlantic puffin; • Northern fulmar; • Red-throated diver; • Great black-backed gull; • Black-legged kittiwake; • Parasitic jaeger; and • Common guillemot.	• Vessel presence	This site transects the Installation Corridors which means that there may be a disturbance at coastal breeding sites, however it is not anticipated to be significant with activities expected to be temporary, short-lived and transient. It is also acknowledged that the seabirds utilising this site may be foraging in the vicinity of the proposed cable installation activities. As such further assessment for these qualifying features is required for potential impacts at sea.
Scapa Flow pSPA	This designated site is < 2 km of the Installation Corridor.	0	This site is of particular importance to European species including: • Great northern diver; • Red-throated diver; • Black-throated diver; and • Slavonian grebe. The site also supports migratory populations of European importance including: • European shag; • Common eider; • Long-tailed duck; • Common goldeneye; and • Red-breasted merganser.	• Vessel presence	This site transects the Installation Corridors which means that there may be a disturbance at coastal breeding sites, however it is not anticipated to be significant with activities expected to be temporary, short-lived and transient. It is also acknowledged that the seabirds utilising this site may be foraging in the vicinity of the proposed cable installation activities. As such further assessment for these qualifying features is required for potential impacts at sea.

Designated Site (Name and Designation)	Reason for Selection	Distance to Orkney – Hoy Installation Corridors (km)*	Relevant Qualifying features of Designated Site	Potential Impact from Cable Installation Activities	Requirement for Further Assessment
The Hoy and West Mainland NSA**	This site transects the installation corridors	0	Hoy and West Mainland includes one of the six WHS in Scotland, and there are several SACs and SPAs within the NSA. This site encompasses the Heart of Neolithic Orkney which includes Maes Howe, the Stones of Stenness, the Ring of Brodgar and Skara Brae.	• Vessel presence	This site transects the Installation Corridors which means that there may be a disturbance to the protected features of the site. The site protects marine and terrestrial aspects. As this site is encompassed by associated SACs and/or SPAs and all activities expected to be temporary, short-lived and transient, no significant impacts are expected. As such further assessment for these qualifying features is not required for potential impacts.

* The distances from both installation corridors have not been provided due to the differences in distances being < 0.1 or the same (i.e. transecting)

** It should be noted that these sites are wholly or partially encompassed by associated SACs and/or SPAs, and hence do not require specific assessment within this MEA, they have been noted here for reference only.

5.5 Assessment of Likely Significant Effects

The following sections will assess the potential for LSE on the designated sites which require further assessment. For each designated site that has the potential to be impacted by the cable replacement works, mitigation measures have been considered based upon site-specific protected features.

5.5.1 Assessment of Likely Significant Effects on SACs with Harbour and/or Grey Seals as a Feature

As per the assessment criteria outlined in Section 5.1, there is one SAC within 50 km designated for harbour seals (Sanday SAC).

The Sanday SAC is located 46 km from both installation corridors. Further details on the assessment of potential impacts on seals is provided in Section 7.

5.5.1.1 Underwater Noise

Underwater noise emissions have the potential to cause physical injury or disturbance to seals, particularly if they fall within their generalised hearing range (Southall *et al.*, 2019; NOAA, 2018). As detailed in Section 7 and Appendix A, no injury risk is associated with the proposed installation works, and the disturbance range is limited to approximately 200 m.

The proposed cable installation activities are due to take place between December and June, so may coincide with breeding and moulting periods of harbour seal (mid-June – August) which are the qualifying feature relevant to the Sanday SAC. However, considering the intervening distance between the Sanday SAC and both Installation Corridors, and the availability of comparable marine habitat surrounding the installation works, the potential for adverse effects on harbour seals is considered limited and are not anticipated to impede their ability to forage or transit to or from their breeding sites within he SAC.

As the installation activities will be transient, temporary and localised, any disturbance to seals at these sites resulting from underwater noise emissions will be temporary and this is not thought to adversely affect the conservation objectives of the protected site. As such, no LSE on the Sanday SAC are expected from underwater noise emissions.

5.5.1.2 Vessel Presence

With the increase in vessel traffic associated with the cable installation, marine mammals could potentially be at an increased risk of collision and disturbance.

However, as the installation vessels will be slow-moving, collision risk is generally considered to be low. Moreover, the presence of vessels associated with the installation works is not considered to be substantive change from baseline vessel activity in the area and as such, there is no LSE expected on these sites.

5.5.2 Assessment of Likely Significant Effects on SPAs with Seabirds as a Feature

As per the assessment criteria outlined in Section 5.1, there is one SPA and one pSPA within 2 km of the Installation Corridors designated for seabirds. These sites are the Hoy SPA and the Scapa Flow pSPA which both transect the Installation Corridors. Further details on the assessment of potential impacts on seabirds is provided in Section 9.

5.5.2.1 Vessel Presence

The proposed cable installation activities will potentially be conducted during the bird breeding season but given the activities are expected to be temporary, short-lived and transient, no significant impacts are expected. In addition to this, this appraisal only covers the marine cable installation activities below MHWS and as such no

direct disturbance to breeding birds at their nesting sites is expected. It is recognised that with the increase in vessel traffic associated with the cable installation activities, seabirds could potentially be at an increased risk of collision and disturbance at sea.

However, as the installation vessels will be slow-moving, and as detailed in Section 4.3, lighting on board the vessels will be minimised in so far as possible, disturbance and risk of collision at sea is anticipated to be minimal. Moreover, the presence of vessels associated with the installation works is not considered to be a substantive change from baseline vessel activity in the area and as such, there is no LSE expected on the Hoy SPA or the Scapa Flow pSPA.

5.5.3 Impact Assessment

Due to the temporary and localised nature of the proposed cable installation activities, no LSE is predicted on the conservation objectives of any protected site and as such it is not expected that an Appropriate Assessment (AA) will be required. Overall, the installation of the Orkney – Hoy North and Centre cables constitutes work of an overriding public need whilst presenting a trivial and temporary disturbance in a limited area.

6 Seabed and Water Quality

6.1 Introduction

This section provides an overview of potential impacts on seabed conditions and water quality resulting from the proposed cable replacement works. Details on baseline seabed conditions presented in this section provides the relevant information for the purposes of the Environmental Appraisal and is not intended for engineering applications.

The offshore section of the proposed cables will be surface laid, and as such no disturbance to underlying geological features in the area is expected. The benthic footprint of the works will be also be minimal, largely confined to the physical footprint of the cable itself, as no seabed modification such as trenching and/or burial will be undertaken. Lateral movement of the cable will be prevented where required by the placement of rock filter bags or concrete mattresses directly onto the cable, with associated impacts on benthic features discussed in Section 8. As such, potential effects on seabed quality have been screened out of this assessment.

As the offshore sections of each cable will be surface laid, the installation activities will not result in significant levels of sediment resuspension, as may be expected from burial activities. Therefore, offshore sedimentation related impacts are screened out and the water quality assessment will focus on potential impacts resulting from accidental release of chemical or hydrocarbon from the installation vessels. It should be noted that burial of the cables is proposed within the intertidal areas, and hence coastal sediment suspension is assessed.

6.2 Data Sources

This section draws on a number of data sources including published papers, industry-wide surveys and site-specific investigations. A key data source available for Scottish waters (within 12 NM and offshore) is the NMPi website (NMPi, 2021) which underpins the Scottish NMP (Scottish Government, 2015). In addition to this, the environmental surveys conducted in 2021 (Fugro, 2021a; 2021b) have also been utilised as mentioned in Section 4.1.

6.3 Baseline and Receptor Identification

According to the British Geological Survey (BGS) illustrated on NMPi (2021) the surface sediments in the vicinity of both Installation Corridors comprise undifferentiated sandy gravel. This is consistent with what was observed during the marine surveys conducted by Fugro which found that most of the seabed within the southern and central reaches of the installation corridors consisted of gravelly SAND and SAND respectively. This area is integrated with four isolated sediment patches of coarser sediment which was identified as sandy GRAVEL. The northern reaches of the corridors are dominated by gravelly SAND with several small elongated sediment bands of sandy GRAVEL and SAND (Fugro 2021b) (Figure 6-1). The area is dynamic and can therefore lead to localised regions of sand ripples where sediment deposition has accumulated subject to tidal currents and areas of exposed boulders and rocky outcrops.

Water depths across the area ranged from approximately 1.2 m above LAT to 40.8 m below LAT (Fugro, 2021b). The bathymetry along the cable routes and in the nearshore areas is presented in Figure 6-2 and Figure 6-3 (Fugro, 2021b)).

The only Annex I habitat likely to transect the area is Annex I reefs, which is further discussed in Section 8.

The Water Framework Directive (WFD) on coastal water body classifications by Scottish Environment Protection Agency (SEPA) over the period 2007 – 2017 (NMPi, 2021) shows that waters in the vicinity of the Installation Corridors have an overall good potential / status or pass.

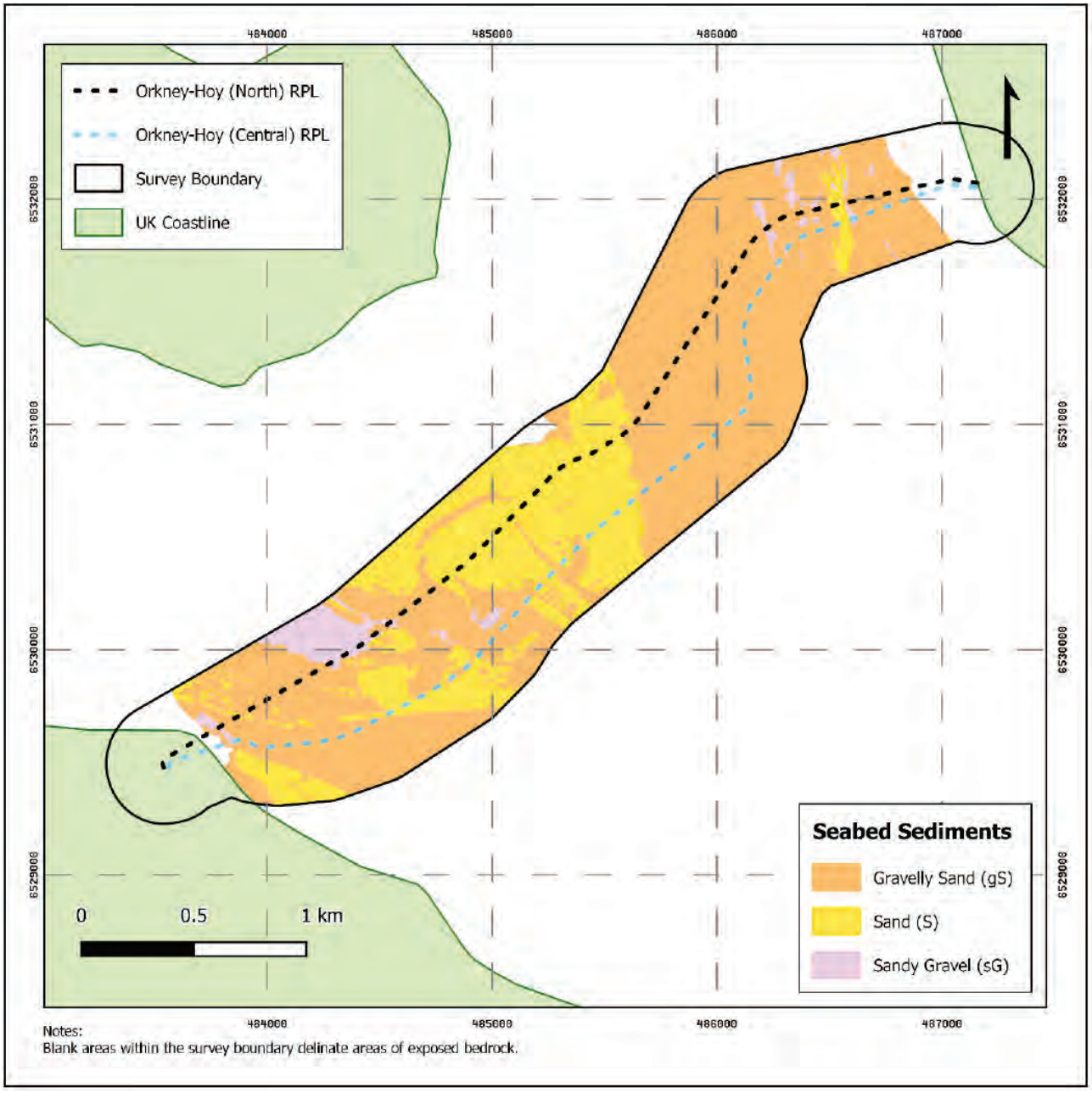


Figure 6-1 Seabed Sediments Overview

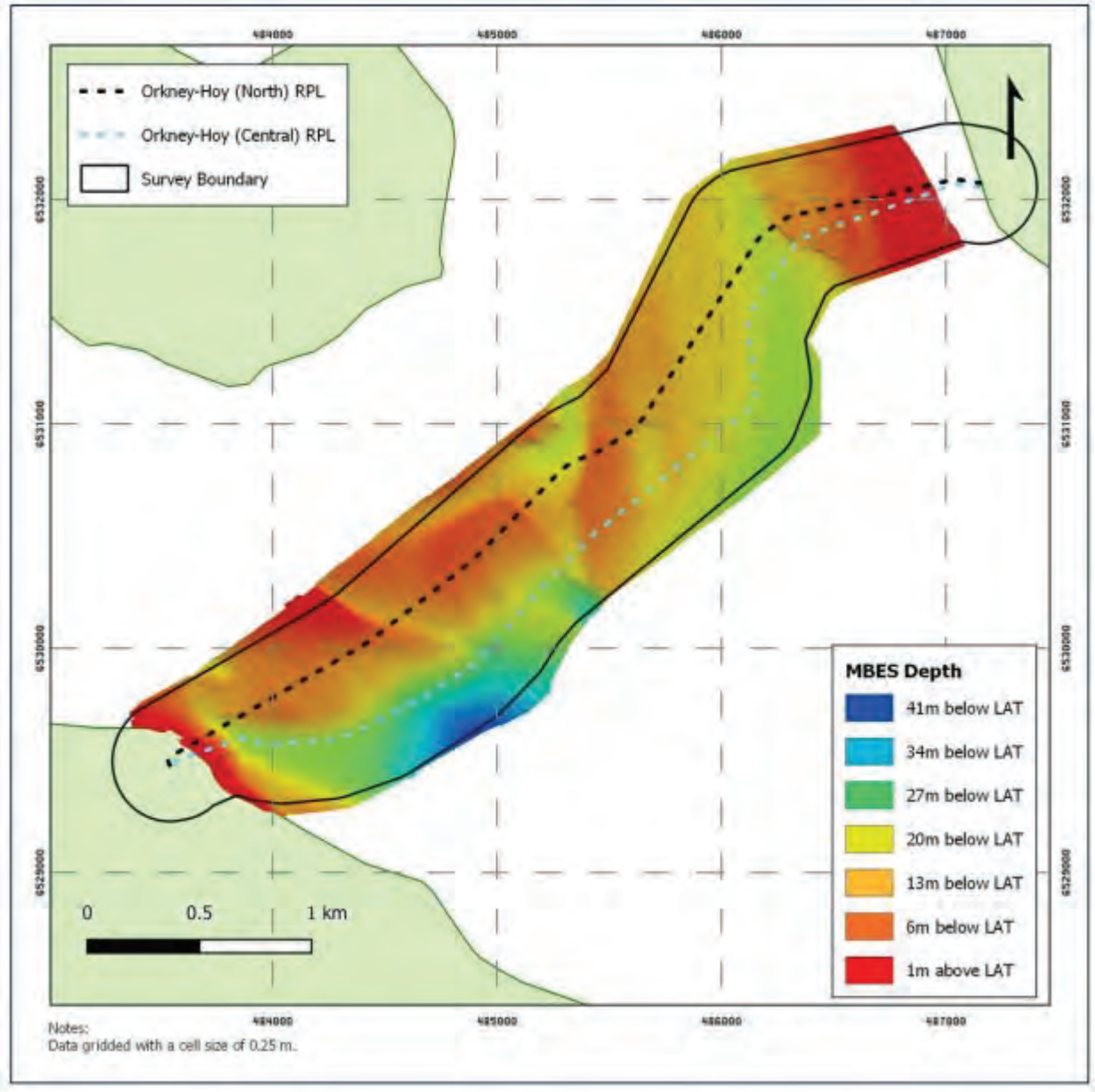


Figure 6-2 Bathymetry Along the Proposed Orkney – Hoy Cable Routes

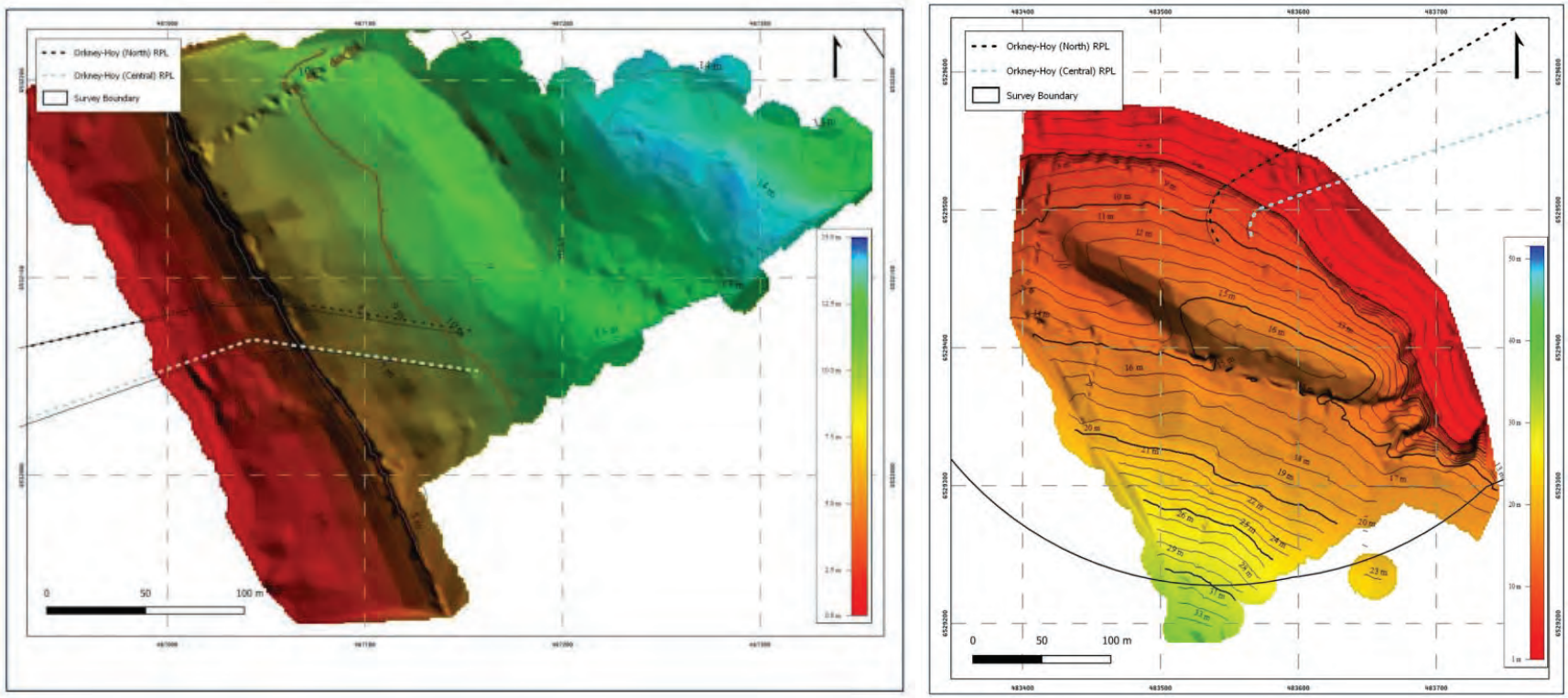


Figure 6-3 Bathymetry at the Orkney (left) and Hoy (right) Landfall Locations (Fugro, 2021b)

6.4 Impact Assessment

6.4.1 Coastal Sediment Suspension

As highlighted in Section 3, the nearshore sections of both cables will be buried by land based excavation. The timing of these works will be tide dependent (working at low water when the intertidal zone is exposed), using traditional terrestrial-based plant including excavators at low tide. It is therefore expected that there will be no disturbance of submerged sediments. There may be temporary and highly localised increases in suspended sediment caused by the incoming tide interacting with the trench walls and associated spoil. However, this will not be significantly greater than that expected by wave action causing low-level erosion of the shoreline sediments. As such the impact on sediment loading is considered to be non-significant.

Assessment of Impact Significance All installation activities at the landfall locations will be tidally dependent, working at low water. Increased suspended sediment will only occur during the interaction between the incoming tide, the trench walls and spoil heaps. This will result in highly localised and temporary increases in suspended sediment. Mitigation measures considered as part of the project design are listed in Section 4 – Assessment Methodology.		
Sensitivity / value	Magnitude of effect	Level of impact
Low	Minor	Negligible
Impact significance – NOT SIGNIFICANT		

6.4.2 Changes to Sediment and Water Quality Following Accidental Release of Hydrocarbons

There is the potential for an unplanned spill to occur in the event that a collision with another vessel occurs, one of the project vessels loses containment of hydrocarbon bunkers, or that a hydraulic line leaks or fails (for example associated with cranes and ROVs. The main release risk associated with the cable installations is a loss of diesel fuel from the installation and support vessels. Diesel has very high levels of light ends, evaporating quickly on release. The low asphaltene content prevents emulsification, therefore reducing its persistence in the marine environment. Light oil (such as diesel) tends to dissipate completely through evaporation and physical dispersion within 1 - 2 days and does not normally form emulsions. Some small-dispersed globules of semi-solid oil may persist for some time if the oil possesses wax or other persistent components.

Any discharge of hydrocarbons will be limited to the inventory of each vessel during the cable installation. Due to the low viscosity of diesel, it will spread very rapidly to form a thin sheen at the surface. The sheen will break up rapidly under the influence of spreading and evaporation. Diesel is unlikely to persist within the water column once the spill has occurred.

Based on the volume and components of marine diesel, it is unlikely that diesel will percolate to the seabed and deposit on sediments. Therefore, sediments are unlikely to be affected by a spill. As such, it is not considered to present a major risk to the environment. Additionally, the project's Emergency Spill Response Plan, and the SOPEPs in place for each vessel, will provide a clear protocol in the event of a release scenario, resulting in rapid and effective remedial action, limiting the extent of any spill.

Accidental releases of hydraulic fluids from the cranes on the project vessels and used for the ROVs are possible. Hydraulic fluids are used as part of a closed system (i.e. lines) in cranes and other machinery equipment (such as ROVs). The potential impacts of a hydraulic fluid release depend on the properties and components of each

hydraulic fluid. Hydraulic fluids can either be oil or water-based. Water-based hydraulic fluids used are unlikely to be toxic to the marine environment and will disperse rapidly as they tend to not bioaccumulate and are biodegradable. Any accidental spills of oil-based hydraulic fluid are unlikely to form a sheen, as the potential volume of hydraulic fluid spilled is likely to be small and mineral oil content is low. Equipment (cranes, ROVs etc.) used during the project will be regularly maintained, reducing the likelihood of a release.

A large spill of hydrocarbons or hydraulic fluids is very unlikely during the planned cable replacement activities. The impact of an accidental release (diesel or hydraulic fluid) is therefore considered to be minor and not significant.

Assessment of impact significance Best Practice will be followed, and it is therefore unlikely that a spill from would occur during the operations. Impact significance will vary depending on the size, volume and nature of the spill. Based on the very low likelihood of such an event, the overall level of impact is Minor. Mitigation measures considered as part of the Project design are listed in Section 4 – Assessment Methodology.		
Sensitivity/ value	Magnitude of effect	Level of impact
Low	Moderate	Minor
Impact significance – NOT SIGNIFICANT		

6.5 Conclusion

All installation activities at the landfall locations will be tidally dependent. Increased suspended sediment will only occur during the interaction between the incoming tide, the trench walls and spoil heaps. This will result in highly localised and temporary increases in suspended sediment which will not have a significant impact on coastal water quality.

Best practice will be followed by all installation vessels, therefore the likelihood of an accidental hydrocarbon releases from the installation vessel is extremely remote. The level of impact is therefore considered minor and not significant.

7 Marine Megafauna

7.1 Introduction

This section of the report provides further detail on the large marine species, including marine mammals and basking sharks, in the vicinity of the proposed marine cable installation corridors, and presents results from an assessment of potential impacts on key sensitive species. Management and mitigation measures to ensure impacts are minimised will also be suggested.

This section also provides a Protected Species Risk assessment, with regard to potential impacts on cetaceans and basking sharks, in order to inform the associated EPS and basking shark licence applications.

7.2 Data Sources

This section draws on a number of data sources including published papers and industry-wide surveys such as Hague (2020). A key data source available for Scottish waters is the NMPi website (NMPi, 2021) which underpins the Scottish NMP (Scottish Government, 2015).

7.3 Existing Baseline Description

7.3.1 Cetaceans

Around nine species of cetacean have been recorded off the north-east coast of Scotland, with four being commonly observed in the region surrounding both Installation Corridors (NMPi, 2021; Reid *et al,* 2003); harbour porpoise *Phocoena phocoena*, minke whale *Balaenoptera acutrostrata*, bottlenose dolphin *Tursiops truncatus*, and white-beaked dolphin *Lagenorhynchus albirostris* (NMPi, 2021). It should be noted that the project area is located within SCANS Block S. The following summarises those species regularly sighted within the Orkney - Hoy area:

- Harbour porpoise are the most abundant cetacean species in UK waters and are generally observed in small groups of one to three individuals (Reid et al., 2003). They are the most frequently sighted cetacean along the east coast of Scotland where they are present year-round (NMPi, 2021; Reid *et al.,* 2003; Hague *et al.,* 2020). They are most commonly sighted between April and October when densities reach > 0.1 individuals/ km^2 (Pollock *et al.*, 2000). The density of harbour porpoise within Block S of the Small Cetaceans Abundance in the North Sea (SCANS) III survey, within which the project resides, was approximately 0.152 animals/km^2, which is average in the context of the wider United Kingdom Continental Shelf (UKCS) region (Hammond *et al.*, 2017). According to density modelling data (combining SCANS-III density data with environmental predictive factors), it is predicted that harbour porpoise densities within the area will be low, with higher densities occurring in deeper offshore waters (Hague *et al.,* 2020; Hammond *et al.,* 2017).
- Minke whale are the smallest, most prevalent baleen whales to occur in Scottish waters. They feed mainly in shallower waters over the continental shelf and regularly appear around shelf banks and mounds, or near fronts where zooplankton and fish are concentrated at the surface (Reid *et al.,* 2003). They are also commonly seen in the strong currents around headlands and small islands, where they can come close to land, even entering estuaries, bays and inlets. Minke whale density within Block S of the SCANS -III survey is considered to be moderate in comparison to the rest of the UKCS, with an estimate 0.01 animals/km^2 (Hammond *et al.,* 2017). This species shows a large seasonal variation with much lower densities in the winter months, likely driven by variations in sea surface temperature and chlorophyll concentrations (Hague *et al.*, 2020). Breeding locations of this species are currently unknown.

- Bottlenose dolphin sightings are less common in Orkney in comparison to other areas on the east coast (Cheney *et al.,* 2013). The main bottlenose dolphin population on the east coast of Scotland resides between the Moray Firth and Fife (Cheney *et al.,* 2013). These bottlenose dolphins are highly mobile and do move north towards Orkney in smaller numbers (Cheney *et al*., 2013; NMPi, 2021). The north coast of Scotland is the most northerly known extent of the coastal bottlenose dolphin ecotype in the Atlantic coasts of Western Europe, and while bottlenose dolphins have been encountered further north and off the shelf edge, they are likely to be the offshore ecotype (Cheney *et al,* 2013; Hague *et al.,* 2020). Densities of bottlenose dolphin along the North coast of Scotland are expected to be lower than the West and East coast and densities within Block S of the SCANS-III survey were approximately 0.004 animals/ km^2, which is low to average for the region (Hammond *et al.,* 2017; Hague *et al.,* 2020).
- White-beaked dolphins are common in Northern European continental shelf seas from Iceland and Norway south to Ireland and Southwest England, including the northern and central North Sea. White-beaked dolphin have an estimated density within Block S of the SCANS III survey of 0.021 animals/km^2, which is considered moderate compared to the rest of the UKCS (Hammond *et al.,* 2017). They are frequently sighted in the Central and Northern North Sea areas throughout the year, mainly in waters of 50 – 100 m depth (Reid *et al,* 2003; Hague *et al.,* 2020). They are most commonly observed in the project area between July and October (NMPi, 2021).
- Other species, such as killer whale, humpback whale and Risso's dolphin are seen infrequently in varying numbers and are occasional and/or seasonal visitors (Hammond *et al,* 2017; Reid *et al.,* 2003; WDC, 2018). A pod of up to eleven Killer whales has been sighted regularly off Orkney during the summer months, these are likely to migrate to Norwegian waters for the rest of the year. These species do not occur frequently enough to require specific assessment.

The distribution, density, and abundance of the five most commonly occurring cetacean species in the vicinity of the two installation corridors are described in Table 7-1.

Table 7-1 Population Parameters of Cetacean Species Potentially Present in the Vicinity of the Installation Corridors

Species name	Estimated density across the project area1 (individuals/km2) (Hammond *et al.,* 2017)	Management Unit (MU) / biogeographical population estimate (IAMMWG, 2015)
Harbour porpoise	0.152	227,298
Minke whale	0.010	23,528
Bottlenose dolphin	0.004	195
White-Beaked dolphin	0.021	15,895

7.3.2 Seals

Two species of seals inhabit UK waters: the grey seal *Halichoerus grypus* and the harbour seal *Phoca vitulina*. The waters around Scotland are an important habitat for both species, which utilise the coastlines and nearshore waters year-round for breeding and feeding (Pollock *et al.,* 2000).

[1] SCANS III Block S used for density estimate

The at-sea density of grey and harbour seals surrounding the Orkney – Hoy North and Centre Installation Corridors are shown in Figure 7-1.

The mean at-sea usage of grey seals is high for both installation corridors with densities in the area ranging between 10 – 1,000 individuals per 25 km^2. The mean at-sea usage of harbour seals is lower than that of grey seals but still features moderate densities for both installation corridors, with densities ranging between 1 - 50 individuals per 25 km^2. Densities of both species have been recorded as higher nearer Hoy.

The pupping season of harbour seals is mid-June to July with moulting occurring in August. Grey seals in Orkney breed from October through to December and then moult until early April (SCOS, 2018). Similar to seabirds, seals are central-place foragers, utilising a terrestrial 'base' for important life history events (i.e. breeding, pupping, moulting, etc.) and to rest, and then head offshore on foraging trips before returning to land (Pollock, 2000). While both species are associated with shallower shelf waters, grey seals often make longer foraging trips to deeper waters than harbour seals.

As discussed in Section 5, there is one SAC with harbour seals as their qualifying feature within a distance of 50 km from the Installation Corridors. This is the Sanday SAC located approximately 46 km to the northeast.

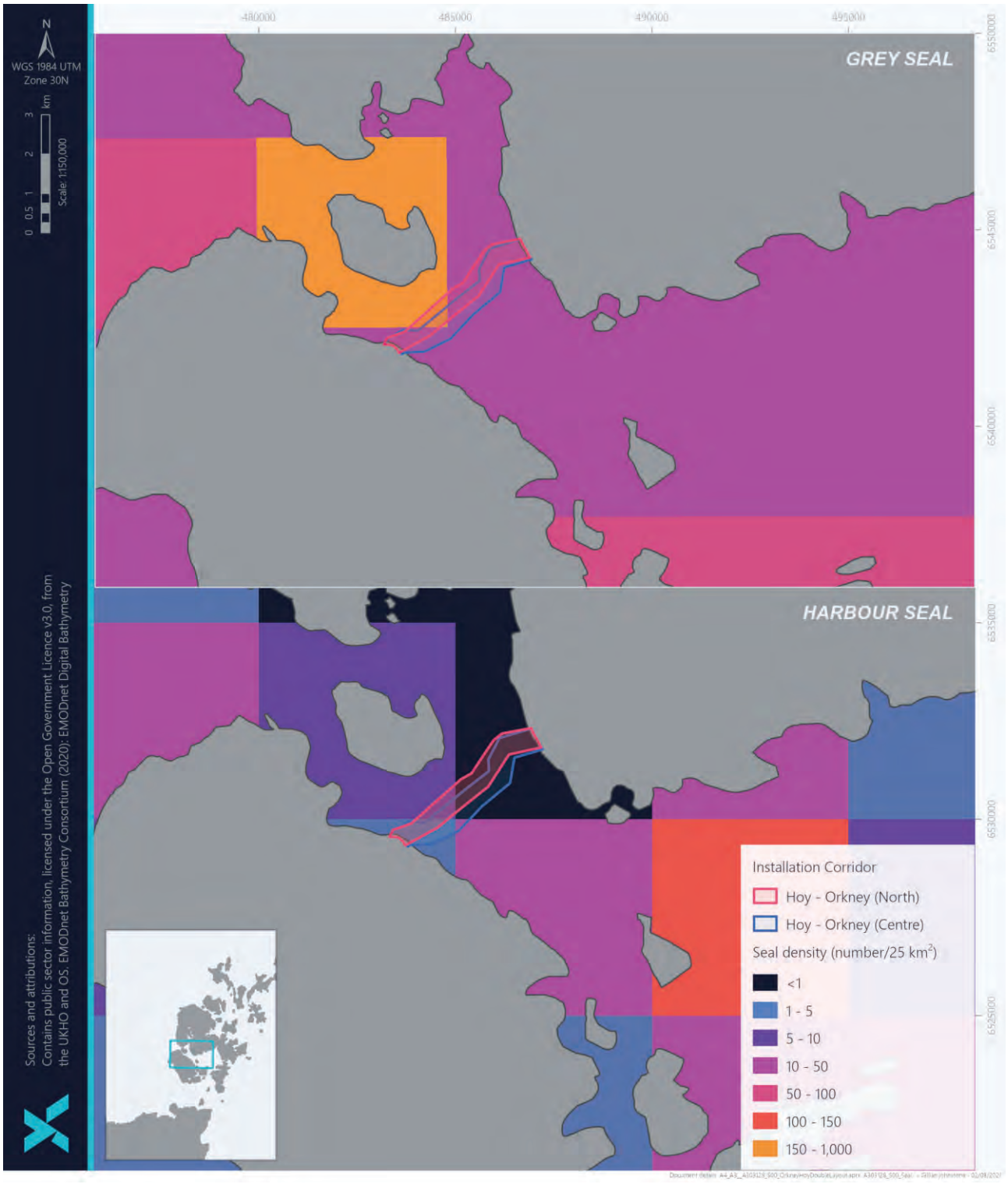


Figure 7-1 Estimated Grey and Harbour Seals at Sea Densities in the Vicinity of the Installation Corridors

7.3.3 Basking Shark

Basking sharks (*Cetorhinus maximus*) are one of the only three species of shark which filter feed and are the second largest fish in the world (Sims, 2008). This species can be found throughout the offshore waters in the UK continental shelf (Sims, 2008) and are considered frequent visitors to the north and west coasts of Scotland (HWDT, 2018; Witt *et al*, 2012). They are widely distributed in cold and temperate waters and feed predominantly on plankton and zooplankton e.g. barnacles, copepods, fish eggs and deep-water oceanic shrimps by filtering large volumes of water through their wide-open mouth. They typically move very slowly (around 4 miles per hour). In the winter, they dive to great depths to get plankton while in the summer they are mostly near the surface, where the water is warmer.

Due to their size, slow swimming speeds and preference for swimming in coastal waters during the summer months, basking sharks are considered to be at potential risk of collision with vessels associated with the cable route survey activities. Given that basking sharks are slow to mature and have a long gestation period, the species can be slow to recover if populations are rapidly depleted.

Basking sharks seasonally arrive on Scottish shores during spring and leave in autumn. They appear to aggregate in summer to breed, with peak numbers in July and August. The NMPi (2021) reports basking sharks to be present in the vicinity of Orkney - Hoy are at a predicted density of 0.00-0.10 animals/km^2.

7.4 Impact Assessment

This section outlines the proposed activities which have the potential to impact upon marine megafauna species, including cetaceans, pinnipeds, and basking shark.

7.4.1 Identification of Potential Impacts

This section reviews potential impacts to marine megafauna receptor species from the proposed installation activities and narrows down which activities require further assessment to identify the likelihood and significance of those impacts.

Impacts from accidental releases from pollution for all marine megafauna have not been considered for further assessment given that the likelihood of this is extremely low.

7.4.1.1 Impacts on Marine Mammals

Underwater noise emissions from the cable installation activities are likely to constitute the greatest potential risk to marine mammals within the vicinity of the proposed activities. Noise has the potential to impact cetaceans and other marine species in two ways:

- Injury – physiological damage to auditory or other internal organs; and
- Disturbance (temporary or continuous) – disruptions to behavioural patterns, including, but not limited to: migration, breathing, nursing, breeding, foraging, socialising and / or sheltering (note: this impact factor does not have the potential to cause injury).

If a noise emission is composed of frequencies which lie outside the estimated auditory bandwidth for a given species, then the potential for auditory impacts are considered to be very unlikely (NOAA, 2018). To understand the potential for noise-related impacts, the likely hearing sensitivities of different marine mammal hearing groups has been summarised in below in Table 7-2.

Table 7-2 Auditory Bandwidths Estimated for Marine Mammals (Southall et al., 2019; NOAA, 2018)

Hearing group	Estimated auditory bandwidth
Low-frequency (LF) cetaceans: (e.g. baleen whales, such as minke whales, humpback whales, etc.)	7 Hz to 35 kHz
High-frequency (HF) cetaceans: (e.g. dolphins, toothed whales, beaked whales and bottlenose whales)	150 Hz to 160 kHz
Very high-frequency (VHF) cetaceans: (e.g. marine mammal species such as harbour porpoises and other 'true' porpoises)	275 Hz to 160 kHz
Phocid carnivores in water (PW): (e.g. earless or 'true' seals, such as grey and harbour seals)	50 Hz to 86 kHz

The main sources of underwater noise associated with cable installation activities include:

- Vessel noise from ships and other marine plant utilised during the works;
- Noise from cable laying activities;
- Noise from the USBL device used to position the ROV to conduct touch down monitoring and installation of external protection; and
- Noise from geophysical survey devices used during pre, during and post installation survey and inspection. However, geophysical surveys are subject to existing consents held by SHEPD and are out-with the scope of this assessment.

While vessel noise is broadband and will be audible to marine mammals, the presence of the installation vessels along the Installation Corridors will not constitute a substantive change from baseline vessel numbers, or types of vessels in the area. As such the presence of installation vessels will not result in a significant change to the existing soundscape in the area, hence, this aspect does not have the potential to result in adverse underwater noise impacts on cetaceans and is not considered further.

Underwater noise emissions resulting from the cable laying activities are expected to be minimal. This is because SHEPD intend to surface lay the North and Centre cables, and no sub-marine trenching or burial works are proposed, as described in the Orkney – Hoy (North) and Orkney – Hoy (Centre) Project Description. Trenching works in the intertidal area will be conducted at low water when the area is dry, and hence there is no potential for underwater noise emissions to result from this activity. As such, noise from cable laying works does not have any potential for adverse effects on cetaceans and is not considered further.

USBL devices commonly operate in a frequency range which makes them audible to cetaceans, and hence this activity does have the potential to result in adverse effect on these receptors. The highly mobile nature of cetaceans and the temporary, localised nature of USBL noise emissions associated with the Project dramatically reduce the likelihood of interactions between Project activities and cetacean receptors resulting in significant impacts. However, as the risk of injury or disturbance to a small number of individual animals remains and EPS licence may be required, hence impacts from noise emissions associated with USBL have been carried forward for further assessment.

Collision risk is another potential risk to marine mammals in the area and may cause mortality and sublethal injury (Laist *et al.* 2001). However, marine mammals are highly mobile and as all of the proposed activities associated with cable installation activities are due to take place from slow moving vessels operating in well-defined routes, collision risk is anticipated to be negligible. Any remaining residual risk from vessel movements will be further reduced on the basis of the embedded mitigation measures outlined in Section 4, which include the management of vessel speed and the commitment for project vessels to adhere to the SMWWC. For this reason, vessel movements have not been identified as having the potential to cause adverse or significant impacts to the FCS of any marine mammal population and has therefore been screened out from further assessment.

The marine mammal species of interest in the area do not rely extensively on eyesight for hunting and navigation and potential impacts resulting from localised elevation of sediment, considering this and the fact that changes to water quality are expected to be minimal (as detailed in Section 6), water quality impacts are not discussed further.

Vessel and human presence in the immediate vicinity of seal haul-outs may potentially impact seals. Seals are particularly susceptible to disturbance during their respective pupping and moulting seasons, when the residency of seals at haul-outs and in surrounding waters elevates the relative density of each species. Given that the proposed cable installation works are expected to occur between December and June, this is likely to overlap with the pupping and moulting season for harbour seals. That said, there are no designated seal breeding or haul-out sites within 500 m of either installation corridor (as detailed in Section 5.3). As such, impacts to seals from landfall activities have not been considered further.

7.4.1.2 Impacts on Basking Sharks

The basking shark is an elasmobranch (sharks and rays) which is a group with generally low sensitivity to noise vibrations due to the fact they do not have a swim bladder. The hearing range of basking sharks is not known; however, five other elasmobranchs have been found to have a hearing range between 20 Hz to 1 kHz (Macleod *et al.*, 2011). It is acknowledged that this may not be entirely transferable to basking sharks, however since the USBL equipment operates at a minimum frequency of 20 kHz (which is several of orders in magnitude higher than 1 kHz) it is unlikely this equipment will be audible to basking sharks. On this basis, the potential for noise emissions to impact upon basking sharks is screened out of further assessment.

Vessel collision does pose a threat to this slow-moving species. Collision risk increases with increasing vessel speed. As the survey vessels will be moving slowly, collision risk is generally low, however does warrant further assessment.

7.4.2 Injury or Disturbance from Noise Emissions

Underwater noise generated by USBL constitutes the only source of sound with the potential to cause injury or significant disturbance to marine mammals. USBL typically operates in the frequency range of 20 – 33.5 kHz, and as such is audible to all marine mammal species likely to be present in the vicinity of the cable corridors. The USBL source level utilised during the cable replacement activities will be limited to 200dB re 1µPa (peak).

Noise modelling has been undertaken to identify the potential range (i.e. the straight-line distance from the source) in which noise impacts to marine mammals could occur. This assessment was based on the methods and thresholds provided by the current best practice guidance, as presented by National Oceanic and Atmospheric Administration (NOAA) and Southall (NOAA, 2018; Southall *et al.* 2019). The full noise assessment has been presented in Appendix A; a summary of the results is presented below.

The peak injury criteria were not exceeded for any marine mammal hearing group, since the source level is less than 202 dB re 1µPa (peak), as such no injury risk to marine mammals has been identified for USBL according to this metric. However, a theoretical risk of injury has been identified with regard to the cumulative sound exposure level criteria.

Under the worst-case scenario, the largest injury range resulting form USBL was 104 m for VHF cetaceans (harbour porpoises), when considering cumulative sound exposure levels for a stationary animal. For whale, dolphin, and seal receptors (LF, VHF and PW hearing groups) the potential injury ranges were significantly reduced. While a theoretical injury risk is identified by the underwater noise modelling, this is based on a cumulative exposure over an extended time period. As such, in order for a harbour porpoise to be at risk of injury, an animal would have to remain within 104 m of the USBL device for a period of several hours. The likelihood of this scenario occurring is extremely low when considering that the source is deployed from a moving vessel, and that animals will tend to move away from sources of acoustic disturbance.

As such, the assessment concludes that there is no realistic risk of injury to marine mammals, resulting from the use of USBL with source levels up to 200 dB re 1µPa (peak).

Whilst no injury impacts are expected, noise emissions have the potential to affect the behaviour of marine mammals in the vicinity of the noise source. Significant or strong disturbance may occur when an animal is at risk of a sustained or chronic disruption of behaviour or habitat use resulting in population-level effects. The potential impacts resulting from USBL noise was modelled in the noise assessment in Appendix A.

Under the worst-case scenario, it was predicted that a behavioural change may occur for marine mammals within 207 m of the cable installation vessel. As such, underwater noise emissions from the use of USBL have the potential to elicit a strong behavioural response in marine mammals which could be classed as a disturbance of EPS offence as defined under Regulations 39(1) or 39(2).

However, for the relevant biogeographical population Management Units (MU) for harbour porpoise, minke whale, bottlenose dolphin and white-beaked dolphin, which all occur in the area, this will not result in population levels effects or adverse impact the FCS of the species. This is due to the fact that the noise assessment predicts that less than 0.1% of the biogeographic populations of relevant cetacean species will be impacted by noise-related disturbance as a result of USBL operations. Moreover, the number of animals within the disturbance range at any one time is predicted to be < 0.1. This means that on average, there will be no marine mammals within the disturbance range for 90% of USBL operations, making potential disturbance impacts at the population level arising from this equipment negligible.

As the vessel and/or the subsea equipment (e.g. an ROV) will generally not be stationary during USBL operations, animals within a particular area will not be exposed to extended periods of underwater noise. Rather, individuals would have to follow the moving equipment to be subjected to lasting or prolonged periods of acoustic disturbance. As such, the exposure to disturbance from USBL operations will be extremely limited in duration, and hence does not have the potential to result in adverse effects at a population or species level.

Given the transient, highly localised and short-term nature of the USBL activities, it is highly unlikely that any disturbance offences from use of USBL would negatively impact upon the FCS of any of the cetacean species which may be present in the survey area. This is on the basis that the modelled level of disturbance is unlikely to affect the ability of any individual animal to survive or reproduce and will not have significant population-level impacts to any marine mammal. As such, no mitigation is required to limit the potential impacts on marine mammals resulting from USBL operations.

The above notwithstanding, it is possible that a small number of cetaceans may experience some level of disturbance for the short period that they encounter the proposed installation activities. As such, EPS Licences are expected to be required for the USBL-related activities which will be conducted during the installation of the Orkney - Hoy cable installation activities (as per Regulation 39(2)) (Scottish Government, 2014).

Impacts to marine mammal receptors There will be no injurious impacts to marine mammals as a result of noise-generating installation activities. However, there is potential for disturbance to marine mammals from underwater noise. Activity-related disturbance is expected to be limited to one or a few individuals of a species and will therefore not result in any adverse impact to the FCS of any marine mammal species. As the impact is not significant, no secondary mitigation measures are required. Embedded mitigation measures considered as part of the Project design are listed in Section 4.3.		
Sensitivity/value	Magnitude of effect	Level of impact
High	Minor	Minor
Impact significance – NOT SIGNIFICANT		

7.4.3 Injury or Disturbance from Vessel Presence (Basking Sharks)

As discussed in Section 7.4, impacts on marine mammals resulting from vessel presence are screened out of this assessment. However, basking sharks are considerably less mobile than marine mammals, and are therefore identified as being more sensitive to vessel presence.

The vessels being used for the cable installation activities will be moving slowly during operations which will reduce the risk of collision and disturbance to basking sharks. Moreover, SHEPD are committed to ensuring vessels adhere to the SMWWC. These factors considerably reduce the risk of injury or disturbance to basking sharks resulting from interaction with project vessels. Furthermore, basking shark densities are reported to be low in the vicinity of the cable installation activities which further reduces the risk of interactions between basking shark and vessels occurring.

Considering these factors, and that the presence of the project vessels will not constitute a substantive change from baseline vessel activity in the vicinity of Orkney - Hoy, it is concluded that vessel presence will not adversely affect the FCS of basking sharks. However, since the risk of disturbance cannot be entirely ruled out, a basking shark derogation licence may be required under the WCA 1981.

Impacts to basking sharks There the risk of injury or disturbance of basking sharks as a result of vessel presence during the Orkney - Hoy cable installation activities are extremely limited, and not expected to reduce FCS of the species. As the impact is not significant, no secondary mitigation measures are required. Embedded mitigation measures considered as part of the Project design are listed in Section 4.3.		
Sensitivity/value	Magnitude of effect	Level of impact
Medium	Minor	Minor
Impact significance – NOT SIGNIFICANT		

7.5 Conclusion

Underwater noise emissions are the impact mechanism most likely to affect marine megafauna in the area of activities. Noise modelling used to inform the assessment, presented in Appendix A, demonstrates that whilst there may be some disturbance to marine mammals resulting from USBL operations, this is likely to be limited in space and time and should only affect a few individuals of any species.

There will be no injurious impacts to cetaceans or seals as a result of project activities and no requirement to apply for an EPS Licence in that respect. However, there is potential for disturbance to cetaceans, and SHEPD will therefore apply for an EPS Licence in respect to disturbance of cetaceans. However, this disturbance is expected to be limited to one or a few individuals of the local population and will therefore not result in any adverse impact to the FCS of any marine mammal species.

The proposed activities will not result in the catching or killing of seals, and thus the protection provided to the two species by the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) will not be breached.

Furthermore, the short-term and localised nature of the proposed activities mean that harbour and grey seals making use of protected haul-outs is not expected to be significantly disturbed. As such, the protection given by Section 117 or the Marine (Scotland) Act 2010, and the Protection of Seals (Designation of Haul-Out Sites) (Scotland) 2014 will also not be breached.

It is acknowledged that the presence of the installation vessels does have the potential to result in adverse (injury or disturbance) interactions with basking sharks. However, considering their low abundance of the species in the area, behaviour of the installation vessels, and embedded mitigation the risk of this occurring is extremely remote. No adverse impact on the FCS of basking shark is therefore expected, however SHEPD will apply for a basking shark derogation licence, since the risk cannot be entirely ruled out.

Considering the temporary and localised nature of the activities, there are not anticipated to be any significant impacts to individuals or populations of marine megafauna in the area.

8 Benthic and Intertidal Ecology

8.1 Introduction

This section provides detail on the benthic and intertidal habitats and species located along, and in the immediate vicinity of, the proposed cable corridors and landfall locations. An assessment of potential impacts on key sensitive habitats and species is presented, along with an outline of secondary mitigation measures that will be undertaken in order to ensure impacts are minimised. The impact assessment focuses on habitats that are protected or are qualifying features of conservation sites located within the installation Corridors and that have the potential to be impacted.

As highlighted in Section 3, the intertidal sections of both cables will be buried by land based excavation which has the potential to cause sediment resuspension. However, the timing of these works will be tide dependent (working at low water when the intertidal zone is exposed).

As outlined in the Orkney – Hoy Project Descriptions, the replacement cables will be surface laid, with no burial proposed below MLWS. This will not result in significant levels of sediment resuspension, as would be expected from burial or jet-trenching activities. Therefore, offshore sedimentation related impacts are screened out of the assessment.

It should be noted that the Installation Corridors have been considered together in the assessment due to the Installation Corridors overlapping considerably, with the seabed and associated benthic features therefore expected to be similar.

8.2 Data sources

This section draws on a number of data sources including published papers, industry-wide surveys and site-specific investigations. A key data source available for Scottish waters is the NMPi website (NMPi, 2021) which underpins the Scottish NMP (Scottish Government, 2015). In addition to this, the environmental surveys conducted in 2021 (Fugro, 2021a; 2021b) have also been utilised as mentioned in Section 4.1.

8.3 Baseline and Receptor Identification

8.3.1 Overview

The Orkney - Hoy Installation Corridors are located within the Hoy Sound in an area of dynamic tidal regime. The sound is fed by western currents originating from the influx of Atlantic water, via the Fair Isle Channel which promotes wave action and tidal streams. Hoy and the Orkney mainland are large, low-lying islands in the southwest of the Orkney archipelago. Surrounded by clear, relatively shallow water, the islands have complex coastlines dominated by extensive sandy beaches and sheltered inlets, interspersed with rocky headlands.

The below subsection summarise the sediment types and biotope observed in the area during the Fugro surveys (2021a; 2021b).

8.3.2 Nearshore Characteristics

8.3.2.1 Orkney Nearshore Area

The proposed cables will make landfall at mainland Orkney. The landfall within this area is 80% high grass pasture with swampy regions. The beach transition is a small slope of approximately 2 m high from the water line. The beach area is mostly flat, but rocky with large unmovable boulders and stratified rocks are also present (Figure 8-1). An aerial view of the mainland Orkney landfall is shown Figure 8-2.

The broad habitat 'Littoral rock and other hard substrata' (A1) includes all hard substrata (e.g. bedrock, boulders and cobbles) that occurs in the splash zone and intertidal regions. Several areas of littoral rock and other substrata were observed. Table 8-1 summarises the classification hierarchy for the intertidal habitats (from high level environment to low level sub-biotope) observed within the survey area with distribution shown in Figure 8-3.

Figure 8-1 Beach at the Orkney Landing Area (Fugro, 2021b)

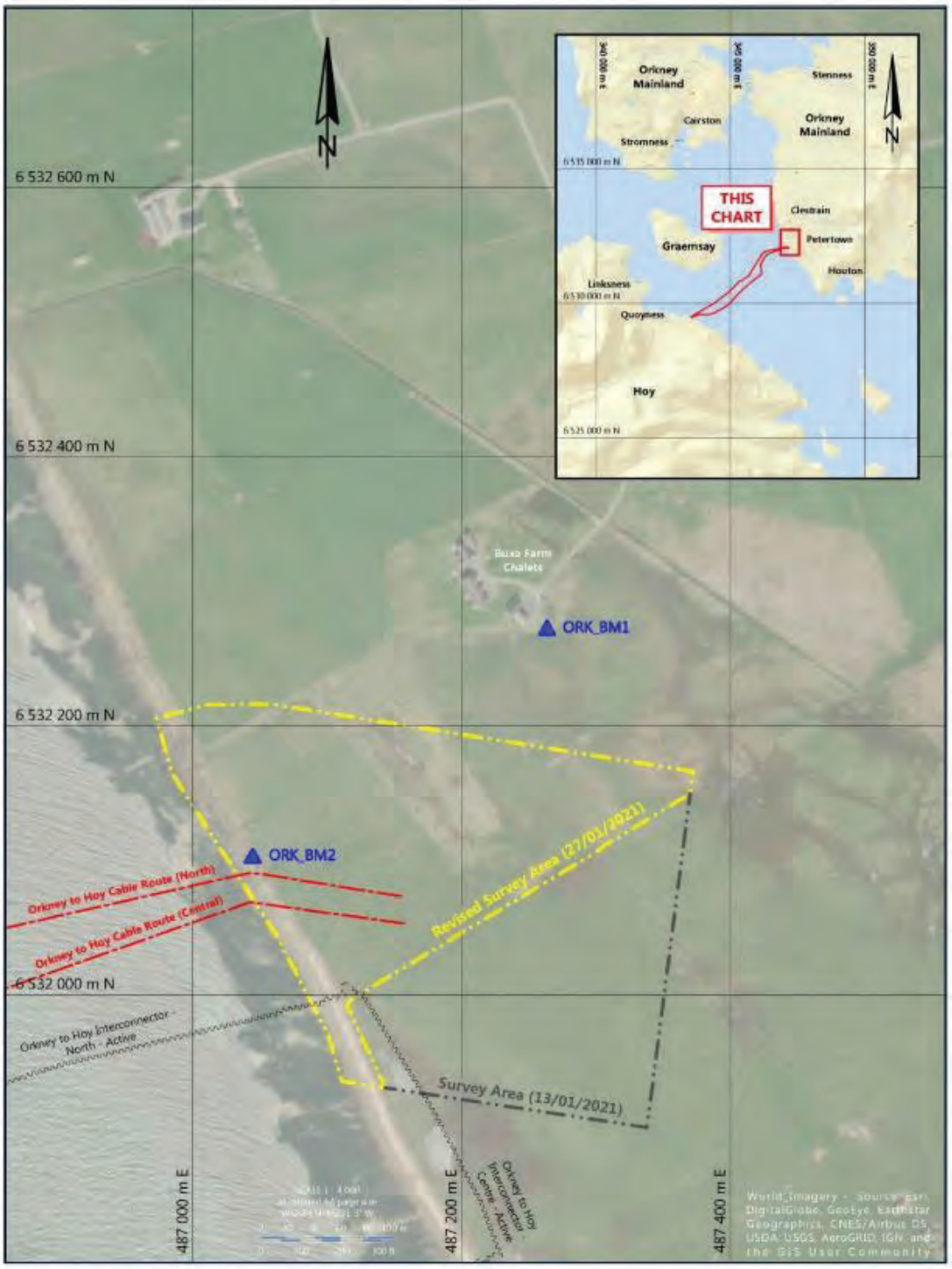


Figure 8-2 Birdseye View of the Orkney Landfall Area (Fugro, 2021b)

Table 8-1 Key Biotopes Recorded in the Intertidal Areas at the mainland Orkney Landfall Site

Broad Habitat Level 2	Broad Habitat Level 3	Broad Habitat Level 4	Broad Habitat Level 5	Broad Habitat Level 6
A1 Littoral rock and other hard substrata	A1.1 High energy littoral rock	A1.11 Mussel and/or barnacle communities	A1.113 Semibalanus balanoides on exposed to moderately exposed or vertical sheltered eulittoral rock	-
	A1.2 Moderate energy littoral rock	A1.21 Barnacles and fucoids on moderately exposed shores	A1.211 Pelvetia canaliculata and barnacles on moderately exposed littoral fringe rock	-
			A1.213 Fucus vesiculosus and barnacle mosaics on moderately exposed mid eulittoral rock	-
			A1.214 Fucus serratus on moderately exposed lower eulittoral rock	A1.2141 Fucus serratus and red seaweeds on moderately exposed lower eulittoral rock
				A1.2142 Fucus serratus and underboulder fauna on exposed to moderately exposed lower eulittoral boulders
	A1.3 Low energy littoral rock	A1.31 Fucoids on sheltered marine shores	A1.312 Fucus spiralis on sheltered upper eulittoral rock	A1.3121 Fucus spiralis on full salinity sheltered upper eulittoral rock
			A1.313 Fucus vesiculosus on moderately exposed to sheltered mid eulittoral rock	A1.3131 Fucus vesiculosus on full salinity moderately exposed to sheltered mid eulittoral rock
			A1.314 Ascophyllum nodosum on very sheltered mid eulittoral rock	A1.3141 Ascophyllum nodosum on full salinity mid eulittoral rock
			A1.315 Fucus serratus on sheltered lower eulittoral rock	-
	A1.4 Features of littoral rock	A1.41 Communities of littoral rockpools	-	-
		A1.45 Ephemeral green or red seaweeds (freshwater or sand-influenced) on nonmobile substrata	-	-

Broad Habitat Level 2	Broad Habitat Level 3	Broad Habitat Level 4	Broad Habitat Level 5	Broad Habitat Level 6
A2 Littoral sand and muddy sand	A2.1 Littoral coarse sediment	-	-	-
	A2.2 Littoral sand and muddy sand	A2.21 Strandline	A2.211 Talitrids on the upper shore and strandline	-
	A2.5 Coastal saltmarshes and saline reedbeds	A2.55 Pioneer saltmarshes	-	-
A3 Infralittoral rock and other hard substrata	A3.1 Atlantic and Mediterranean high energy infralittoral rock	A3.12 Sediment-affected or disturbed kelp and seaweed communities	A3.126 Halidrys siliquosa and mixed kelps on tide-swept infralittoral rock with coarse sediment	-
	A3.2 Atlantic and Mediterranean moderate energy infralittoral rock	A3.21 Kelp and red seaweeds (moderate energy infralittoral rock)	A3.211 Laminaria digitata on moderately exposed sublittoral fringe rock	A3.2112 Laminaria digitata and underboulder fauna on sublittoral fringe boulders
B3 Rock cliffs, ledges and shores, including the supralittoral	B3.1 Supralittoral rock (lichen or splash zone)	B3.11 Lichens or small green algae on supralittoral and littoral fringe	B3.111 Yellow and grey lichens on supralittoral rock	
	B3.3 Rock cliffs, ledges and shores, with angiosperms	-	-	-

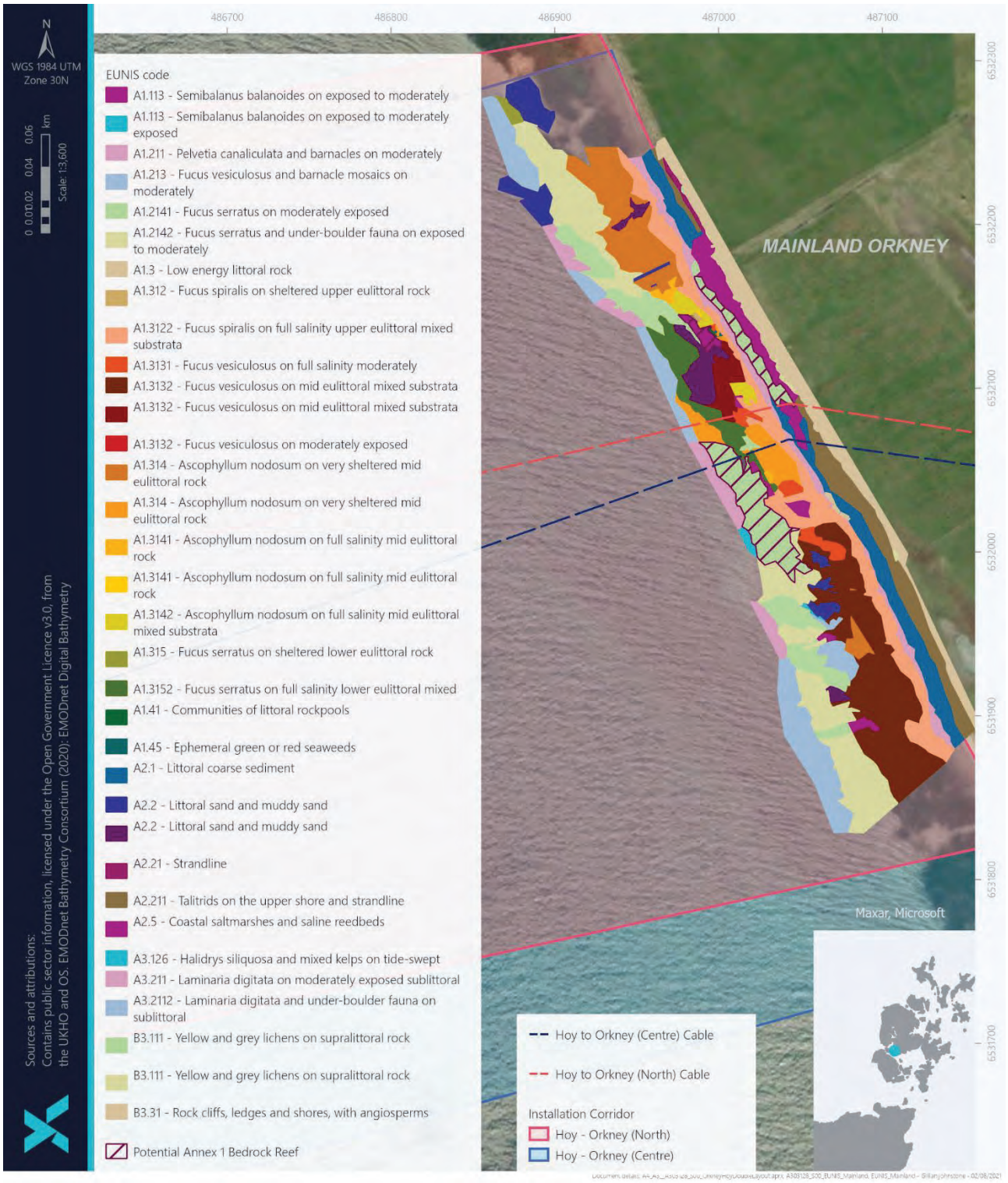


Figure 8-3 Seabed Biotopes within the Landfall Region of Orkney (Fugro, 2021b)

There were various protected and/or sensitive habitats and species observed along the Orkney nearshore area which included coastal saltmarshes, geogenic reefs and intertidal under-boulder communities (Fugro, 2021a).

Figure 8-3 Figure 8-3 Example Photographs of Potential Intertidal and Coastal Protected Habitats at Nearshore Orkney (Fugro, 2021a) presents example photographs of these observed protected features.

Saltmarsh vegetation consists of a limited number of halophytic (salt tolerant) species adapted to regular immersion by the tides and were observed during the Fugro (2021a) survey. Saltmarshes are defined in the UKBAP (UKBAP, 2007) as the lower limit of pioneer saltmarsh vegetation (but excluding seagrass *Zostera* beds) and the upper limit as one metre above the level of highest astronomical tides to take in transitional zones. The Joint Nature Conservation Committee (JNCC) biotope complex 'Saltmarsh' (LS.LMp.Sm) is a relevant biotope for this UKBAP priority habitat. Within the Orkney intertidal survey area, the biotope complex 'Pioneer saltmarshes' (A2.55; contained within 'Saltmarsh' LS.LMp.Sm) was present. Therefore, there was the potential for the UKBAP 'Coastal saltmarsh' habitat to occur on the upper bedrock shoreline, above the lichen dominated bedrock within the Installation Corridor (Fugro, 2021a).

Geogenic reefs are rocky marine habitats or biological concretions that rise from the seabed. They are generally subtidal but may extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide. Intertidal areas are only included within this Annex I type where they are connected to subtidal reefs (JNCC, 2021c). Within the Orkney intertidal survey area bedrock outcroppings were present along the low tide area and extended into the sublittoral zone. The bedrock supported seaweeds (Fucoids) and barnacles (*S. balanoides*). Therefore, this area could potentially meet the criteria of be Annex I geogenic (bedrock) reef (Fugro, 2021a).

The UKBAP priority habitat 'Intertidal under-boulder communities' can occur from the mid eulittoral to the sublittoral fringe, encompassing areas of boulders (>256 mm diameter) that support a diverse under-boulder community. The under-boulder habitat (including fissures, crevices and any interstitial spaces between adjacent boulders) is a series of microhabitats that naturally increase biodiversity (BRIG, 2008). Under-boulder communities in the Orkney intertidal survey area were indicated by the presence of sub-biotopes '*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders' (A1.2142/LR.MLR.BF.Fser.Bo) and '*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders' (A3.2112 /IR.MIR.KR.Ldig.Bo). These sub-biotopes were present along the low tide area and extended into the sublittoral zone. The communities supported kelp (*L. digitata*), seaweeds (*F. serratus*) and diverse under-boulder communities including low densities of maerl (*P. calcareum*). Therefore, there was the potential for the UKBAP priority habitat 'Intertidal under-boulder communities' to occur in the Orkney nearshore area (Fugro, 2021a).

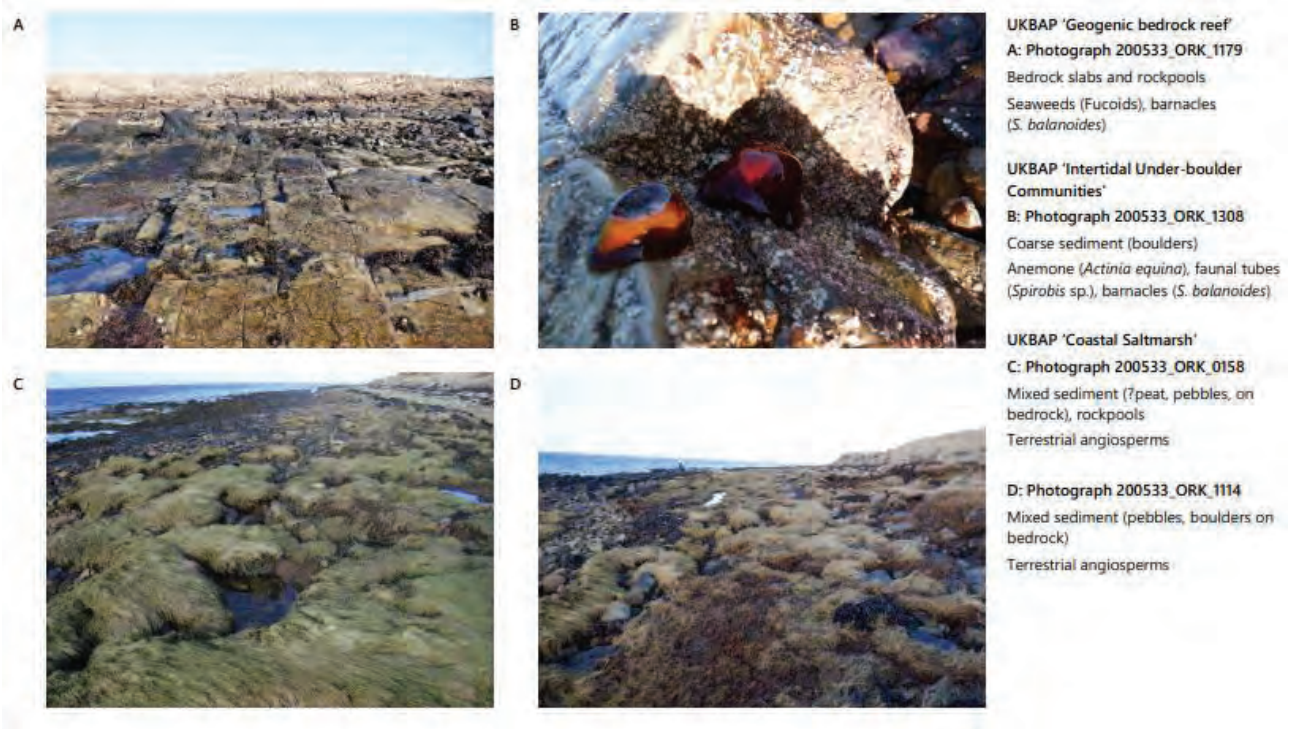


Figure 8-3 Example Photographs of Potential Intertidal and Coastal Protected Habitats at Nearshore Orkney (Fugro, 2021a)

8.3.2.2 Hoy Nearshore Area

The proposed cables will make landfall at Hoy. The Hoy foreshore predominantly comprised bedrock slabs that extended into the subtidal, in places overlaid by coarse sediments (e.g. sand to boulders) that were disturbed by wave action (Figure 8-4). An aerial view of the Hoy landfall is shown Figure 8-5.

The broad habitat 'Littoral rock and other hard substrata' (A1) includes all hard substrata (e.g. bedrock, boulders and cobbles) that occurs in the splash zone and intertidal regions. Several areas of littoral rock and other substrata were observed. Table 8-2 summarises the classification hierarchy for the intertidal habitats (from high level environment to low level sub-biotope) observed within the survey area with distribution shown in Figure 8-6.

Figure 8-4 Beach at the Hoy Landing Area (Fugro, 2021b)

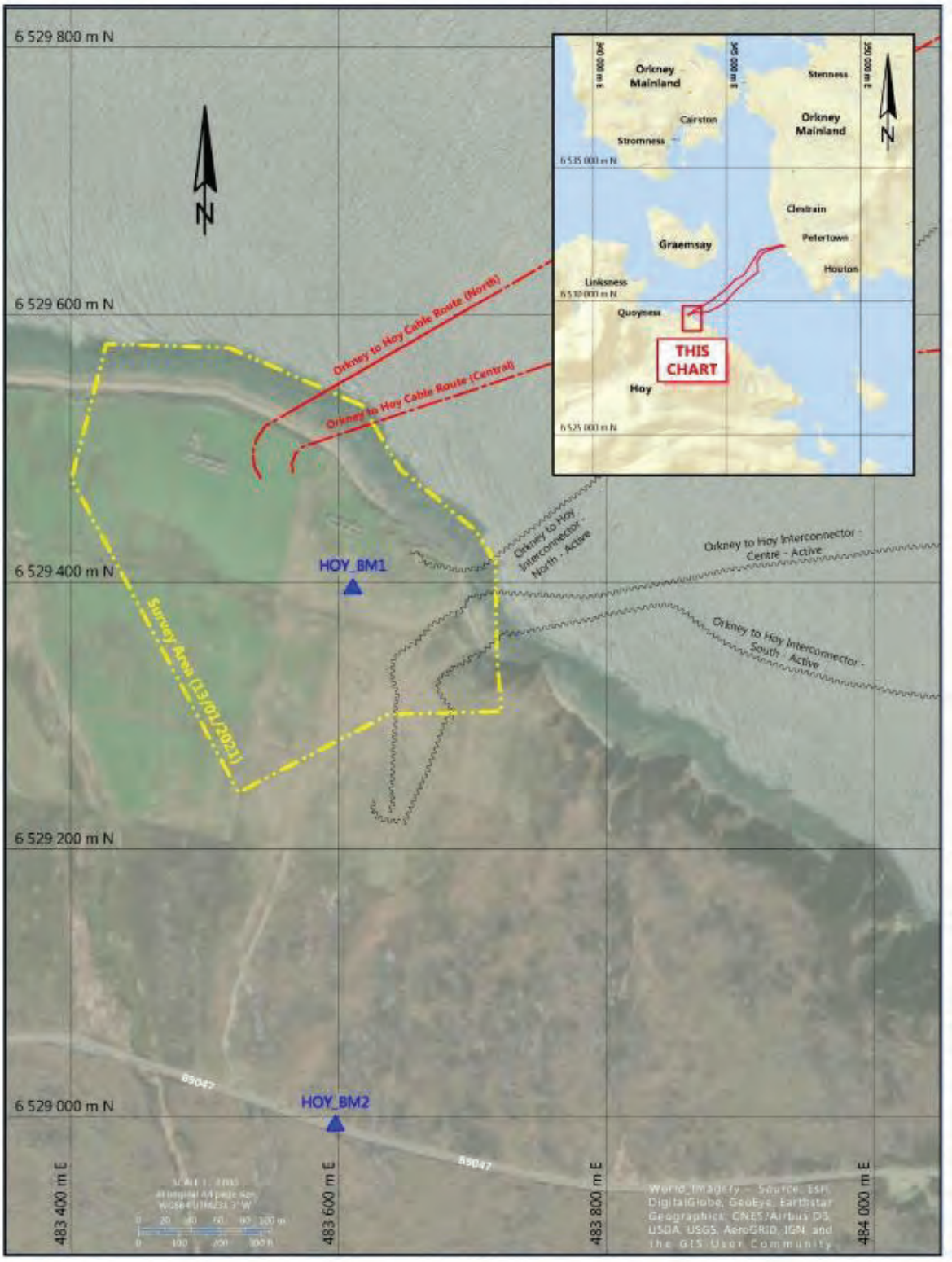


Figure 8-5 Birdseye View of the Hoy Landfall Area (Fugro, 2021b)

Table 8-2 Key Biotopes Recorded in the Intertidal Areas at the mainland Orkney Landfall Site

Broad Habitat Level 2	Broad Habitat Level 3	Broad Habitat Level 4	Broad Habitat Level 5	Broad Habitat Level 6
A1 Littoral rock and other hard substrata	A1.1 High energy littoral rock	A1.12 Robust fucoid and/or red seaweed communities	A1.123 Himanthalia elongata and red seaweeds on exposed lower eulittoral rock	-
	A1.2 Moderate energy littoral rock	A1.21 Barnacles and fucoids on moderately exposed shores	A1.211 Pelvetia canaliculata and barnacles on moderately exposed littoral fringe rock	-
			A1.213 Fucus vesiculosus and barnacle mosaics on moderately exposed mid eulittoral rock	-
			A1.214 Fucus serratus on moderately exposed lower eulittoral rock	A1.2141 Fucus serratus and red seaweeds on moderately exposed lower eulittoral rock
				A1.2142 Fucus serratus and underboulder fauna on exposed to moderately exposed lower eulittoral boulders
	A1.3 Low energy littoral rock	A1.31 Fucoids on sheltered marine shores	A1.312 Fucus spiralis on sheltered upper eulittoral rock	A1.3121 Fucus spiralis on full salinity sheltered upper eulittoral rock
			A1.313 Fucus vesiculosus on moderately exposed to sheltered mid eulittoral rock	A1.3131 Fucus vesiculosus on full salinity moderately exposed to sheltered mid eulittoral rock
			A1.314 Ascophyllum nodosum on very sheltered mid eulittoral rock	-
	A1.4 Features of littoral rock	A1.41 Communities of littoral rockpools	A1.411 Coralline crust-dominated shallow eulittoral rockpools	-
		A1.42 Communities of rockpools in the supralittoral zone	A1.421 Green seaweeds (Enteromorpha spp. and Cladophora spp.) in shallow upper shore rockpools-	-
		A1.45 Ephemeral green or red seaweeds (freshwater or sand-influenced) on nonmobile	-	-

Broad Habitat Level 2	Broad Habitat Level 3	Broad Habitat Level 4	Broad Habitat Level 5	Broad Habitat Level 6
A2 Littoral sand and muddy sand	A2.1 Littoral coarse sediment	A2.11 Shingle (pebble) and gravel shores	A2.111 Barren littoral shingle	-
	A2.2 Littoral sand and muddy sand	A2.21 Strandline	-	-
	A2.5 Coastal saltmarshes and saline reedbeds	A2.55 Pioneer saltmarshes	-	-
A3 Infralittoral rock and other hard substrata	A3.2 Atlantic and Mediterranean moderate energy infralittoral rock	A3.21 Kelp and red seaweeds (moderate energy infralittoral rock)	A3.211 Laminaria digitata on moderately exposed sublittoral fringe rock	-
A5 Sublittoral sediment	A5.1 Sublittoral coarse sediment	A5.13 Infralittoral coarse sediment	-	-
B3 Rock cliffs, ledges and shores, including the supralittoral	B3.1 Supralittoral rock (lichen or splash zone)	B3.11 Lichens or small green algae on supralittoral and littoral fringe rock	B3.111 Yellow and grey lichens on supralittoral rock	
			B3.112 Prasiola stipitata on nitrateenriched	-
	B3.3 Rock cliffs, ledges and shores, with angiosperms	-	-	-

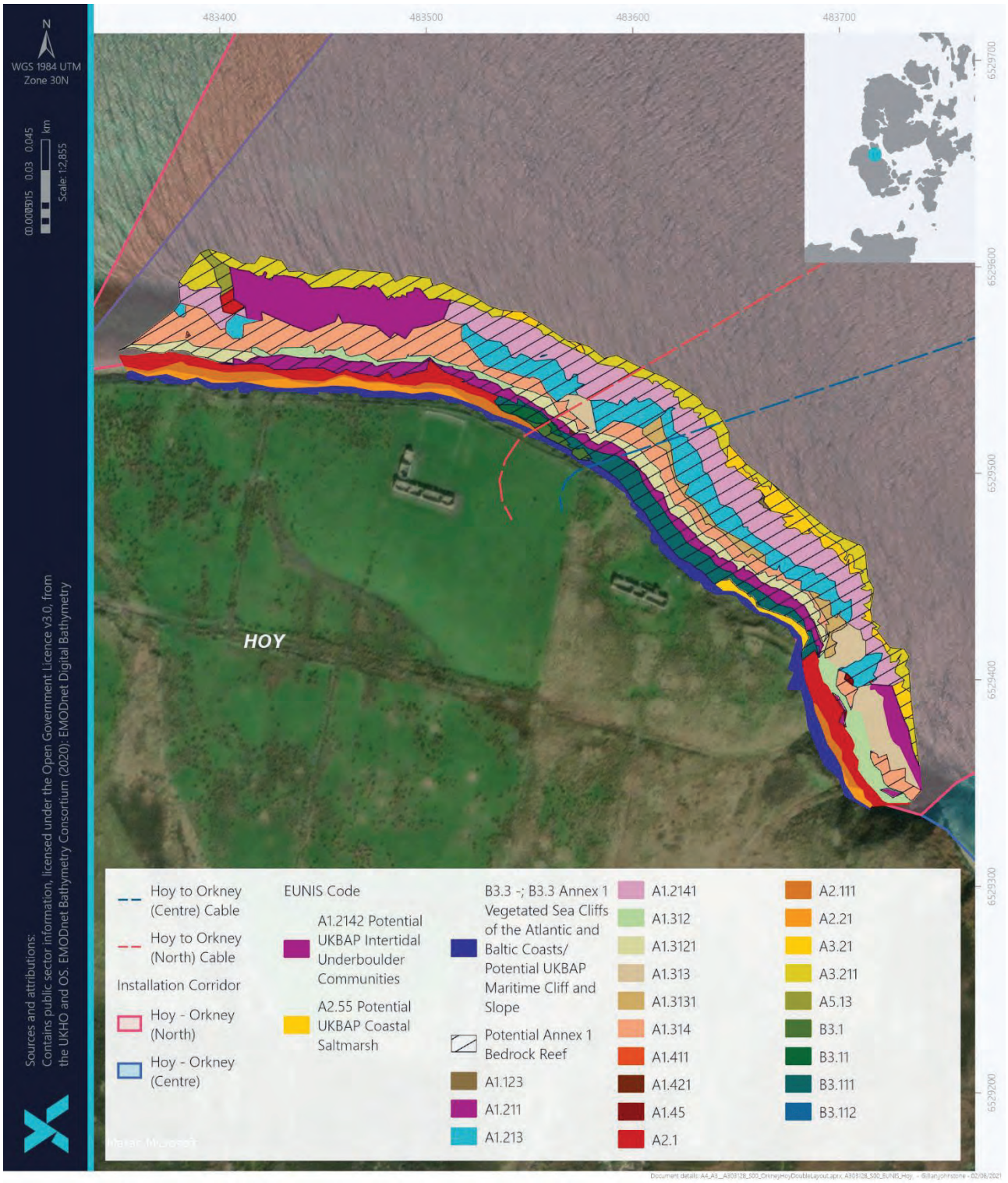


Figure 8-6 Seabed Biotopes within the Landfall Region of Hoy (Fugro, 2021b)

There were various protected and/or sensitive habitats and species observed along the Hoy nearshore area which included coastal saltmarshes, geogenic reefs, intertidal under-boulder communities and vegetated sea cliffs of the

Atlantic and Baltic coasts (Fugro, 2021a). Figure 8-7 Figure 8-3 Example Photographs of Potential Intertidal and Coastal Protected Habitats at Nearshore Orkney (Fugro, 2021a)presents example photographs of these observed protected features.

Saltmarsh vegetation consists of a limited number of halophytic (salt tolerant) species adapted to regular immersion by the tides and were observed during the Fugro (2021a) survey. Saltmarshes are defined in the UKBAP (UKBAP, 2007) as the lower limit of pioneer saltmarsh vegetation (but excluding seagrass *Zostera* beds) and the upper limit as one metre above the level of highest astronomical tides to take in transitional zones. The Joint Nature Conservation Committee (JNCC) biotope complex 'Saltmarsh' (LS.LMp.Sm) is a relevant biotope for this UKBAP priority habitat. Within the Hoy intertidal survey area, the biotope complex 'Pioneer saltmarshes' (A2.55; contained within 'Saltmarsh' LS.LMp.Sm) was present. Therefore, there was the potential for the UKBAP 'Coastal saltmarsh' habitat to occur on the upper limits of the shore to the east (Fugro, 2021a).

Geogenic reefs are rocky marine habitats or biological concretions that rise from the seabed. They are generally subtidal but may extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide. Intertidal areas are only included within this Annex I type where they are connected to subtidal reefs (JNCC, 2021c). Within the Hoy intertidal survey area, bedrock outcroppings were present across the majority of the intertidal area, with coarse sediment overlying the bedrock in places and extending into the sublittoral zone. Therefore, the Hoy intertidal area has the potential to be Annex I geogenic (bedrock) reef (Fugro, 2021a). The bedrock was largely dominated by brown seaweeds with standard intertidal zonation (*P. canaliculata, F. spiralis, A. nodosum* and *F. vesiculosus, F, serratus* to *L. digitata*) with an understorey largely comprised of red-turf forming seaweed (Rhodophyta) in the lower shore (Fugro, 2021a).

The UKBAP priority habitat 'Intertidal under-boulder communities' can occur from the mid eulittoral to the sublittoral fringe, encompassing areas of boulders (>256 mm diameter) that support a diverse under-boulder community. The under-boulder habitat (including fissures, crevices and any interstitial spaces between adjacent boulders) is a series of microhabitats that naturally increase biodiversity (BRIG, 2008). Under-boulder communities in the Hoy intertidal survey area were indicated by the presence of sub-biotope '*Fucus serratus* and under-boulder fauna on exposed to moderately exposed lower eulittoral boulders' (A1.2142/LR.MLR.BF.Fser.Bo) and '*Laminaria digitata* and under-boulder fauna on sublittoral fringe boulders' (A3.2112 /IR.MIR.KR.Ldig.Bo). These sub-biotopes give the indication that the UKBAP 'Intertidal under-boulder communities' habitat could occur in nearshore area of Hoy (Fugro, 2021a). These habitats were supported by kelp (*L. digitata*), seaweeds (*F. serratus*) and diverse under-boulder communities including low densities of maerl (*P. calcareum*). Therefore, there was the potential for the UKBAP priority habitat 'Intertidal under-boulder communities' to occur in the Orkney nearshore area (Fugro, 2021a).

Vegetated sea cliffs are steep slopes fringing hard or soft coasts, created by past or present marine erosion, and supporting a wide diversity of vegetation types with variable maritime influence. Exposure to the sea is a key determinant of the type of sea cliff vegetation (JNCC, 2021d). Grassy slopes within the western section of the Installation Corridor developed to sandstone cliffs to the east of the survey area (out-with the Installation Corridor). Therefore, it was determined that the cliffs to the east had the potential to be both Annex I 'Vegetated Sea Cliffs of the Atlantic and Baltic Coasts' and UKBAP 'Maritime Cliff and Slope' priority habitat due to elevation, angle and the presence of vegetation (Fugro, 2021a).

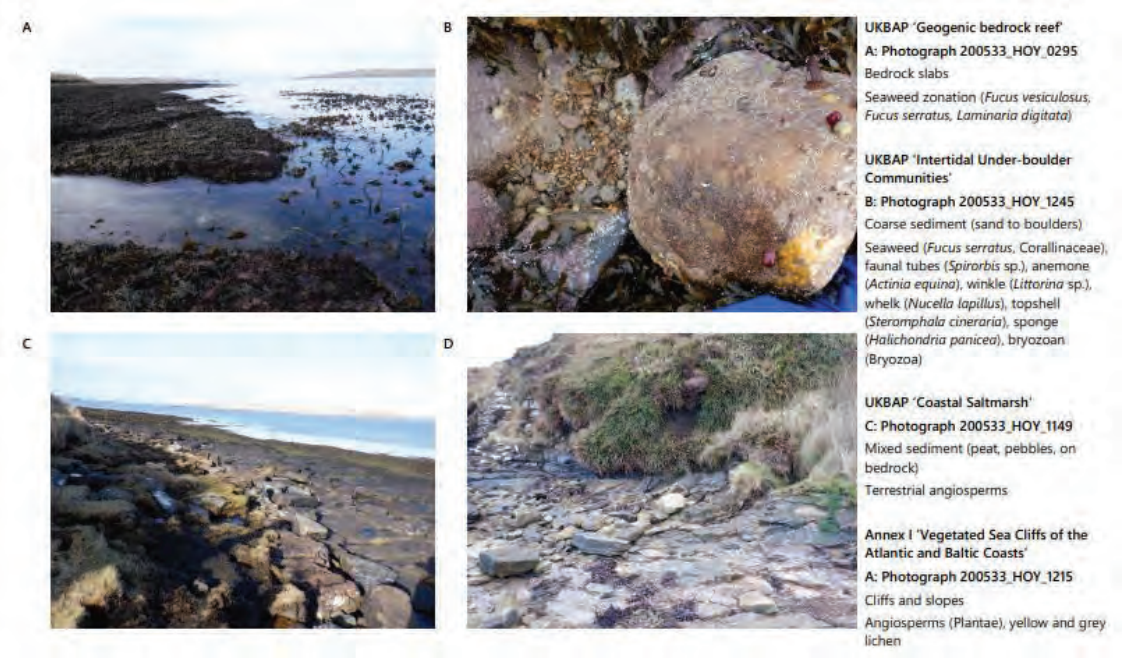


Figure 8-7 Example Photographs of Potential Intertidal and Coastal Protected Habitats at Nearshore Hoy (Fugro, 2021a)

8.3.3 Offshore Characteristics

Offshore surveys were undertaken along the proposed Orkney – Hoy cable replacement routes. As mentioned in Section 6.3, both Installation Corridors offshore area primarily consist of coarse sediment. The 2021 survey conducted in the area acquired video and stills photographic data along twelve of the fifteen proposed transects.

As discussed in Section 6, the BGS seabed sediments within both Installation Corridors primarily consist coarse sediment (NMPi, 2021). The representative European Union Nature Information System (EUNIS) biotopes found within the area are mainly Infralittoral coarse sediment (A5.13) and Atlantic and Mediterranean high energy infralittoral rock (A3.2) with small sporadic areas of Circalittoral coarse sediment (A5.14), Atlantic and Mediterranean high energy infralittoral rock (A3.1) and sublittoral sediment (A5) (Figure 8-8).

The rocky sedimentary habitats as listed above, support a variety of benthic species and habitats. These sediment properties and associated supporting network communities are summarised in Table 8-3Table 8-3. A number of the habitats observed during the Fugro (2021a) survey were identified as being protected and/or potentially sensitive. These included subtidal sands and gravel, maerl beds and reefs.

Some areas of the proposed cable route were classified as 'Infralittoral Coarse Sediment' (A5.13) and 'Infralittoral Fine Sand' (A5.23). These habitats are categorised within the broad habitat of 'subtidal sands and gravels'. Sublittoral sand and gravel habitats occur in a wide variety of environments, from sheltered (sea lochs, enclosed bays and estuaries) to highly exposed conditions (open coast). The particle structure of these habitats ranges from mainly sand, through various combinations of sand and gravel, to mainly gravel. The diversity of flora and fauna living within the biotopes varies according to the level of environmental stress to which they are exposed. The infauna expected to occur in the exposed nearshore area would be small opportunistic capitellid and spionid

polychaetes and isopods (*Pontocrates arenarius, Haustorius arenarius* and *Eurydice pulchra*) that are adapted to living in a highly perturbed environment. The epifauna is characterised by mobile predators such as crabs (*Carcinus maenas* and *Liocarcinus spp*), hermit crabs (*Pagurus bernhardus*), whelks (*Buccinum undatum*), and occasionally sand eels (*Ammodytes spp*) (UKBAP, 2008).

Beds of maerl in coarse clean sediments of gravels and clean sands, which occur either on the open coast or in tide-swept channels of marine inlets (the latter often stony). In fully marine conditions the dominant maerl is typically *Phymatolithon calcareum* (SMP.Pcal), whilst under variable salinity conditions in some sealochs beds of *Lithothamnion glaciale* (SMP.Lgla) may develop. Along the Orkney to Hoy (North and Centre) subtidal survey area live maerl was present along six transects (stations TR02, TR05, TR07, TR08, TR11 and TR12) all located in the northeast of the survey area, five of which had moderate coverage (20% to 50%) and one (TR12) had low coverage (1% to 10%). All other transects were classified as either dead maerl or had no maerl present. *Phymatolithon calcareum* is a red seaweed which, when dead contributes, with other similar algae, to maerl found below low tide in certain places. *Phymatolithon calcareum* is a coralline alga, that is, an alga which is calcified and hard in texture. This species has been observed within the Fugro, (2021a) survey (see Table 8-3).

Geogenic reefs are rocky marine habitats or biological concretions that rise from the seabed. They are generally subtidal but may extend as an unbroken transition into the intertidal zone, where they are exposed to the air at low tide. Intertidal areas are only included within this Annex I type where they are connected to subtidal reefs (JNCC, 2021c). It is considered that bedrock outcroppings has the potential to be present in the subtidal area.

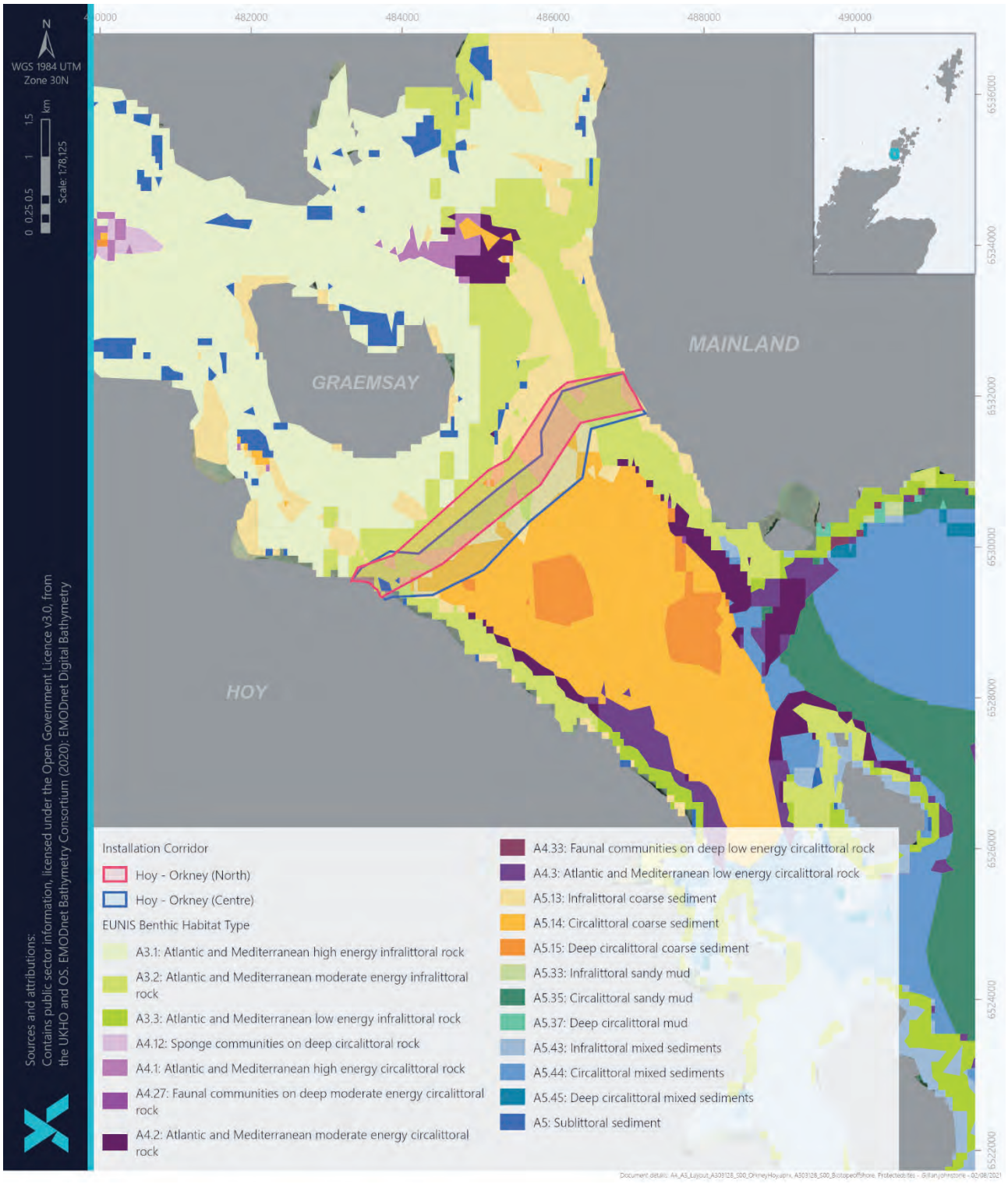
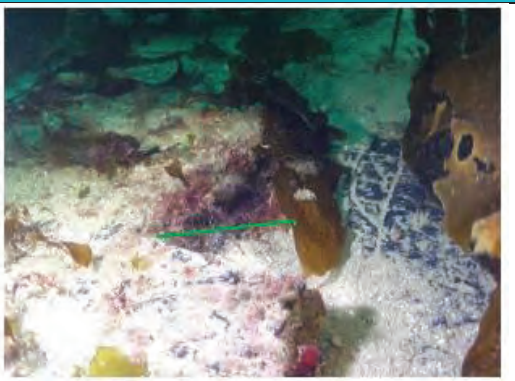
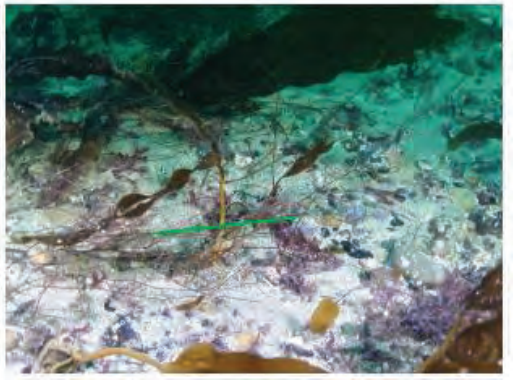
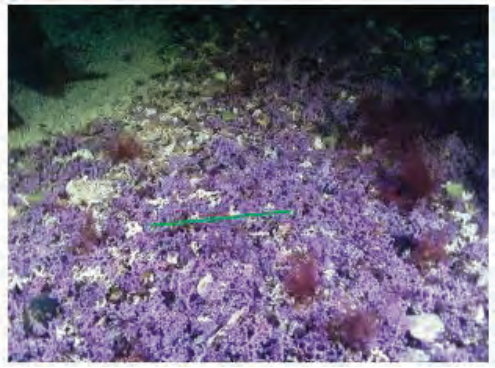
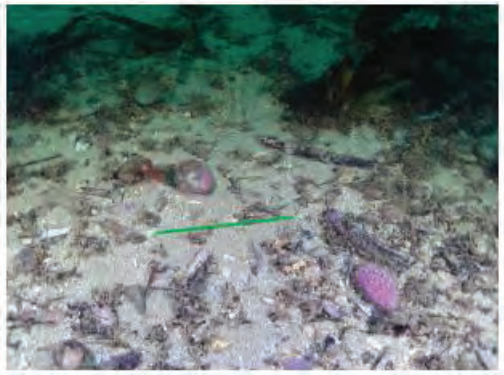


Figure 8-8 Sediment Characteristics within the Installation Corridors

Table 8-3 EUNIS Classification and Supporting Network Found within the Installation Corridors (European Environment Agency, 2021)

Broad Habitat Level 3	Broad Habitat Level 4	PMF	Annex I	Supporting Network	Example Image
A3.2 - Atlantic and Mediterranean moderate energy infralittoral rock	A3.21 Kelp and red seaweeds (moderate energy infralittoral rock)	No	No	On bedrock and stable boulders there is typically a narrow band of kelp *Laminaria digitata* in the sublittoral fringe which lies above a *Laminaria hyperborea* forest and park. Associated with the kelp are communities of seaweeds, predominantly reds and including a greater variety of more delicate filamentous types than found on more exposed coasts (A3.11). In the Fugro (2021a) survey the supporting network shown by the image includes: Kelp *Laminaria sp.*, Algae (Rhodophyta/Phaeophyceae), faunal turf (Hydrozoa/Bryozoa) and sea squirt *Ascidia/Ascidiella sp*.	
A5.1 Sublittoral coarse sediment	A5.13 - Infralittoral coarse sediment	No	No	Moderately exposed habitats with coarse sand, gravelly sand, shingle and gravel in the infralittoral, are subject to disturbance by tidal steams and wave action. Such habitats found on the open coast or in tide-swept marine inlets are characterised by a robust fauna of infaunal polychaetes such as *Chaetozone setosa* and *Lanice conchilega*, cumacean crustacea such as *Iphinoe trispinosa* and *Diastylis bradyi*, and venerid bivalves. Habitats with the lancelet *Branchiostoma lanceolatum* may also occur. In the Fugro (2021a) survey the supporting network shown by the image includes: Kelp *Laminaria sp.*, Algae (Rhodophyta/Phaeophyceae), faunal turf (Hydrozoa/Bryozoa).	

A5.2 - Circalittoral coarse sediment	A5.23 Infralittoral fine sand	No	No	Clean sands which occur in shallow water, either on the open coast or in tide-swept channels of marine inlets. The habitat typically lacks a significant seaweed component and is characterised by robust fauna, particularly amphipods (*Bathyporeia*) and robust polychaetes including *Nephtys cirrosa* and *Lanice conchilega*. In the Fugro (2021a) survey the supporting network shown by the image includes Whelks (Buccinidae).	
A5.5 Sublittoral macrophytedominated sediment	A5.51 Maerl beds	Yes – potentially 'Maerl or coarse shell gravel with burrowing sea cucumbers'	No	Beds of maerl in coarse clean sediments of gravels and clean sands, which occur either on the open coast or in tide-swept channels of marine inlets (the latter often stony). In fully marine conditions the dominant maerl is typically *Phymatolithon calcareum* (A5.511), whilst under variable salinity conditions in some sealochs beds of *Lithothamnion glaciale* (A5.512) may develop. In the Fugro (2021a) survey the supporting network shown by the image includes: Maerl (Corallinates), Algae (Rhodophyta/Phaeophyceae) and faunal turf (Hydrozoa/Bryozoa).	
	A5.52 Kelp and seaweed communities on sublittoral sediment	Yes	No	Shallow sublittoral sediments which support seaweed communities, typically including the kelp *Laminaria saccharina*, the bootlace weed *Chorda filum* and various red and brown seaweeds, particularly filamentous types. The generally sheltered nature of these habitats enables the seaweeds to grow on shells and small stones which lie on the sediment surface; some communities develop as loose-lying mats on the sediment surface. In the Fugro (2021a) survey the supporting network shown by the image includes: Kelp *Laminaria sp.*, Algae (Rhodophyta/Phaeophyceae), faunal turf (Hydrozoa/Bryozoa).	

8.4 Impact Assessment

8.4.1 Area of Impact

Potential impacts associated with the installation of the proposed cables include habitat loss and disturbance, introduction of invasive non-native species, sedimentation, and pollution.

The proposed cable and cable protection installation in direct contact with the seabed has the potential to impact on the benthic species and habitats directly within the project footprint. The two cable installation corridors will cross a variety of benthic habitats and biotopes as described in Section 8.3. Areas of significant bedrock, boulders and sensitive habitats will be avoided during the cable installation activities where feasible, in order to minimise the impact on sensitive marine features. Therefore, the exact cable location cannot currently be determined and therefore the impact footprint on specific habitat types encountered along each Installation Corridor cannot be estimated.

The North and Centre cables will be replaced on a like-for-like basis with approximate length of 5 km and 5.5 km, respectively. As discussed in Section 3, it is expected that the cable will be surface laid, with excavation works carried out at each landfall site. The length of cable proposed to surface laid and buried is summarised in Table 8-4. Lateral movement and protection of the cable will be prevented via the placement of rock filter bags, mattresses and/ or grout bags, situated directly on top of the cables, where applicable. The lengths and associated impacts of the cables and associated deposits have been included in Table 8-5.

Table 8-4 Cable Protection Quantity Summary for the North and Centre Cables

Installation Corridor		Surface Laid (km)	Buried (km) *Intertidal Only*
North	Length	4.5	0.148
	% of Route	0.97	0.03
Centre	Length	4.703	0.166
	% of Route	0.98	0.02

The following worst-case assumptions have been made for the area of seabed impacted:

- The impacts corridor of the landfall sites where excavation and a Sea Earth is required has been assessed based on the length of the cable expected to buried (see Table 8-4) with an assumed 10 m wide corridor;
- Articulated pipe / uraduct protection has been assessed based on the length required for each cable (507 m for the North cable and 524 m for the Centre cable) with an assumed 10 m wide corridor;
- The North cable has a diameter of 12.7 cm;
- The Centre cable has a diameter of 15.4 cm;
- Large clump weights for mulitcat operations are 3.5 m x 3.5m, therefore impacting an area of 12.25 m2 each;
- Each rock filter bag is assumed to impact an area of 4.5 m^2 (2.4 m diameter);
- Each mattress measures 6 m x 3 m, therefore impacting an area of 18 m^2 each;

- The quantity of each material deposit includes 20% contingency.

Table 8-5 presents the overall area of seabed impact from the proposed cable installation activities.

Table 8-5 Footprint of Cable Installation Methods and Permanent Materials Along the Cable Installation Corridors

Installation Corridor	Location and Protection Methods	Source of Impact (*Quantities up to)*	Area of Seabed Impact (m^2)	Area of Seabed Impact (km^2)
North Cable	Excavation activities between MHWS and MLWS (i.e. buried	148 m of cable will be buried at each landfall site (x2) with an assumed 10 m wide corridor.	2,960	0.00296
	Articulated pipe / uraduct protection	Hoy landfall will have 217 m and the Mainland landfall will have 205 m in intertidal area buried by excavator with split pipe. As a contingency, 507 m of split pipe with an assumed 10 m wide corridor has been assumed.	5,070	0.00507
	Surface laid cable	Approximately 4.5 km of the 5 km cable will be surface laid.	572	0.00057
	Grout bags	Each 1 tonne grout bag will be 0.9 m x 0.9 m. Quantity required will be 24.	19	0.00002
	Mattresses	Each 10 tonne mattress will be 6 m x 3 m x 0.3 m. Quantity required will be 92.	1,656	0.00166

Installation Corridor	Location and Protection Methods	Source of Impact (*Quantities up to)*	Area of Seabed Impact (m^2)	Area of Seabed Impact (km^2)
	Rock bags	Each 4 tonne rock bag will be 2.4 m in diameter. Quantity required will be 87.	394	0.00039
	Clump weights*	Each clump weight dimensions will be 3.5 m x 3.5 m. Quantity required will be 8.	98	0.00010
Centre Cable	Excavation activities between MHWS and MLWS (i.e. buried	166 m of cable will be buried at each landfall site (x2) with an assumed 10 m wide corridor.	1660	0.00166
	Articulated pipe / uraduct protection	Hoy landfall will have 233 m and the Mainland landfall will have 203 m in intertidal area buried by excavator with split pipe. As a contingency, 524 m of split pipe with an assumed 10 m wide corridor has been assumed.	5240	0.00524
	Surface laid cable	Approximately 4.703 km of the 5.5 km cable will be surface laid.	724	0.00072
	Grout bags	Each 1 tonne grout bag will be 0.9 m x 0.9 m. Quantity required will be 24.	19	0.00002
	Mattresses	Each 10 tonne mattress will be 6 m x 3 m x 0.3 m. Quantity required will be 60.	1080	0.00108
	Rock bags	Each 4 tonne rock bag will be 2.4 m in diameter. Quantity required will be 92.	416	0.00042
	Clump weights*	Each clump weight dimensions will be 3.5 m x 3.5 m. Quantity required will be 8.	98	0.00010

Installation Corridor	Location and Protection Methods	Source of Impact (*Quantities up to)*	Area of Seabed Impact (m^2)	Area of Seabed Impact (km^2)
		NORTH CABLE TOTAL IMPACT	10,769	0.01077
		CENTRE CABLE TOTAL IMPACT	9,237	0.00924
		TOTAL COMBINED FOR BOTH INSTALLATION CORRIDORS	20,006	0.02001
* These deposits will only be temporary.				

8.4.2 Direct Loss of/ Disturbance to Benthic Habitats and Communities

Cable installation activities will temporarily disturb the seabed, including anchor system deployment, and will lead to a temporary loss of habitat. These activities may affect sensitive seabed features such as the potential rocky reef habitats along the proposed cable installation corridors. It is acknowledged that SHEPD are committed to avoiding sensitive benthic habitats and species insofar as possible during detailed route engineering, informed by the pre-installation survey. However, since it is currently not possible to determine to what extent avoidance of these features will be possible, this embedded mitigation has not been accounted for during the assessment. The assessment therefore represents the worst case.

The activities that will lead to permanent habitat loss within the proposed cable installation corridors include surface laying of cable and placement of protective deposits on the seabed (i.e. rock bags, mattresses and/ or grout bags). The proposed cable installation works will lead to permanent loss to sandy, coarse and mixed sediments habitats as the benthic organisms living on the surface of sediments will not be able to colonise the hard substrate of the surface-laid cable and filter bags or mattresses. As discussed in Section 8.3.2 and Section 8.3.3, there is the potential for sensitive and protected habitats and species within the area. These include coastal saltmarshes, geogenic reefs, intertidal under-boulder communities and vegetated sea cliffs of the Atlantic and Baltic coasts within the intertidal areas or Hoy and Orkney and subtidal sands and gravel, maerl beds and reefs within the subtidal area.

The activities can lead to peripheral localised and temporary re-suspension of sediments into the water column. The re-settlement of this sediment could result in the smothering of benthic species (see Gubbay, 2003, for a review) with the impact related to their ability to clear particles from their feeding and respiratory surfaces (e.g. Rogers, 1990). Infaunal communities will gradually become re-established through re-adjustment to the new sediment surface and by migration and/or reproduction and settlement from nearby undisturbed areas. With regard to the settlement of re-suspended sediments, the infaunal communities that dominate within the sedimentary environment present are by their nature less susceptible to temporary variations in sedimentation rates. In addition, the benthic environment is dynamic and subject to natural disturbance from wave and tidal action (McBreen *et al*., 2011) and there is good potential for rapid recovery.

Post-disturbance recovery of the seabed is dependent both on the cohesiveness of the seabed soils and the ability of the hydrological regime to rework disrupted sediments and return the seabed to its original contours. There is little quantitative information on the likely recovery time of benthic organisms from such physical disturbance. The closest indications might be derived from studies carried out on the physical and biological impacts to the

seabed caused by towed fishing gear (e.g. as reviewed by Løkkeborg, 2005). The proposed area of impact from the activities is expected to be 0.02 km^2, which is considered to be a small area with potential for rapid recovery. Such research indicates that the longevity of the physical scars in the seabed left in the wake of towed gear depends on the sediment type and the energy of the local benthic environment. Scars in high energy sandy and shallow environments may disappear within days or months of the initial disturbance, whilst those in quiescent silty and deeper areas may still be visible after 18 months.

For any activity directly impacting the sea floor, if the affected area is large, it will take a longer time to recolonise through larval dispersion settlement, whereas if it is small, organisms can recolonise quickly by migration into the area from adjacent undisturbed seabed and therefore recovery is more rapid (Løkkeborg, 2005). Studies reviewed by Løkkeborg (2005) have concluded that biological recovery can take place even though physical seabed scarring may still be visible. Therefore, in spite of the relatively quiescent environment, impacts will be minimised by the small localised disturbance created by the cable and deposit stabilisations.

Considering the small footprint of activities (estimated 0.02km^2), the permanent habitat loss will result in imperceptible change to the wider habitat and will not change the ecology of the area, therefore the impact is not considered significant.

In addition, in rocky habitats, the installation of the cables will lead to habitat loss within the direct footprint of these structures. However, the hard structures placed during the installation works represent a substrate to which benthic organisms typically living on hard substrates can attach to, therefore there is potential for re-colonisation of the surface laid cable and associated material by epifauna, and habitat loss in this habitat type will only be temporary. As noted in Section 4.3, where possible, these features will be avoided. If avoidance is not possible, the sensitive areas which may be affected is expected to be minimal when compared in the context of the extent of the sensitive habitats in the wider region. As a result, no adverse effects are expected.

Overall, given the small footprint of the cable installation activities (estimated 0.02 km^2), no significant loss of habitat or features will occur.

Assessment of Impact Significance

Although areas of potential rocky or stony reef are located within the Installation Corridors, the great majority of the area is occupied by biotopes of no specific conservation concern which are present on a wider scale throughout this area. On this basis, the subtidal and intertidal rocky habitats and species potentially affected by the activities are considered to be of moderate sensitivity to disturbance/loss; a minor shift from the baseline conditions is anticipated, however the impact will be localised and temporary/short term with a minor change to a small proportion of the receptor population.

The mixed sediment biotopes along the remainder of the installation corridors are highly sensitive to the installation of the cable and associated protection materials, resulting in permanent loss of habitat. However, the impact will be highly localised, constrained to the direct footprint of the structures and is not anticipated to cause adverse effects on existing benthic communities.

Taking an extremely localised footprint, the magnitude of effect as outlined above is considered minor resulting in a minor level of impact and the residual impacts on benthic ecology are not significant.

The proposed cable installation activities will result in a direct long-term habitat loss of only a very limited area of seabed, with approximately 20,000 m^2 (0.02 km^2) of seabed impacted by the proposed operations. The impact is therefore assessed as minor and not significant.

As the impact is not significant, no secondary mitigation measures are required. Embedded mitigation measures considered as part of the project design are listed in Section 4.3.

Sensitivity / value	Magnitude of effect	Level of impact
Medium	Minor	Minor
Impact significance – NOT SIGNIFICANT		

8.4.3 Temporary Increase in Suspended Sediments and Associated Sediment Deposition

The landfall locations at Hoy and Orkney will be buried by land based excavation. The timing of the works will be tide dependent (working at low water when the intertidal area is exposed). Therefore, there will be no disturbance of submerged sediments. There may be temporary and highly localised increase in suspended sediment caused by the incoming tide and wave action interacting with the trench walls and associated spoil. However, this will not be significantly greater than that expected by high energy wave action causing low-level erosion of the shoreline sediments.

The habitat complexity of the intertidal zone supports a wide range of species that will demonstrate different sensitivities to increased turbidity and sediment deposition. The resettlement of sediments is expected to occur within the 100 m of the excavation works in the intertidal zone, and the impacts will be most applicable to sessile and less mobile fauna. Suspension and deposition of fine particles may have an effect on low mobility filter feeders; however, the benthic communities in muddy and sandy sediments will be generally adapted to high sediment loading and have a high tolerance to smothering. The sensitivity of the intertidal community could be considered high on a precautionary basis, however given the temporary and highly localised effects, the magnitude would be negligible.

Assessment of impact significance The sensitivity of the varied intertidal community to increased sediment resuspension possible during tide and wave action is considered high on a precautionary basis. However, the highly localised and temporary nature of the impact is of a minor magnitude. Therefore, the significance is considered negligible. As the impact is not significant, no secondary mitigation measures are required. Embedded mitigation measures considered as part of the Project design are listed in Section 4.3.		
Sensitivity / value	Magnitude of effect	Significance of impact
High	Negligible	Minor
Impact significance – NOT SIGNIFICANT		

8.4.4 Impact from Non-Native Marine Species (NNMS)

A number of NNMS in UK waters have the potential to impact benthic species and habitats, including circalittoral and infralittoral mixed sediments and reef habitats. Natural England have commissioned a study that investigated the potential impacts of eight NNMS on marine protected area features in England (Macleod *et al.,* 2016). All eight of the NNMS studied were considered as having the potential to colonise or interact with reefs and two of the NNMS could impact subtidal mixed sediments, resulting in adverse impacts.

An approved ballast water management plan will be adopted by all vessels, according to the International Maritime Organization (IMO) ratified the International Convention for the Control and Management of Ships' Ballast Water and Sediments Management Convention in September 2017. Implementation of the BWM Convention will not mitigate the risk of an NNMS being introduced via biofouling on a vessel. However, this vector is considered to carry a lower risk of NNMS introduction than ballast water and the installation vessel

movements are unlikely to constitute a change from baseline conditions with respect to the potential for introducing NNMS. The rock contained within the filter bags will be terrestrially sourced, clean and free from organic material. Concrete mattresses and clump weights will be new, and free from organic material. The protective deposits do not therefore present a risk of transport and introduction of NNMS.

The risk of the potential rocky reef features to be adversely impacted by NNMS depends on the severity of the threat, the likelihood of introduction, which is the potential of the activities to create a suitable vector capable of carrying and introducing a NNMS and/or pathogen, and finally on the likelihood of establishment and spread of the NNMS, which is dependent on the ecological preferences and dispersal potential of NNMS within the recipient environment (Macleod *et al.*, 2016). Although the severity of the threat is high due to the high sensitivity of the feature, the embedded biosecurity measures, including management of ballast water in adherence with the BWM Convention, will ensure that there are no pathways for NNMS to be introduced by the proposed works and subsequently spread. Therefore, the likelihood of introduction of NNMS and the likelihood of spread and establishment are reduced to low and the residual impact is not significant.

Assessment of impact significance Given that the embedded mitigation measures will ensure that no NNMS are introduced and spread as a result of the proposed works, no residuals impact on reef communities are anticipated. Embedded mitigation measures considered as part of the Project design are listed in Section 3		
Sensitivity / value	Magnitude of effect	Level of impact
High	Minor	Minor
Impact significance – NOT SIGNIFICANT		

8.4.5 Accidental Release of Hazardous Substances

The use of vessels could lead to a fuel release, or of cleaning fluids, oils and hydraulic fluids used on board vessels and during ROV operations, which could be released overboard or accidentally discharged. These discharges can be potentially harmful and can lead to localised organic enrichment and a change in the balance of the food chain. However, as the vessels will be <12 NM from shore, there will be no discharge of grey water, sewage, food waste or drain water.

All vessels will be compliant with IMO and MARPOL and as such, the risk of oils and other contaminants entering the marine environment is very low. Neither organic enrichment nor oxygen depletion is considered likely, due to the relatively small cumulative volume of any discharges. Any reduced water quality will be short-term and localised in nature along the installation corridors, occurring sequentially with the location of the installation activity, and near the seabed. A temporary and localised reduction low in water quality is unlikely to cause a detectable change to the benthic species and habitats along the installation corridors.

Assessment of impact significance Given that the embedded mitigation measures will ensure the risk of releases of hazardous substances being released into the marine environment are minimised, impacts on benthic receptors are expected to be minimal. Embedded mitigation measures considered as part of the Project design are listed in Section 4.3.		
Sensitivity / value	Magnitude of effect	Level of impact
High	Negligible	Minor

Impact significance – NOT SIGNIFICANT

8.5 Conclusion

Physical disturbance through seabed preparation, excavation and cable laying activities and smothering of benthic habitat and species via sediment re-suspension and settlement are likely to occur within the footprint of the proposed works. The potential rocky and/or stony reef areas are the only protected and high value habitats with the potential to be impacted. However, the effects are expected to be highly localised and temporary. Consequently, there will be no significant impact on the benthic and intertidal ecology resulting from either the cable installations.

9 Ornithology

9.1 Introduction

This section of the report provides further detail on the ornithological receptors in the vicinity of the proposed marine cable installation corridors and presents results from an assessment of potential impacts which may result from the proposed cable replacement works. Management and mitigation measures to ensure impacts are minimised will also be suggested where necessary.

9.2 Data Sources

This section draws on a number of data sources including published papers and industry-wide surveys. A key data source available for Scottish waters is the NMPi website (NMPi, 2021) which underpins the Scottish NMP (Scottish Government, 2015).

9.3 Baseline and Receptor Identification

As noted in Section 5, the Orkney – Hoy installation corridors are located within two protected sites for seabirds, these are the Scapa Flow pSPA and the Hoy SPA. Nesting birds feed in surrounding waters outside these SPAs and use most of the Orkney Island's coastal waters for loafing (JNCC, 2021a; 2021b). The species listed for protection under these sites are protected by the Wildlife and Countryside Act 1981.

The Scapa Flow pSPA covers an area of 371 km^2 and is designated for European species, including: great northern diver, red-throated diver, black-throated diver and Slavonian grebe. The site also supports migratory populations of European importance including European shag, common eider, long-tailed duck, common goldeneye and red-breasted merganser (SNH, 2016).

The Hoy SPA covers an area of 182 km^2 and is designated for various seabird species, including: great skua, Peregrine falcon, Atlantic puffin, Northern fulmar, red-throated diver, great black-backed gull, black-legged kittiwake, Artic skua and common guillemot (JNCC, 2021b).

SHEPD has noted the importance of the Hoy SPA for the protection of peregrine falcons whose population contributes to 0.5% of the Great Britain population in the breeding season. Due to the activities being localised and short-lived, it is expected that the species will not be impacted by the proposed cable installation activities.

In conclusion, relatively high numbers of seabirds are likely to be present in the vicinity of the cable installation corridors, particularly during the bird breeding season.

9.4 Impact Assessment

The proposed cable installation activities will be undertaken between December and June, and as such, may coincide with the bird breeding season, when seabird numbers are expected to be highest. However, due to the installation activities being short-lived and transient, no potential for direct disturbance of breeding birds at their coastal nesting sites, or loafing birds are expected within the SPA boundary.

The cable installation activities within both the North and Centre Installation Corridors do have the potential to affect breeding seabirds at sea, out-with the SPA boundary, due to the mobile nature of these species. However, the proposed activities are considered extremely unlikely to result in any adverse effects on the FCS of sensitive ornithological receptors. This is concluded for the following reasons:

- No adverse effects on water quality are anticipated, as detailed in Section 6;

- Cable installation vessels will be slow moving, as detailed in Section 4.3., reducing the potential for disturbance;
- During night-time operations, vessel lighting will be minimised insofar as possible whilst allowing for safety, as detailed in Section 4.3. This will reduce the potential for bird strikes or disturbance of seabirds;
- The waters in the vicinity of both cable installation corridors are subject to relatively high levels of vessel activity, predominantly associated with Orkney inter-island ferry traffic. As such, the presence of the installation vessels required to facilitate the cable replacements will not constitute a substantive change from baseline vessel activity in the vicinity of the Installation Corridors; and
- The cable installation vessels will be constantly moving, the zone of potential disturbance is extremely limited, and the disturbance will be limited to the installation period. As such, any potential disturbance to seabirds will be transient, localised and temporary.

Assessment of impact significance Given that the presence of the installation vessel will not constitute a change from baseline conditions, together with the transient, localised and temporary nature of potential impacts whilst considering the embedded mitigation measures; effects on ornithological receptors are expected to be minor, and no adverse effects on the FCS of any species are anticipated. Embedded mitigation measures considered as part of the project design are listed in Section 4.3		
Sensitivity / value	Magnitude of effect	Level of impact
High	Minor	Minor
Impact significance – NOT SIGNIFICANT		

9.5 Conclusion

Both Installation Corridors are located within in waters of potential importance to breeding seabirds. The proposed activities could cause disturbance to these species through vessel presence. However, given the transient, temporary and localised nature of the effects and the mitigation measures described in Section 4.3, activities are unlikely to significantly impact populations of seabirds.

10 Marine Archaeology

10.1 Introduction

This section provides detail on marine archaeological features in the vicinity of the proposed installation corridors. An assessment of potential impacts on these features is then presented, along with recommendations for additional secondary mitigation measures that may be required in order to ensure losses of or impacts to the archaeological record are minimised.

10.2 Data Sources

A review of publicly available information pertaining to marine archaeological sites on the coast of Scotland was conducted in order to inform this assessment. The key sources utilised were:

- UKHO wrecks database (UKHO, 2021);
- NMPi (2021); and
- Canmore Maritime records of marine losses (Canmore, 2021).

In addition to this, the environmental surveys conducted in 2021 (Fugro, 2021a; 2021b) have also been utilised as mentioned in Section 4.1.

10.3 Baseline and Receptor Identification

There are no charted wrecks or documented obstructions within the proposed Installation Corridors (UKHO, 2021; NMPi, 2021; Fugro 2021b). There are however, several wrecks within 5 km of both cable Installation Corridors, as shown in Figure 10-1 which include:

- Ebanezer non-dangerous wreck < 1 km to the southeast;
- Gobernador Bories non-dangerous wreck 2 km to the northwest;
- Dyle dangerous wreck and Ephram non-dangerous wreck 2.2 km to the northwest and southeast, respectively;
- Rotherfield dangerous wreck, Inverlane dangerous wreck and Burdie dangerous wreck 2.3 km to the northwest;
- Karlsruhe dangerous wreck 3.9 km to the southeast;
- Strathelliot 4 km to the northwest;
- Kronprinz Wilhelm dangerous wreck 4.5 km to the southeast;
- Markgraf dangerous wreck 4.7 km to the southeast;
- Brummer dangerous wreck 4.8 km to the southeast;

In addition to the wrecks shown in Figure 10-1, the Canmore Maritime Records note 2 further losses in the vicinity of the of the Installation Corridors. However, it should be noted that the positions assigned to these losses are noted as being arbitrary, and hence very little confidence can be placed in them (Canmore, 2021).

Given the available data, it considered unlikely that sites of marine archaeological significance are located within the Installation Corridors, although their presence (such as drifted debris) cannot be ruled out.

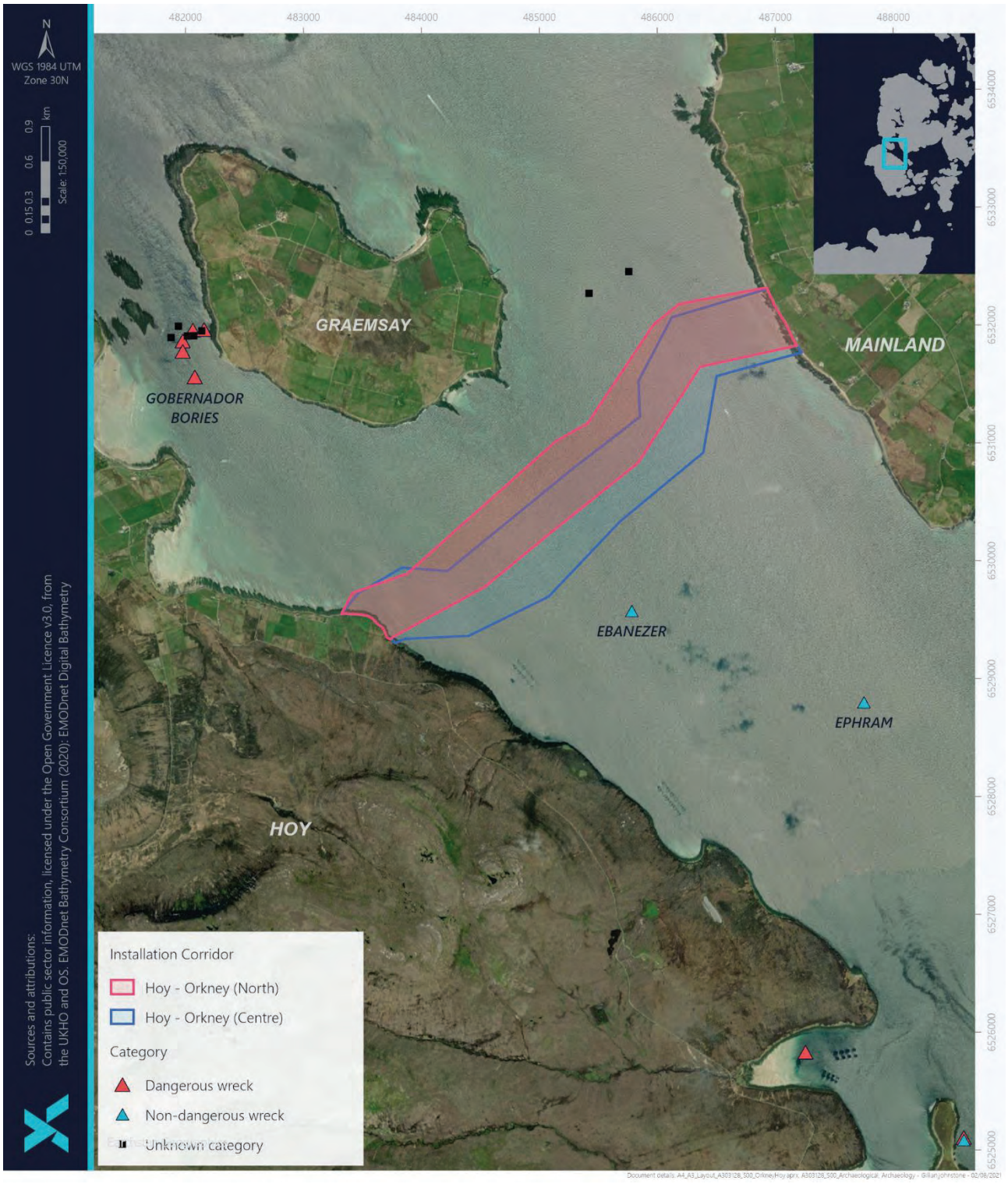


Figure 10-1 Sites of Potential Archaeological Significance in the Vicinity of the Installation Corridors (UKHO, 2021)

10.4 Impact Assessment

As detailed in Section 10.3, while there are no confirmed wrecks within the Installation Corridors, their presence cannot be ruled out from the available data. As such the cable installation works have the potential to result in damage to or loss of the historic record. This would be limited to interactions with wrecks or artefacts during cable laying operations, and the placement of protective structures. Should such interactions occur, the damage or loss of archaeological features would be a permanent effect on a potentially highly sensitive receptor, which has no ability to recover, and as such could constitute a significant impact on historic records.

However, as detailed in Section 4.3, preconstruction surveys will be undertaken to inform the final routing of the replacement cables. This will allow sites of potential archaeological significance to be identified prior to cable installation works commencing. During detailed route design the following provisions shall be implemented with regard to wrecks or other features of potential archaeological value identified in the survey data:

- All wrecks or features of potential archaeological significance shall be avoided by a buffer of at least 50 m during detailed route design;
- The locations of wrecks and features of potential archaeological significance will be clearly identified on electronic charts on board the installation vessel and utilised to guide cable installation operations; and
- The location of any wrecks or features of potential archaeological significance will be provided to Historic Environment Scotland, and the UKHO.

It is acknowledged that there is the potential that archaeological features could be present within the Installation Corridor, which are not identified by preconstruction surveys. In order to account for this, and subject to further discussion with Historic Environment Scotland, the Crown Estate's Protocol for Archaeological Discoveries (PAD) (TCE, 2014) would be used as a basis for further mitigation during installation activities. The role of the Implementation Service described within the above protocol would be replaced by an archaeological service provider appointed by SHEPD or their installation contractor.

Assessment of impact significance The presence of significant historic sites such as wrecks (vessel/aircraft etc.) within the installation corridors cannot be ruled out, although it is thought to be unlikely. If such a site is present, and were disturbed or destroyed by the installation activities, it would have a significant adverse effect on the historic record. Through the implementation of appropriate mitigation, this risk can be designed out during detailed route engineering, making it extremely unlikely that adverse impacts will occur.		
Sensitivity / value	Magnitude of effect	Level of impact
High	Negligible	Minor
Impact significance – NOT SIGNIFICANT		

10.5 Summary

The publicly available data could not rule out the possibility that features of archaeological significance may be present within the installation corridor at each cable route site. As such, it was determined that the proposed cable installation activities have the potential to result in significant adverse effects on the historic record. However, following the implementation of the mitigation measures, it is considered to be extremely unlikely that the cable installation works would result in the loss or damage of archaeological features. As such this assessment concludes that the proposed activities will not result in any adverse impacts on the historic record.

11 Commercial Fisheries and Other Sea Users

11.1 Introduction

Through good communication and understanding of viewpoints, SHEPD aim to minimise any potential impacts by agreeing mitigation strategies before the works begin. This approach continues through all phases of the project for each submarine electricity cable, thus enabling co-existence with other marine users as SHEPD and their Contractors carry out the cable replacement activities.

Works are planned to keep unnecessary interference with other legitimate sea users to a minimum. SHEPD achieve this by actively engaging with legitimate sea users and those with consented development rights close to the operations.

SHEPD's consultations and agreements are tracked through the Fishing Liaison Mitigation Action Plan – North Coast and Orkney (FLMAP). This is a key document which shows the associated risks to the commercial fishing industry and other legitimate sea users, addresses the potential effects and identifies how to minimise and mitigate potential impacts.

SHEPD will give as much notice as is practicably possible for the operations and provide updates when things change.

11.2 Supporting Documents

11.2.1 FLMAP North Coast and Orkney

The purpose of *The FLMAP North Coast and Orkney* is to:

- Illustrate the associated risks to the commercial fisheries industry (and other legitimate sea users), address the potential effects (highlighted in the marine licenced evidence); and
- Identify how to minimise and mitigate potential impacts on local communities.

A summary assessment of all the potential marine interactions and activities which could influence or affect the proposed cable works is given in Chapters 6, 7 and 8 of the FLMAP.

11.2.2 FLMAP Delivery Programme

The *FLMAP Delivery Programme* sets out how the Company Fisheries Liaison Officer (CFLO) and Fishing Industry Representative (FIR) will communicate during the installation activities and how the deliverables, set out in the FLMAP will be measured and fulfilled. This document will also highlight any regional specific communication and consultation that is required, which may extend the notice period required to issue notice to mariners and communicate upcoming works. It will also highlight any ongoing issues which may arise throughout the works.

11.2.3 How Scottish Hydro Electric Power Distribution Co-Exists with Other Marine Users

How Scottish Hydro Electric Power Distribution co-exists with other marine users details how we plan to co-exist with other marine users as SHEPD carry out the proposed works and follow on from the recent consultations with fishermen in 2020 and into 2021.

12 Conclusions

The MEA supports SHEPD's application for a Marine Licence to complete the required cable installation activities between Orkney – Hoy for the North and Centre cable. It provides a robust assessment of potential impacts of the cable installation activities on groups of sensitive environmental receptors (Sections 5 – 11). Where relevant, these impact assessments have considered interactions with protected sites, and indirect impacts on other receptors. Specifically, environmental assessments of potential impact from the proposed works has been carried out for the following receptors:

- Designated Sites;
- Seabed and Water Quality;
- Marine Megafauna;
- Benthic and Intertidal Ecology;
- Ornithology;
- Marine Archaeology; and
- Commercial Fisheries and Other Sea Users.

Table 12-1 gives an overview of the findings from the environmental assessments undertaken within this MEA. On the basis of the findings and recommendations of the impact assessments presented in Sections 5 – 11, and the embedded mitigation requirements discussed in Section 4.3, it is anticipated that the cable installation activities, will be conducted without significant impact on any relevant environmental receptor.

Table 12-1 Outcomes of Environmental Assessments on Receptors

Environmental Receptor Group	Assessment Undertaken	Level of Impact	Assessment Outcome	Overall LSE / Impact Significance	Additional Mitigations Measures Identified	Post Mitigation Impact
Designated Sites (Section 5)	SACs with harbour seals as a feature (Sanday SAC)	No LSE	Due to the temporary and localised nature of the proposed cable replacement works, no LSE is predicted on the conservation objectives of any protected site and as such it is not expected that an AA will be required. Overall, the installation of the submarine power cables constitutes work of an overriding public need whilst presenting a trivial and temporary disturbance in a limited area. Therefore, no LSE are expected from the cable replacement activities.	No LSE Identified	No additional mitigation measures identified specific to designated sites. See Section 4.3 for embedded mitigation requirements, and topic specific mitigation presented in Chapters 5-11.	No LSE
	SPAs/pSPA with seabirds as a feature (Hoy SPA and Scapa Flow pSPA)	No LSE				
Seabed and Water Quality (Section 6)	Coastal Sediment Suspension	Negligible	All installation activities at the landfall locations will be tidally dependent. Increased suspended sediment will only occur during the interaction between the incoming tide, the trench walls and spoil heaps. This will result in highly localised and temporary increases in suspended sediment which will not have a significant impact on coastal water quality. Best practice will be followed by all installation vessels, therefore the likelihood of an accidental hydrocarbon release from one of the installation vessels is extremely remote. The level of impact is therefore considered minor and not significant.	Not Significant	No additional mitigation measures identified. See Section 4.3 for embedded mitigation requirements.	Not Significant
	Changes to Sediment and Water Quality Following Accidental Release of Hydrocarbons	Minor				
Marine Megafauna (Section 7)	Injury or Disturbance from Noise Emissions	Minor	Underwater noise is considered the impact mechanism most likely to affect marine megafauna in the Project area. Noise modelling used to inform the assessment, presented in Appendix A, demonstrates no realistic risk of injury to any species exists resulting from USBL operations. While there may be some disturbance, this is likely to be limited in space and time and should only affect a few individuals of any species. There will be no injurious impacts to marine mammals as a result of project activities and no requirement to apply for an EPS Licence in that respect. However, there is potential for disturbance to cetaceans, and SHEPD will therefore apply for an EPS Licence in respect to this. However, this disturbance is expected to be limited to one or a few individuals of the local population and will therefore not result in any adverse impact to the FCS of any cetacean species, and no mitigation is proposed for USBL operations. The risk of injury or disturbance of basking sharks resulting from the cable installation vessels is minimal. This is due the low prevalence of the species in the vicinity of the installation corridors, the fact that vessels will be slow moving and not constitute a change from baseline vessel activity, and adherence to the SMWWC. No adverse effects on the FCS of basking sharks are expected. However, a basking shark derogation licence will be sought, since the risk disturbance cannot be entirely ruled out. Considering the transitory nature of the activities, there are not anticipated to be any significant impacts to individuals or populations of marine megafauna in the area.	Not Significant	No additional mitigation measures identified. See Section 4.3 for embedded mitigation requirements.	Not Significant
	Injury or Disturbance of Basking Sharks from Vessel Presence	Minor				
	Direct Loss of/ Disturbance to Benthic	Minor	Physical disturbance through seabed preparation, landfall excavation activities, cable laying activities, smothering of benthic habitat and species	Not Significant	No additional mitigation measures identified. See Section 4.3 for embedded mitigation requirements.	Not Significant

Environmental Receptor Group	Assessment Undertaken	Level of Impact	Assessment Outcome	Overall LSE / Impact Significance	Additional Mitigations Measures Identified	Post Mitigation Impact
Benthic and Intertidal Ecology (Section 8)	Habitats and Communities		via sediment re-suspension and settlement are likely to occur within the footprint of the proposed works. There is the potential for coastal saltmarshes, geogenic reefs, intertidal under-boulder communities and vegetated sea cliffs of the Atlantic and Baltic coasts within the intertidal areas or Hoy and Orkney and subtidal sands and gravel, maerl beds and reefs within the subtidal area. The effects on these habitats and associated network fauna are expected to be highly localised and temporary. Consequently, impacts to habitats are expected to be small with 0.02 km^2 of the seabed expected to be disturbed by the proposed operations. Additionally, the expected disturbance to the associated species is likely to be impacted on an individual's basis and not likely to impact communities at a population level. Therefore, it is not likely for significant impacts on the benthic and intertidal ecology to occur.			
	Temporary Increase in Suspended Sediments and Associated Sediment Deposition	Minor				
	Impact from Non-Native Marine Species (NNMS)	Minor				
	Accidental Release of Hazardous Substances	Minor				
Ornithology (Section 9)	SPA within 2 km of the cable installation works and installation being in summer months	Minor	The proposed installation works may be conducted during the summer months, and therefore fall within the bird breeding season where ornithological receptors are generally more sensitive. The Hoy SPA and Scapa Flow pSPA also transect the Installation Corridors. These sites support assemblages of breeding seabirds (see Section 5). Therefore, both Installation Corridors are located within in waters of potential importance to breeding seabirds. The proposed activities could cause disturbance to these species through vessel presence. However, given the transient, temporary and localised nature of the effects and the mitigation measures described in Section 4.3, activities are unlikely to significantly impact populations of seabirds.	Not Significant	No additional mitigation measures identified. See Section 4.3 for embedded mitigation requirements.	Not Significant
Marine Archaeology (Section 10)	Damage or Loss of Historic Record – Wreck Sites	Moderate	The publicly available data could not rule out the possibility that features of archaeological significance may be present within the installation corridor. As such, it was determined that the proposed cable installation works have the potential to result in significant adverse effects on the historic record if such sites were observed in the area out-with what is publicly stated. However, following the implementation of the mitigation measures outlined in Section 10.4, it is considered to be extremely unlikely that the cable installation works would result in the loss or damage of archaeological features. As such this assessment concludes that the project will not result in any adverse impacts on the historic record.	Significant	During detailed route design the following provisions shall be implemented with regard to wrecks or other features of potential archaeological value identified in the survey data: • All wrecks or features of potential archaeological significance shall be avoided by a buffer of at least 50 m during detailed route design; • The locations wrecks and features of potential archaeological significance will be clearly identified on electronic charts on board the installation vessel, utilised to guide cable installation operations; • The location of any wrecks or features of potential archaeological significance will be provided to Historic Environment Scotland, and the UKHO. It is acknowledged that there is the potential that archaeological features (drifted debris) could be present within the installation corridor, which are not identified by preconstruction surveys. In order to account for this, and subject to further discussion with Historic Environment Scotland, the Crown Estate's 'Protocol for Archaeological Discoveries' (PAD) (TCE, 2014) would be used as a basis for further mitigation during installation activities. The role of the Implementation Service described within the above protocol would be replaced by an archaeological service provider appointed by SHEPD or their installation Contractor.	Not Significant

Environmental Receptor Group	Assessment Undertaken	Level of Impact	Assessment Outcome	Overall LSE / Impact Significance	Additional Mitigations Measures Identified	Post Mitigation Impact
Commercial Fisheries and Other Sea Users (Section 11)	Assessment of impacts on commercial fisheries and other sea users has been presented in FLMAP North Coast and Orkney	Not – significant as per FLMAP	The cable installation works have the potential to disrupt the activities of commercial fisheries and other legitimate sea users. SHEPD has taken a pro-active approach to minimising impacts on commercial fisheries and other legitimate sea users. Potential impacts have been identified and appropriate mitigation measures and consultations will be in place to minimise these. Once these consultations and mitigation measures have been implemented, no significant impact on commercial fisheries and other sea users are expected. This information has been provided in the supporting documents outlined in Section 11.	Not – significant as per FLMAP	Additional mitigation measures identified are provided in the supporting documents in Section 11. See Section 4.3 for embedded mitigation requirements.	Not – significant as per FLMAP

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APPENDIX A NOISE IMPACT ASSESSMENT

During the cable lay, an ROV with USBL will be utilised, deployed from the CLV, to monitor the cable at the touch down locations with the seabed. This will capture seabed information at the contact point and helps observe the lay tension that is applied to the cable from the vessel. This will also help to minimise the potential for cable suspensions along the route. If rock bags or mattresses are required, the ROV with USBL will be used for these activities too.

This section describes the potential frequency impacts and disturbance to marine mammal species in the area as a result of utilising USBL.

1.1 Acoustic Injury or Disturbance Criteria for Marine Mammals

1.1.1 Injury

A dual-metric approach has been adopted which identifies the range of potential injury to marine mammals from both the peak sound pressure level ($SPL_{Peak;}$ also called the source level) and cumulative SEL for each equipment type identified to require consideration for noise-related injury (see Table 1-1). The thresholds above which each marine mammal hearing group may experience noise-related injury are presented in Table 1-1 below. These thresholds are derived from measurements of marine mammal hearing using weighting functions which account for peak hearing abilities for each hearing group (NOAA, 2018).

Table 1-1 Criteria Considered in this Assessment for the Onset of Injury in Marine Mammals from Impulsive Noise (NOAA, 2018; Southall et al., 2019)

Marine mammal hearing group	Impulsive noise		Non-impulsive noise
	Peak pressure (dB re 1 µPa)	Cumulative SEL (dB re 1 μPa^2s)	Cumulative SEL (dB re 1 μPa^2s)
Low-frequency (LF) cetaceans	219	183	199
High-frequency (HF) cetaceans	230	185	198
Very high-frequency (VHF) cetaceans	202	155	173
Phocid pinnipeds (underwater)	218	185	201

1.1.2 Disturbance

1.1.2.1 Disturbance Regulations

There are two regulations which govern disturbance to EPS: Regulation 39(1) and Regulation 39(2). Regulation 39(1) from the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) defines disturbance for all EPS in UK waters and individuals which are vulnerable to disturbance due to biological or environmental circumstances. Regulation 39(2) goes beyond the disturbance guidelines provided in Regulation 39(1) by making it an offence to

deliberately or recklessly disturb any cetacean in Scottish Territorial Waters (i.e. up to 12 nm) (Marine Scotland, 2014). The definitions of disturbance are provided in Box 1 below.

Box 1 Disturbance Regulations in Scottish Territorial Waters

The Conservation (Natural Habitats, &c.) Regulations 1994 (as amended)

Regulation 39 (1) makes it an offence —

(a) deliberately or recklessly to capture, injure, or kill a wild animal of a European protected species;

(b) deliberately or recklessly –

(i) to harass a wild animal or group of wild animals of a European protected species;

(ii) to disturb such an animal while it is occupying a structure or place which it uses for shelter or protection;

(iii) to disturb such an animal while it is rearing or otherwise caring for its young;

(iv) to obstruct access to a breeding site or resting place of such an animal, or otherwise to deny the animal use of the breeding site or resting place;

(v) to disturb such an animal in a manner that is, or in circumstances which are, likely to significantly affect the local distribution or abundance of the species to which it belongs;

(vi) to disturb such an animal in a manner that is, or in circumstances which are, likely to impair its ability to survive, breed or reproduce, or rear or otherwise care for its young; or

(vii) to disturb such an animal while it is migrating or hibernating.

Regulation 39(2) provides that it is an offence —

to deliberately or recklessly disturb any dolphin, porpoise or whale (cetacean).

To consider the possibility of a disturbance offence resulting from the proposed activities, it is necessary to consider the likelihood that the activities would generate a non-trivial disturbance based on the sensitives of the species present and whether the number of individuals impacted would generate population-level consequences. Where there is a possibility of disturbing an individual animal, it is necessary to apply for a Marine EPS Licence to ensure that an offence is not committed. However, in issuing a Marine EPS Licence, Marine Scotland must consider whether the FCS of any species will be affected. Consequently, the impacts of proposed activities on the FCS of all protected species must be considered to satisfy both Regulation 39(1) and 39(2). The impact assessment below addresses the impacts of the activities on the existing conservation status of protected species within the area.

1.1.2.2 Acoustic Disturbance Criteria

Auditory thresholds for disturbance, as defined by NMFS (2014), coupled with behavioural response criteria detailed in Southall *et al.* (2007) have been adopted for the assessment of potential marine mammal disturbance from both non-impulsive and impulsive noise sources. These thresholds and behavioural response severity ratings are provided in Table 1-2 below.

Table 1-2 Disturbance threshold criteria for impulsive sounds (Southall et al., 2007; NMFS, 2014).

Behavioural Effect	Threshold Criteria SPLrms
Potential strong behavioural reaction (6 or more on the severity scale)	160

1.2 Noise Modelling Approach

Noise modelling has been undertaken to identify the potential range (i.e. the straight-line distance from the source) in which noise impacts to marine mammals could occur. The dual-metric modelling approach disseminated in NOAA (2018) has been used to identify impacts from: (1) the peak SPL; and (2) the cumulative SEL, where necessary these values are derived from the root-mean-square (rms) pressure level (SPL_{rms}). The SEL represents the total energy produced by a noise-generating activity standardised to a one-second interval. This enables comparison of the total energy attributed to different activities with different inter-pulse intervals. As described above, empirically-based weighting functions (NOAA, 2018; Southall *et al.*, 2019) have been applied to the modelling outputs to account for peak hearing sensitivity for the respective marine mammal hearing groups.

The following assumptions have been applied to the models:

1. Maximum sound pressure levels have been used for all calculations;
2. Maximum pulse length and minimum turn around has been used where provided;
3. Where source frequencies occur across a range of frequencies, a flat 3rd octave spectrum has been used;
4. Where data is unavailable, the time between pulses has been calculated as 1.5 times the ping length;
5. Mammals swim at seabed depths (this represents the worst-case);
6. Vessels are moving at slow speeds; and
7. Survey equipment likely to be used in the nearshore shallow water environment (i.e. <10 m) will be very high frequency to provide better resolution and will have a lower SPL, and so does not constitute a worst-case scenario.

It is important to note that the rms value associated with the SPL_{rms} depends upon the length of the integration window used. Using a longer duration integration window results in a lower rms than produced by a shorter integration window.

An acoustic phenomenon results from the elongation of the waveform with distance from the source due to a combination of dispersion and multiple reflections. Measurements presented by Breitzke *et al.* (2008) indicate elongation of the T90 window up to approximately 800 m at 1 km. This temporal "smearing" reduces the rms amplitude with distance by elongating the rms window and has been included within the disturbance modelling scenarios. Since the auditory organs of most marine mammals integrate low frequency sounds over an acoustic

window of around 200 ms (Madsen *et al.*, 2006 and references therein), this duration was used as a maximum integration window for the received SPL_{rms}.

The directivity characteristics of the sound sources are also an important factor affecting the received sound pressure levels from noise-generating activities. In geophysical surveys, source arrays are designed so that the majority of acoustic energy is directed downwards towards the ocean floor for data collection purposes. As such, the amount of energy emitted across the horizontal plane is significantly less (20 dB +) than that emitted directly downwards. Due to the frequency-dependent nature of sound, the loss of pressure on the horizontal plane is more pronounced at higher frequencies than at lower frequencies. Directivity corrections can be applied to the model outputs, which provide broadband normalised amplitudes at varying angles of azimuth[2] and dip angle[3]. Directivity corrections have been applied to the modelling outputs under the assumption that the animal is directly in-line with the vessel (i.e. at the 0º azimuth).

1.3 Injury Impacts

The expected frequency range for USBL overlaps with the hearing range of all cetacean hearing groups (Table 7-2 of the Main Report). Potential injury to cetaceans (i.e. injury which results from a permanent threshold shift in hearing abilities) is limited to impulsive noise sources which exceed the injury thresholds defined in Table 1-3.

Modelling of ranges at which injury impacts may result from the USBL operations has been undertaken, as described in Section 1.1. Impacts from noise sources which are strictly behavioural in nature (i.e. disturbance impacts) are covered in Section 1.4.

[2] The azimuth is taken as the angle of circumference around the boat which lies parallel to the surface of the water, progressing around the boat from port to starboard.

[3] The dip angle is taken as the angle under the boat, progressing from prow to stern.

*Table 1-3 Noise Modelling Results for Injury Impacts from Impulsive Noise Sources (*N/E = no exceedance of thresholds*)*

Activity	Depth (m)[4]	Frequency (kHz)	Source Level SPLPeak (dB re 1µPa)	Injury range (m)											
				Cumulative SEL (Static Mammals)				Cumulative SEL (Moving Mammals)				Peak SPL			
				VHF	HF	LF	PW	VHF	HF	LF	PW	VHF	HF	LF	PW
USBL	100	20 – 33.5	200	104	98	73	86	104	56	36	44	-	-	-	-
	10	20 – 33.5	200	12	11	11	11	12	11	11	11	-	-	-	-

[4] Depth refers to depth below the survey activity, which has been assumed to be hull-mounted or towed at the surface.

The model outputs suggest that there is a potential for USBL at 200 dB re 1µPa (peak) to result in injury to marine mammals. Across all modelling scenarios and metrics, the injury ranges were generally highest for the VHF hearing group (Table 1-3), which is represented by harbour porpoise in UK waters. Conversely, HF cetaceans seemed to constitute the hearing group with the lowest potential impact. No exceedances of the SPL_{Peak} injury criteria are expected, since the source level is below 202 dB re 1µPa (peak) (the lowest peak injury threshold).

The deployment of a hull-mounted USBL in 100 m depths elevated the potential range of impact to a maximum of 104 m for VHFs, when considering cumulative SEL metric. However, the likelihood of a cetacean being this close to operational equipment is extremely low when considering that the source is deployed from a moving vessel and, in some cases, is being towed at depth (e.g. a USBL may be mounted on an ROV within a few metres of the seabed).

The injury ranges were at least slightly reduced when considering animal movement during cumulative SEL estimation. Swim speeds of the species most likely to be observed in the area have been shown to be several ms^{-1} (e.g. cruising minke whale swim speed is 3.25 ms^{-1} and harbour porpoise may swim up to 4.3 ms^{-1}) (Blix and Folkow, 1995; Otani *et al.*, 2000). Further, SNH (2016b) has provided standard values for mean swimming speeds of various marine mammal species likely to occur in the project area, including harbour porpoise (1.4 ms^{-1}; Westgate *et al.*, 1995); harbour seal / grey seal (1.8 ms^{-1}; Thompson, 2015); and minke whale (2.1 ms^{-1}; Williams, 2009). To offer a representative model of the predicted noise exposure ranges of marine mammals moving away from the sound source, a mean swim speed of 1.5 ms^{-1} has been used in the calculations. Considering that the surveys themselves will take place while the vessel is moving, the cumulative SELs of all equipment types are expected to be even lower based on the premise that animals are likely to move away from the mobile noise source at some angle opposite to the direction of travel of the vessel.

It should also be noted that the modelling scenarios are meant to define the worst-case injury ranges associated with the deployment of the project's survey equipment. The *in-situ* deployment of the noise-generating survey equipment will most frequently occur in waters of intermediate depths (i.e. somewhere between 10-100 m). Moreover, the frequency ranges depicted constitute the lowest and highest reasonably practicable settings for the survey activities modelled, meaning that the spread of sound in the marine environment is also likely to fall somewhere between the modelled extremes. The injury ranges anticipated to result from equipment use are thus likely to fall within the spectrum of those defined by the model outputs, thereby reducing the impact ranges associated with the low frequency survey equipment.

As such, the assessment concludes that there is no realistic risk of injury to EPS which may result from the use of USBL with SPL_{Peak} source levels of up to 200 dB re 1µPa.

1.4 Disturbance Impacts

Whilst no injury impacts are expected, noise emissions have the potential to affect the behaviour of cetaceans in the vicinity of the noise source. Significant or strong disturbance (see Southall *et al.*, 2007) may occur when an animal is at risk of a sustained or chronic disruption of behaviour or habitat use resulting in population-level effects. An assessment of potential disturbance impacts from USBL is provided in the below. The outputs of the noise modelling assessment against the disturbance thresholds are provided in Table 1-4.

Table 1-4 Noise Modelling Results for Disturbance Impacts from Impulsive Noise Sources

Activity	Depth (m)	Frequency (kHz)	SPL_{rms} (dB re 1µPa)	Range of Behavioural Change (m)
USBL	100	20 – 33.5	197	182
	10	20 – 33.5	197	207

The USBL activities have the potential to generate a strong disturbance event (i.e. a disturbance offence) as described in Section 1.1. The sound generated by the USBL has the potential to generate disturbance impacts on the order of a couple hundred metres (Table 1-4).

The number of individuals which may experience disturbance from the worst-case scenario for USBL has been calculated in Table 1-5 below, based on the population parameters supplied in Table 7-1 of the main report. In these calculations, the impact range serves as a radius with which to calculate the total area of coverage for a potential disturbance event associated with each survey activity.

Table 1-5 Noise of Cetacean Individuals and Proportion of the MU Which May Experience a Disturbance Offence from USBL Activities, Based on Known Population Parameters of the Most Frequently Occurring Species

Species name	Number of individuals which may incur a strong disturbance	Maximum proportion of the MU potentially affected by project activities
	USBL (0.13 km^2 area)	
Harbour porpoise	< 0.1	< 0.1%
Minke whale	< 0.1	< 0.1%
Bottlenose dolphin	< 0.1	<0.1%
White-Beaked dolphin	< 0.1	<0.1%

The source levels associated with USBL have the potential to elicit a strong behavioural response in EPS which could be classed as a disturbance offence as defined under Regulations 39(1) or 39(2) (Box 1). However, for the relevant biogeographical population Management Units (MU) for harbour porpoise, minke whale, bottlenose dolphin and white beaked dolphin which all regularly occur in the area, this will not incur significant impacts. For these species, less than 0.1% of the biogeographic population will be impacted by noise-related disturbance (Table 1-5). Moreover, less than a tenth of any cetacean will be potentially disturbed by USBL deployment at any given time, making potential disturbance impacts from this survey equipment negligible.

Given the transient and short-term nature of the survey and vessel activities, it is highly unlikely that any disturbance offences from the use of USBL would negatively impact upon the FCS of any of the cetacean or seal species which may be present in the survey area. This is on the basis that the modelled level of disturbance is unlikely to affect the ability of any individual animal to survive or reproduce and will not have significant population-level impacts to any EPS. Regardless, it is possible that a small number of animals may experience some level of disturbance for the short period that they encounter the proposed survey activities.