Shetland HVDC Link Environmental Appraisal

Report identifying additional studies required to support Shetland HVDC Link marine licence application

Scottish Hydro Electric Transmission plc

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1 INTRODUCTION

1.1 Introduction

In line with Part 4 of the Marine (Scotland) Act 2010, Scottish Hydro Electric Transmission plc (SHE Transmission) is planning to submit an application for a Marine Licence for the installation of a 320 kV 600 MW single circuit High Voltage Direct Current (HVDC) link between Weisdale Voe in Shetland and Noss Head in Caithness ('Shetland HVDC Link'). The proposed 253 km subsea cable route is shown in Figure 1-1.

The purpose of this report is to determine the type, and scope of studies to be undertaken to support the application for the Marine Licence.

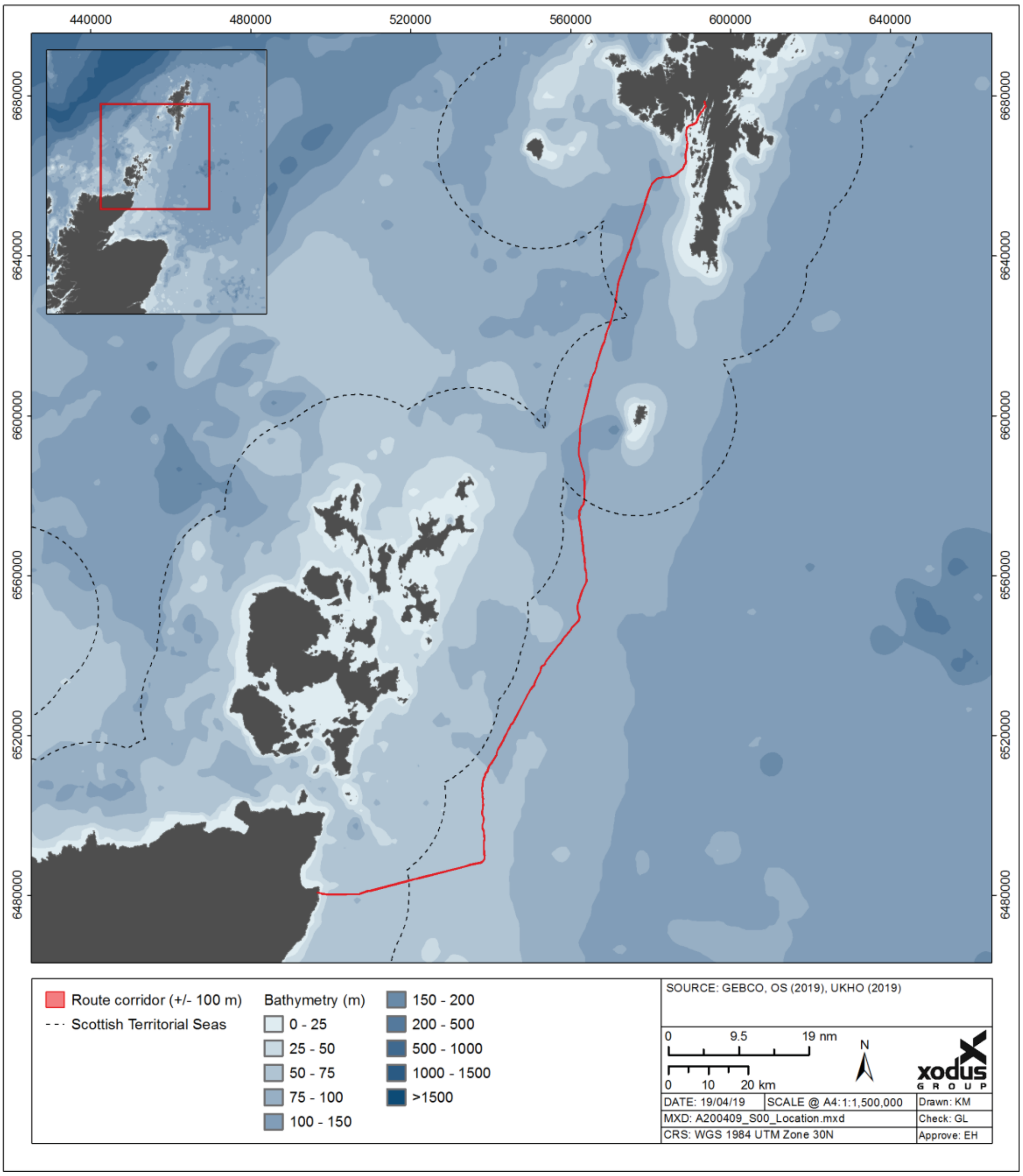

Figure 1-1 Shetland HVDC Link preferred subsea cable route corridor

1.2 Background

SHE Transmission, part of the SSE plc group of companies, is the licensed electricity Transmission Owner (TO) in the north of Scotland. It owns the 5,000 km network of high voltage underground cables and overhead lines that provides electricity to people across northern Scotland and connects northern Scotland to central and southern Scotland and the rest of Great Britain. SHE Transmission is also responsible for maintaining and investing in this transmission network, which covers around 70% of Scotland.

SHE Transmission is currently looking at taking forward a number of strategic projects which are aimed at expanding the transmission network across northern Scotland. These projects, which involve both network reinforcements and upgrades, have been identified as being required to facilitate the substantial increase in renewable generation in the north of Scotland and the subsequent increasing demand for renewable energy connections and hence to support the growth of the low carbon economy. The Shetland HVDC Link is one of these projects.

1.2.1 Project Need

Shetland currently has no mainland transmission or distribution electricity link and its electrical need is served by an isolated electricity network comprising a 33 kV distribution network supplied by local thermal generation, one at Lerwick Power Station with 60 MW of diesel fuelled generation, and the other at the Sullom Voe Terminal with 100 MW of independent gas-fired generation.

The Shetland Isles are well located to harness renewable generation, particularly from wind and marine sources. However, no further generation connections can be made to the existing Shetland system without a transmission link to the Scottish mainland.

Several large wind farm developments on Shetland have signed connection agreements and are actively seeking connection into the SHE Transmission network:

- Viking wind farm development (457 MW);
- Beaw Field (72 MW); and
- Energy Isles (120 MW).

To enable this renewable generation to connect to the mainland transmission network and support the supply to Shetland a transmission link is required. The link will comprise the following elements:

- 132 kV Substation at Kergord in Shetland;
- 600 MW HVDC converter Station at Kergord in Shetland;
- 600 MW HVDC cable between Kergord Converter station and Noss Head;
- HVDC Switching station at Noss Head Near Wick; and
- HVDC cable tie in between the existing Caithness Moray HVDC Link and the switching station

1.3 Route Development

The options considered for the subsea cable routing and landfall selection have been informed by work undertaken as part of a number of previous studies to establish a technically and environmentally feasible subsea cable route corridor which can be taken forward for consenting.

1.3.1 Landfall Locations

An initial search area on Shetland was defined in 2007 which identified six potential landfall options which were then subjected to environmental appraisal in order to select an environmentally preferred option (SHETL, 2009). The proposed landfall at Weisdale Voe, offered the shortest onshore route to the converter station and

also had the least environmental constraints. Since this study was undertaken there have been no reasons to select a different landfall in Shetland.
Four alternative landfall locations on the Caithness coast were initially considered (SSEPD, 2013). Three of these were located in embayments (Freswick's Bay, Sinclair's Bay (North) and Sinclair's Bay (South) with the fourth located on a rocky headland (Noss Head). Following evaluation, the sites at Sinclair's Bay (North) and Noss Head were taken forward as both being technically feasible, however final section of the preferred landfall location at Noss Head was determined based upon a locational preference for the converter station and consideration of the location of the existing Caithness to Moray HVDC Link cable route

1.3.2 Subsea Cable Route

An initial marine area of search was defined between the Shetland Islands and the Moray coast in 2007. Within this area three primary routes were initially defined (western route, eastern route and central route) each with different constraints. Following initial routing considerations in 2010, and as a result of evolving strategic requirements of the transmission network, the connection between Shetland and the Moray coastline was separated into two distinct projects: The Caithness to Moray HVDC Link and the Shetland HVDC Link (the Project).

Through 2012 and 2013, the route for the Project was refined with a 'straight line' route from Weisdale Voe to Caithness and a 'near Orkney' route being discounted and a route between Weisdale Voe and Noss Head being taken forward.

1.3.3 Marine Survey

MMT was contracted in 2013 to undertake marine geophysical seabed mapping, environmental and geotechnical surveys to investigate further route development in connection with previously planned and engineered routes. The survey of the proposed route provides a complete mapping across the entire route corridor. As part of this process, data acquired for the previous Caithness – Shetland routes were validated and included to form continuous routes and provide an understanding of expected ground conditions. The routes connected with this work were also surveyed by MMT in 2008, 2010 and 2012.

The 2013 marine and nearshore survey operations were undertaken in different phases and included the following:

- Geophysical data acquisition to determine water depths, seabed features, shallow geology, object detection and cable crossing positions. Instruments used: Multibeam Echo Sounder (MBES), Side Scan Sonar (SSS), Sub-bottom Profiler (SBP) and Magnetometer (offshore and nearshore);
- Environmental survey comprising the recovery of sediment samples and seabed photography as part of the habitat mapping (offshore). Instruments used: grab sampler and drop-down camera; and
- Geotechnical survey to determine the structure and physical properties of the surficial and shallow sediment layers (offshore). Instruments used: Vibrocorer and Cone Penetrometer Testing (CPT).

A survey data review, trenching assessment and route review was undertaken by Xodus in 2018 (Xodus, 2018). The review considered aspects of route optimisation, including the potential for route length reduction or routing options that could be expected to be more favourable, or reduced risk, for cable burial.

MMT was contracted in 2018 to collect additional geotechnical data along the route (vibrocores and CPT). Locations for investigation were nominally spaced at 1 km intervals and optimised by Xodus following a review of the existing data. In addition, further geophysical and hydrographic data (high resolution MBES) was collected in areas that were not previously covered by high resolution data. A complete centre line was acquired prior to the geotechnical operations to ensure the route was clear of potential obstructions and/or Unexploded Ordnance (UXO) prior to undertaking this work.

It should be noted that this route development has been undertaken in order to ascertain feasibility and to ensure that SHE Transmission have selected a route that is suitable for installation and as such can inform the consenting process. However, ultimately the successful cable installation contractor will be responsible for defining their own optimised route within an agreed 200 m wide consented corridor (+/- 100 m along the preferred route corridor centreline).

1.3.4 Cable Burial Risk Assessment

Following initial re-routing based on results and data from the marine surveys, a Cable Burial Risk Assessment (CBRA) will be carried out for the refined subsea cable route utilising Carbon Trust Methodology. The main objective of the CBRA will be to ensure that, based on the available survey data, cable burial can be achieved, using a variety of installation tools, if necessary, along as much as possible of the preferred cable route. The CBRA will consider a variety of tooling, i.e. pre- and post-lay plough, jetting, fluidisation and mechanical cutting (see Section 1.4.2.3), all of which will be considered as options for the cable installation contractor to utilise as required.

The CBRA will produce an indicative depth of burial listing for the cable route, which will afford suitable protection to the cable based on external threats. The minimum burial depth of the cable is expected to be approximately 600 mm of sediment. Where the CBRA identifies that due to seabed conditions, cable burial is not possible, where it is necessary to lay the cable directly on the seabed, alternative options for protecting the cable will be considered. These additional protection measures may include, for example, rock placement, concrete mattressing, Uraducting or cast iron half shells (see Section 1.4.3). The CBRA will also provide indicative rock volumes and locations.

1.4 Project Description

1.4.1 Cable Specification

Electricity will be transmitted using HVDC submarine technology. The circuit will comprise two separate power cables, one per pole, and a separate fibre optic communications cable. The three cables will be laid as a single bundle.

1.4.2 Installation

SHE Transmission intend to bury the subsea cable along the majority of the route, apart from where this is not possible, for example at crossings with existing cables, or where the seabed characteristics are inappropriate for burial. The cable route crosses a Nature Conservation Marine Protected Area (NCMPA) approximately 1 km east of the Noss Head landfall (see Section 4.2) where the cable will be required to be surface laid across a horse mussel bed and protected using Uraduct / Tekmar or a similar cable protection system.

The exact details of the cable installation technique to be employed will be confirmed when the contract for installation is awarded. It is however envisaged that a variety of installation and burial techniques will be required due to the variable nature of the seabed along the proposed cable corridor.

1.4.2.1 Seabed Preparations

Prior to offshore cable installation the installation contractor will clear the seabed of any obstacles from the path of the planned cable. This will be undertaken with a grapnel. Areas of boulders may also be cleared and along the route where areas of sandwaves cannot be avoided pre-sweeping may be required in order for the burial techniques to be employed effectively.

1.4.2.2 Cable burial

The main construction options available for cable burial include:

- Separate cable lay and burial campaigns – cable buried by cable plough or trencher after it has been laid on the seabed (post-lay burial).
- Simultaneous lay and burial with cable plough or trencher.
- Separate trenching and burial campaigns – trench pre-cut by a large plough or trencher and cable laid into an open trench followed by backfill by plough, natural backfill or rock placement.

1.4.2.3 Cable burial tools

There are a diverse range of cable burial machines available on the market capable of burying and protecting offshore cables. These include:

- Cable Burial Ploughs.
- Jetting systems.
- Mechanical Rock Wheel Cutters.
- Mechanical Chain Excavators.

1.4.3 Additional Cable Protection Methods

Cable routing is the principal method of avoiding hazards and sensitive features. Once the routes have been identified any remaining hazards to the cables, and the impact to other seabed users from the cables can be accurately identified. This then allows for further protection by burial.

In areas where insufficient sediment cover, or burial cannot be achieved, or for cable crossings, additional cable protection may be required. Options include:

- Rock placement – this technique, one of the most established methods of cable protection, is likely to be suitable in the areas of cable crossings, subject to detailed design. This procedure can also be utilised along lengths of cable as well as crossings with existing cables.
- Concrete mattresses are frequently used to protect subsea cables and can also be used to construct crossings over existing subsea cables and pipelines. They are flexible and thus follow the contours of the seabed.
- Sand / grout / rock bags – smaller bags filled with either sand, grout (which sets in water to the profiled shape) or rock bags can also be used to provide very localised protection, where most mechanical means such as trenchers cannot reach.
- Cable physical protection – additional protection can be provided around the cable in the form of articulated half shells. They are generally made of either polyurethane (PU) or cast-iron.

1.4.4 Cable Landfalls

The onshore cables will be connected with the marine cables in a transition jointing pit (TJP) buried in the ground above the high water mark. The marine cables will be brought ashore at both landfalls using a number of pre-installed Horizontal Directionally Drilled (HDD) ducts which will emerge in approximately 20 m water depth (Lowest Astronomical Tide (LAT)). The bundled cables will diverge at the landfalls with one cable being installed per HDD duct.

The section of cable between the HDD pop-out and the horse mussel located to the west of the Noss Head landfall will be surface laid and protected by rock. No rock will be placed within 100 m of the horse mussel bed feature.

1.4.5 Operations, Maintenance and Repair

Once buried, submarine cables do not require routine maintenance. However, it is likely that regular inspection surveys will be undertaken using standard geophysical survey equipment and/or Remotely Operated Vehicles (ROVs) to monitor the cables buried depth. Maintenance activities will be required to ensure the integrity of the cable is maintained through sufficient cable burial and or cable protection such as rock or mattress placement. For example, maintenance works may be required to re-bury any sections of cable that have become exposed and or to reinstate cable protection that has become displaced.

1.4.6 Decommissioning

Cables in Scottish territorial waters are installed on Crown Estate Scotland (CES) land and therefore a lease or licence is generally entered into for a set term, in this case, 40 years. An Initial Decommissioning Plan (IDP) will be developed and appended to the Crown Estate's licence agreement entered into by SHE Transmission for this project.

The case for cable recovery will need to be the subject of an environmental and economic assessment in the years leading up to decommissioning and will follow industry best practice at the time.

2 CONSENT REQUIREMENTS

2.1.1 Marine Licence and EIA requirements

Under Part 4 of the Marine (Scotland) Act 2010, a Marine Licence is required for the installation and operation of submarine cables in Scottish waters. The cable sections outside of the Scottish waters territorial limit are exempt from marine licence requirement, although a marine licence would still be required for any rock protection placed on the cable.

Submarine cables do not require a formal Environmental Impact Assessment (EIA) as they are not listed on either Schedule 1 or Schedule 2 of the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 (as amended).

Although a formal EIA is not required for submarine cables, Marine Scotland advises, in their Guidance for Marine Licence Applicant Version 2 June 2015 that "*applicants for marine licences for submarine cables should consider the scale and nature of their projects and give consideration to the need for a proportionate environmental assessment*".

For larger projects, where there is potential for the subsea cable to impact key environmental receptors, it is recommended by Marine Scotland (Marine Scotland, 2015) that an assessment of potential impacts on these receptors is carried out. Results from this assessment along with other relevant information about the Project should then be provided to support the Marine Licence application.

The purpose of this report is to determine the type, and scope, of studies to be undertaken to support the application for the Marine Licence for the Shetland HVDC Link.

2.1.2 Scottish National Marine Plan

The Scottish Government adopted the National Marine Plan in early 2015 (Scottish Government, 2015) to provide an overarching framework for marine activity in Scottish waters, in an aim to enable sustainable development and the use of the marine area in a way that protects and enhances the marine environment whilst promoting both existing and emerging industries. This is underpinned by a core set of general policies which apply across existing and future development and use of the marine environment; policies of particular relevance to the marine components of the Shetland HVDC Link include:

- General planning principle: There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of the Plan;
- 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;
- 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.
  - Protect and, where appropriate, enhance the health of the marine area.
- Noise: Development and use in the marine environment should avoid significant adverse effects of manmade noise and vibration, especially on species sensitive to such effects;
- Engagement: Early and effective engagement should be undertaken with the general public and interested stakeholders to facilitate planning and consenting processes; and
- Cumulative impacts: Cumulative impacts affecting the ecosystem of the Marine Plan area should be addressed in decision-making and Plan implementation.

Sectoral policies are also outlined in the Plan where a particular industry brings with it issues beyond those set out in the general policies. With respect to submarine cables, the Marine Plan sets out a number of key objectives. Those that are relevant to the Shetland HVDC Link include:

- Protect submarine cables whilst achieving successful seabed user co-existence;
- Achieve the highest possible quality and safety standards and reduce risks to all seabed users and the marine environment;
- Safeguard and promote the global communications network; and
- Support the generation, distribution and optimisation of electricity from traditional and renewable sources to Scotland, UK and beyond.

Key marine policies underpinning work carried out as part of this project include:

- Stakeholder engagement – this should be undertaken before routes are selected and agreed;
- Cable developers are required to provide evidence that they have taken a joined-up approach to development and activity to minimise impacts on the environment and other sea users;
- Cables should be suitability routed to provide sufficient requirement for installation and protection;
- 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 to be not feasible, cables may be suitability protected through recognised and approved measures (such as rock placement, concrete mattresses or cable armouring) where practicable and cost-effective and as risk assessments direct; and
- When selecting locations for cable landfalls consideration should be given to flooding and coastal protection and align with policies in Scottish Planning Policy and Local Development Plans.

With respect to sea fisheries, the NMP sets out several policies. Those relevant to the Project include:

- Account should be taken of the EU's common Fisheries Policy, Habitats Directive, Birds Directive and Marine Strategy Framework Directive.
- Key factors should be taken into account when deciding on uses of the marine environment and potential impact on fishing such as; the cultural and economic importance of fishing, in particular to vulnerable coastal communities.
- In the event that fishing opportunities or activities cannot be safeguarded, a Fisheries Management and Mitigation Strategy should be prepared by the proposer of development or use.

With respect to submarine cables, the NMP sets out a number of key objectives. Those relevant to the Project include:

- Protect submarine cables whilst achieving successful seabed user co-existence;
- Achieve the highest possible quality and safety standards and reduce risks to all seabed users and the marine environment; and
- Support the generation, distribution and optimisation of electricity from traditional and renewable sources to Scotland, UK and beyond.

2.1.3 Shetland Islands' Marine Spatial Plan

The Shetland Islands Marine Spatial Plan (SIMSP) provides an overarching policy framework to guide marine development and activity. This SIMSP is based on Scottish Ministers' commitment to making marine management more efficient, inclusive and accessible. Areas of constraint and/or opportunities for development have been identified in order to reduce potential conflicts between marine activities and encourage co-existence between multiple users. The SIMSP aims to provide an approach to the management of the sea around Shetland; facilitating an integrated and better-informed decision-making process regarding the future distribution of activities and resources; and enabling the long-term protection and use of the marine environment.

Section 4 of the SIMSP sets out the legislative requirements that need to be considered for any development proposal. This section covers marine and works licences, planning permission, controlled activity regulation (CAR) authorisation, seabed agreement for lease, electricity regulations, EIA, cumulative impacts and consultation with stakeholders.

Section 5 of the SIMSP sets out a number of general policies that ensure that the SIMSP is contributing to the high-level government targets that are supporting a clean and safe, healthy and diverse, and productive marine environment. Those that are most relevant to this Project include: underwater noise, navigational safety, cables and pipelines, climate change, coastal defence and flood protection, protected species, nature conservation designations, marine recreation and invasive non-native species.

2.1.4 The Islands' Bill

The Islands Bill (2018), which received Royal Assent on 6th July 2018, makes the provision for a National Islands Plan (NIP) in Scotland. One of the objectives of the NIP is to establish a licensing scheme in respect of marine development adjacent to the islands. The plans will see the introduction of Scottish Island Marine Areas; areas adjacent to an island and/or up to 12 nm from that island. Specific development activities carried out within Scottish Island Marine Areas will be required to be licensed. Development activities include; construction, alteration or improvement works of any description (either in or over the sea, or on or under the seabed) as well as any form of dredging. As such, the future licensing requirements of the Shetland HVDC Link will be reviewed in accordance with the newly introduced Islands Bill.

2.1.5 The Zetland County Council Act

The Shetland Islands Council has a duty under the Zetland County Council Act 1974 (ZCC Act) to promote the conservation of, and control development in, the coastal area of Shetland with the exception of those areas under the jurisdiction of the Lerwick Port Authority and Broonies Taing Pier Trust. The council's Works Licence Policy provides the detailed and development policy framework that underpins the Local Development CST1 Coastal Development on all marine developments, including dredging but excluding those connected with marine aquaculture, below MHWS out to 12 nautical miles.

2.1.6 Other legislative requirements

Where there is potential for a project to have an adverse effect on a Natura site (Special Area of Conservation (SAC) or Special Protection Area (SPA)) including proposed or candidate sites e.g. pSPAs or cSACs, an appropriate assessment is required in accordance with the Habitats Directive to ascertain whether a project will adversely affect the integrity of a site in view of the conservation objectives of the site.

The requirements of the Habitats Directive are transcribed in Scotland by the Conservation (Natural Habitats, &c.) Regulations 1994 as amended. In accordance with these regulations, and as part of the Habitats Regulation Appraisal (HRA) process, where it is identified that there is potential for a Likely Significant Effect (LSE) on a Natura site, the applicant is required to provide information on the effects of the project on the integrity of a European site to the competent authority to enable them to undertake an appropriate assessment of the project.

In addition to requirements for an HRA, where a project has the potential to impact either a designated or possible Nature Conservation Marine Protected Area (NCMPA or possible NCMPA) designated under the Marine (Scotland) Act 2010, applicants are also required to provide specific information on the potential impacts of the proposed project on the conservation objectives of these sites.

3 ASSESSMENT METHODOLOGY

3.1 Introduction

This section presents an outline of the assessment methodology to be employed within the Environmental Appraisal (EA) for those impacts scoped into the assessment. It outlines the methodology for the identification and evaluation of potential significant environmental effects on physical, biological and human receptors.

3.2 Assessment approach

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 proposed. The process considers:

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

It is important to have a common approach to impact assessment across a project, there are definitions and issues specific to each impact that the assessment must take into account. However, where relevant the EA will present further topic specific detail in the impact assessment sections.

3.2.1 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 will be 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. As mentioned above, in carrying out individual assessments, a more specific scale of increasing sensitivity will be defined where this is appropriate.

3.2.2 Magnitude

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

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

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

3.2.3 Significance of impact

The significance of potential effects will be determined by a combination of the sensitivity and value of a receptor and the magnitude of an effect. The proposed framework for assessing the significance of potential effects is outlined below Table 3-1.

Table 3-1 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
Moderate	Negligible	Minor	Moderate	Moderate	Major
Major	Minor	Minor / moderate	Moderate	Major	Major

Where a range of significance is presented in Table 3-1 expert judgement will be used to consider the final impact. In general, moderate or major impacts are classified as significant and will require additional mitigation and further assessment of the residual effect.

Certain measures will be incorporated into the Project design in adherence to best practices (BP) or embedded mitigation / management measures in accordance with standard industry practice.

4 OVERVIEW OF KEY ENVIRONMENTAL CONSIDERATIONS

4.1 Overview of proposed cable route area

This section presents the key environmental features associated with the area covered by the proposed Shetland HVDC Link subsea cable route. The sensitivity of those features to the installation and operation of a subsea cable is described further in the following sections. The overview has been informed by a range of data sources including a review of the information provided in the geophysical and environmental survey reports (MMT, 2013).

The maximum recorded water depth along the proposed cable route was 124 m (LAT) (MMT, 2013).

The waters between the north coast of Scotland and Shetland support a variety of marine wildlife including benthic species, marine mammals, birds and fish. The proposed cable route overlaps with the following designated sites; Noss Head NCMPA, Seas off Foula pSPA and the Shetland NSA. There are a number of additional designated sites, including SAC's and SSSI's, which the cable route is located within the vicinity of and has the potential to impact upon including, but not limited to: Mousa SAC; Yell Sound Coast SAC; and South Whiteness SSSI. There is only one designated seal haul-out located within 2 km of the proposed cable corridor: the Sanda and Score Islands seal haul out.

Fisheries within the vicinity of the proposed cable corridor target predominantly mackerel with herring, cod and haddock also forming other important species caught within the region. Trawling gear represents the largest part of the fishing effort. The cable route passes through, or close by, areas which are classed as important shellfish dredging sites for scallops and important creeling areas for Norway lobster.

Existing infrastructure within the vicinity of the cable route includes renewable energy projects, a number of telecommunication and power cables, oil and gas infrastructure as well as potential wrecks,

Some of the key environmental features and human factors associated with the proposed cable route and landfalls are discussed in more detail below.

4.2 Protected sites

The identification of the protected sites to include in the EA has been based on the filtering of qualifying interests / features and associated protected sites in a process based on:

- Identifying the range of impacts that the Project could have on qualifying interest(s) of a site (impact pathways); and
- Determining connectivity with the sites.

The following selection criteria, based on the above, was used to identify the sites that require assessment:

- SPAs and NCMPAs (including proposed and candidate sites) with breeding seabirds qualifying features with foraging ranges (as identified by Thaxter *et al.,* (2012)), that overlap with the proposed cable corridor;
- SACs (including proposed and candidate sites) with harbour seal interests within 50 km of the proposed cable corridor and breeding grey seal within 20 km of the proposed cable corridor;
- Designated seal haul outs that overlap with or are located within 500 m of the proposed cable corridor;
- SACs (including proposed and candidate sites) with otter interests that overlap with or are located within 500 m of the proposed cable corridor;
- SACs and NCMPAs (including proposed and candidate sites) with cetaceans as qualifying features within 50 km of the proposed cable corridor;
- SACs and NCMPAs (including proposed and candidate sites) with cetaceans as qualifying features within 50 km of the proposed cable corridor;

- SACs with Atlantic salmon and freshwater pearl mussel (which is dependent on salmonids) who's migrating smolts or adult salmon are likely to cross the proposed cable corridor);
- SACs (including proposed and candidate sites and NCMPAs with seabed/benthic protected features that overlap with or are located within 2 km of the proposed cable corridor; and
- SSSIs which overlap with the marine environment (to MLWS) that overlap with or are located within 2 km of the proposed cable corridor.

The sites which have the potential to be impacted by the Project, based on the selection criteria above are presented in Table 4-1.

Table 4-1 List of protected sites with marine components located within the vicinity of the proposed Shetland HVDC Link cable corridor

Site name	Description	Approximate distance (km) from proposed subsea cable corridor (at closest point)	Scoped in or out based on selection criteria
NCMPA			
Noss Head	The site has been designated for the following feature: > Biodiversity - Horse mussel *Modiolus modiolus* beds	0	Scoped in
East Caithness Cliffs	The site has been designated for the following criteria: > Black Guillemot *Cepphus grylle*	3.6	Scoped in
SAC			
Mousa	The site has been designated for the following Annex II species: > Harbour seal *Phoca vitulina*	14.1	Scoped in
Yell Sound Coast	The site has been designated for the following Annex II species: > Harbour seal *Phoca vitulina* > Otter *Luttra luttra*	19.2	Scoped in
Sanday	The site has been designated for the following Annex II species: > Harbour seal *Phoca vitulina*	25.8	Scoped in
SPA/pSPA			

Site name	Description	Approximate distance (km) from proposed subsea cable corridor (at closest point)	Scoped in or out based on selection criteria
Seas off Foula	The site supports the following Annex I species (breeding season): > Great skua *Stercorarius skua* > Northern fulmar *Fulmarus glacialis* > Arctic skua *Stercorarius parasiticus* > Common guillemot *Uria aalge* > Atlantic puffin *Fratercula arctica* The site also supports the following Annex I species (non-breeding season): > Great skua *Stercorarius skua* > Northern fulmar *Fulmarus glacialis* > Common guillemot *Uria aalge*	0	Scoped in
Pentland Firth	This site supports the following Annex I species (breeding season): > Arctic skua *Stercorarius parasiticus* > Arctic tern *Sterna paradisaea* > Common guillemot *Uria aalge*	3.3	Scoped in
East Caithness Cliffs	This site supports the following Annex I species: > Peregrine *Falco peregrinus* This site also supports the following migratory species: > Common guillemot *Uria aalge* > Razorbill *Alca torda* > Herring gull *Larus argentatus* > Black-legged kittiwake *Rissa tridactyla* > European Shag *Phalacrocorax aristotelis* This site also regularly supports in excess of 20,000 individual seabirds including but not limited to Great-backed gull *Larus marinus*, Cormorant *Phalacrocoracidae*, northern fulmar *Fulmarus glacialis*, common guillemot *Uria aalge*, black-legged kittiwake *Rissa tridactyla*, herring gull *Larus argentatus* and European shag *Phalacrocorax aristotelis*.	3.6	Scoped in

Site name	Description	Approximate distance (km) from proposed subsea cable corridor (at closest point)	Scoped in or out based on selection criteria
East Mainland Coast	This site supports the following Annex I species (breeding) species: > Red-throated diver *Gavia stellata* This site also supports the following Annex I (non-breeding) species: > Common eider *Somateria mollissima* > Great northern diver *Gavia immer* > Long-tailed duck *Clangula hyemalis* > Red-breasted merganser *Mergus serrator* > Slavonian grebe *Podiceps auritus*	4.2	Scoped in
Caithness Lochs	This site supports the following Annex I species (over winter): > Greenland White-fronted Goose *Anser albifrons flavirostris* > Whooper Swan *Cygnus Cygnus* > Greylag Goose *Anser anser* (migratory)	7.3	Scoped out
Caithness and Sutherland Peatlands	This site supports the following Annex I species (breeding): > Black-throated Diver *Gavia arctica* > Golden Eagle *Aquila chrysaetos* > Golden plover *Pluvialis apricaria* > Hen Harrier *Circus cyaneus* > Merlin *Falco columbarius* > Red-throated Diver *Gavia stellate* > Short-eared Owl *Asio flammeus* > Wood Sandpiper *Tringa glareola* The site also supports the following Annex I species (migratory): > Common Scoter *Melanitta nigra* > Dunlin *Calidris alpine schinzii* > Greenshank *Tringa nebularia* > Wigeon *Anas Penelope*	7.3	Scoped in

Site name	Description	Approximate distance (km) from proposed subsea cable corridor (at closest point)	Scoped in or out based on selection criteria
Fair isle	The site supports the following Annex I species (breeding): > Arctic Tern *Sterna paradisaea* > Fair Isle Wren *Troglodytes troglodytes fridariensis* The site supports the following Annex I species (migratory): > Guillemot *Uria aalge* The site also regularly supports at least 20,000 seabirds including Puffin *Fratercula arctica,* Razorbill *Alca torda,* Kittiwake *Rissa tridactyla,* Great Skua *Catharacta skua,* Arctic Skua *Stercorarius parasiticus,* Shag *Phalacrocorax aristotelis,* Gannet *Morus bassanus,* Fulmar *Fulmarus glacialis,* Guillemot *Uria aalge,* Arctic Tern *Sterna paradisaea.*	9.1	Scoped in
North Caithness Cliffs	The site supports the following Annex I species (breeding): > Peregrine *Falco peregrinus* > Guillemot *Uria aalge* The site supports at least 20,000 seabirds including Puffin *Fratercula arctica,* Razorbill *Alca torda,* Kittiwake *Rissa tridactyla,* Fulmar *Fulmarus glacialis,* Guillemot *Uria aalge*	12.2	Scoped in
Mousa	The site supports the following Annex I species (breeding): > Arctic Tern *Sterna paradisaea* > Storm Petrel *Hydrobates pelagicus*	14.9	Scoped in
Noss	The site supports the following Annex I species (breeding): > Gannet *Morus bassanus* > Great Skua *Catharacta skua* > Guillemot *Uria aalge* This site also regularly supports at least 20,000 seabirds including Puffin *Fratercula arctica,* Kittiwake *Rissa tridactyla,* Fulmar *Fulmarus glacialis,* Guillemot *Uria aalge,* Great Skua *catharacta skua,* Gannet *Morus bassarus.*	15.1	Scoped in
Lochs of Spiggie and Brow	The site supports the following Annex I species (over winter): > Whooper Swan *Cygnus cygnus*	15.2	Scoped out

Site name	Description	Approximate distance (km) from proposed subsea cable corridor (at closest point)	Scoped in or out based on selection criteria
East Mainland Coast	The site supports the following Annex I species (breeding): > Red-throated diver *Gavia arctica* This site also supports the following Annex I species (non-breeding): > Common eider *Somateria mollissima* > Great northern diver *Gavia immer* > Long-tailed duck *Clangula hyemalis* > Red-breasted merganser *Mergus serrator* > Slavonian grebe *Podiceps auritus*	18.2	Scoped in
Samburgh Head	The site supports the following Annex I species (breeding): > Arctic Tern *Sterna paradisaea* The site also regularly supports at least 20,000 seabirds including Guillemot Uria aalge, Kittiwake *Rissa tridactyla*, Fulmar *Fulmarus glacialis*, Arctic Tern *Sterna pradisaea*	20	Scoped in
Copinsay	The site regularly supports at least 20,000 seabirds including Guillemot *Uria aalge,* Kittiwake *Rissa tridactyla,* Great Black-backed Gull *Larus marinus,* Fulmar *Fulmarus glacialis*	22.5	Scoped in
Papa Stour	The site supports the following Annex I species (breeding): > Arctic Tern *Sterna paradisaea* The site supports the following Annex I species (migratory): > Ringed Plover *Charadrius hiaticula*	22.5	Scoped in
Pentland Firth Islands	The site supports the following Annex I species (breeding): > Arctic Tern *Sterna paradisaea*	24.3	Scoped in
Foula	This site supports the following Annex I species (breeding): > Arctic Tern Sterna paradisaea > Leach's Storm-petrel *Oceanodroma leucorhoa* > Red-throated Diver *Gavia stellata*	24.8	Scoped in
Ramsar			
Caithness lochs	This site is designated for the following species: > Greenland white-fronted goose *Anser albifrons flavirostris* > Greylag goose, *Anser anser*	7.3	Scoped out

Site name	Description	Approximate distance (km) from proposed subsea cable corridor (at closest point)	Scoped in or out based on selection criteria
Caithness and Sutherland peatlands	This site regularly supports the following species during the breeding season: > Dunlin Calidris alpine schinzii	7.4	Scoped out
Seal haul-out			
Sanda & Score Islands	This site protects both grey seal *Halichoerus grypus* and harbour seal *Phoca vitulina*	0.068	Scoped in
SSSI			
South Whiteness	The natural features for which this site is designated for include: > Coastlands - Saltmarsh > Vascular plants - Shetland mouse-ear hawkweed *Pilosella flagellaris ssp bicapitata*	1.5	Scoped out
NSA			
Shetland	This site is designated for the following special qualities: > The stunning variety of extensive coastline > Coastal views both close and distance > Coastal settlement and fertility within a large hinterland of unsettled moorland and coast > The hidden coasts > The effects and co-existence of wind and shelter > A sense of remoteness, solitude and tranquillity > The notable and memorable coastal stacks, promontories and cliffs > The distinctive cultural landmarks > Northern light	0	Scoped in

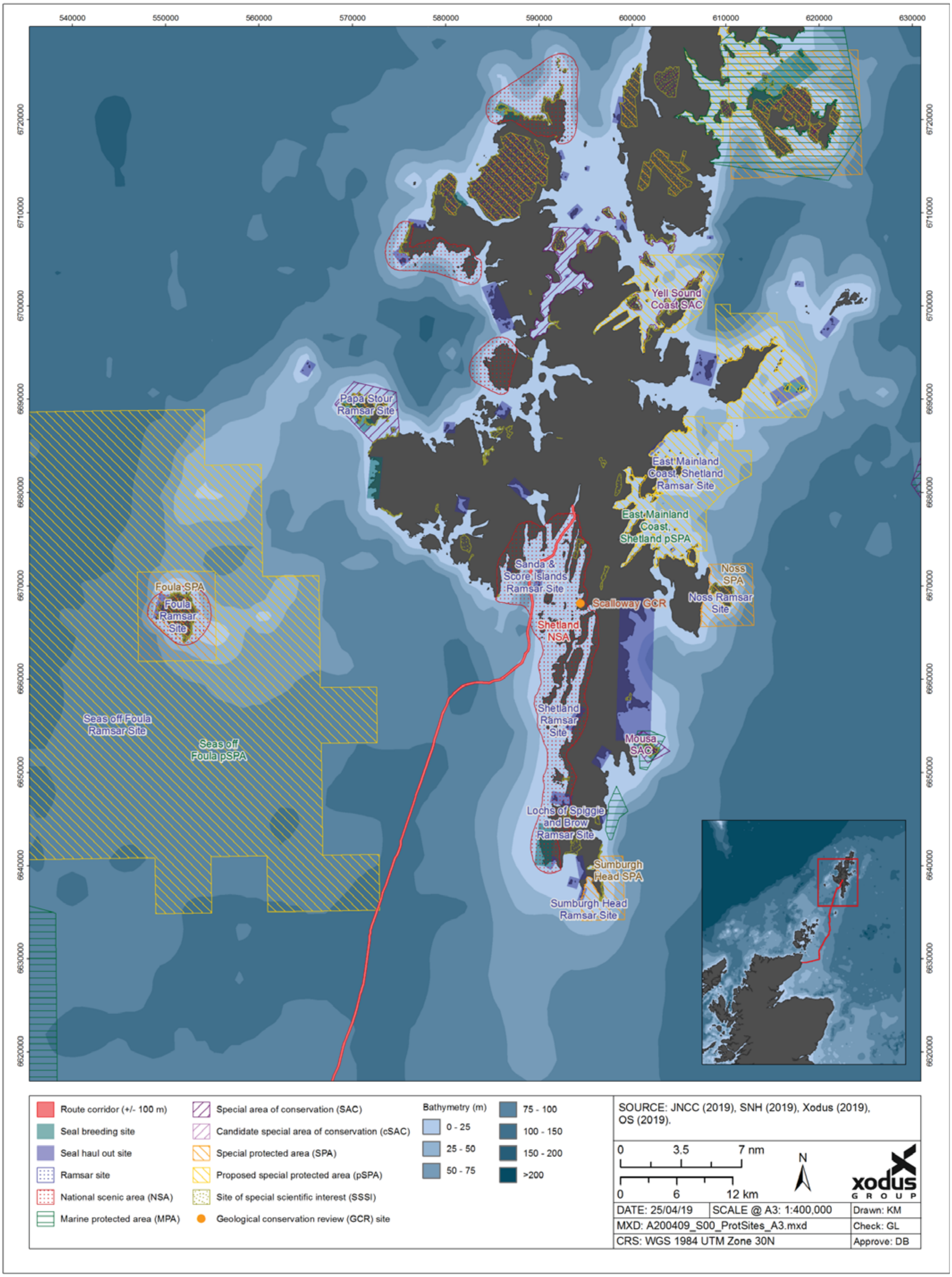

Figure 4-1 Designated sites that meet the selection criteria thresholds within vicinity of the northern section of the Shetland HVDC Link subsea cable corridor

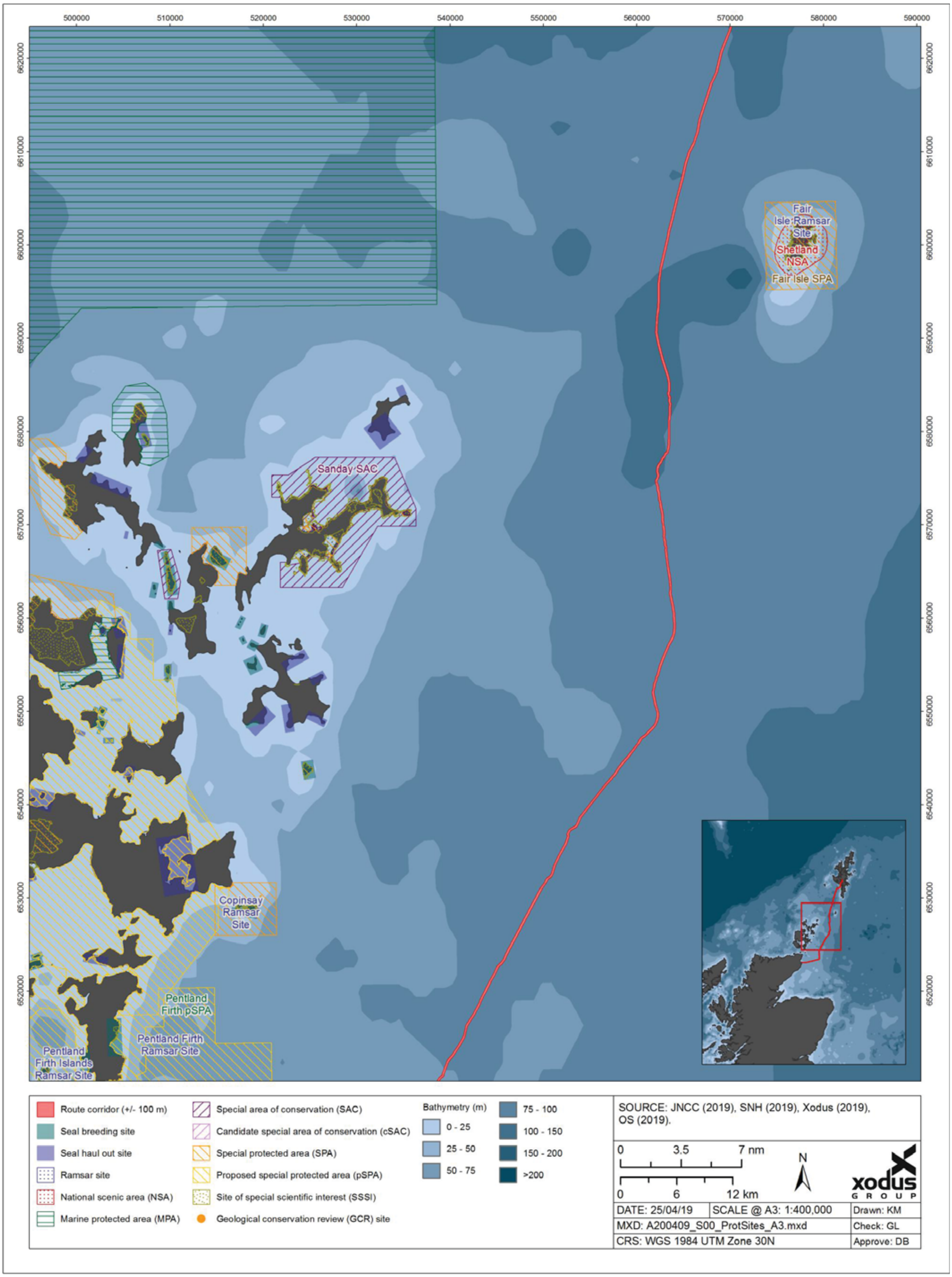

Figure 4-2 Designated sites that meet the selection criteria thresholds within the vicinity of the central section of the Shetland HVDC Link subsea cable corridor

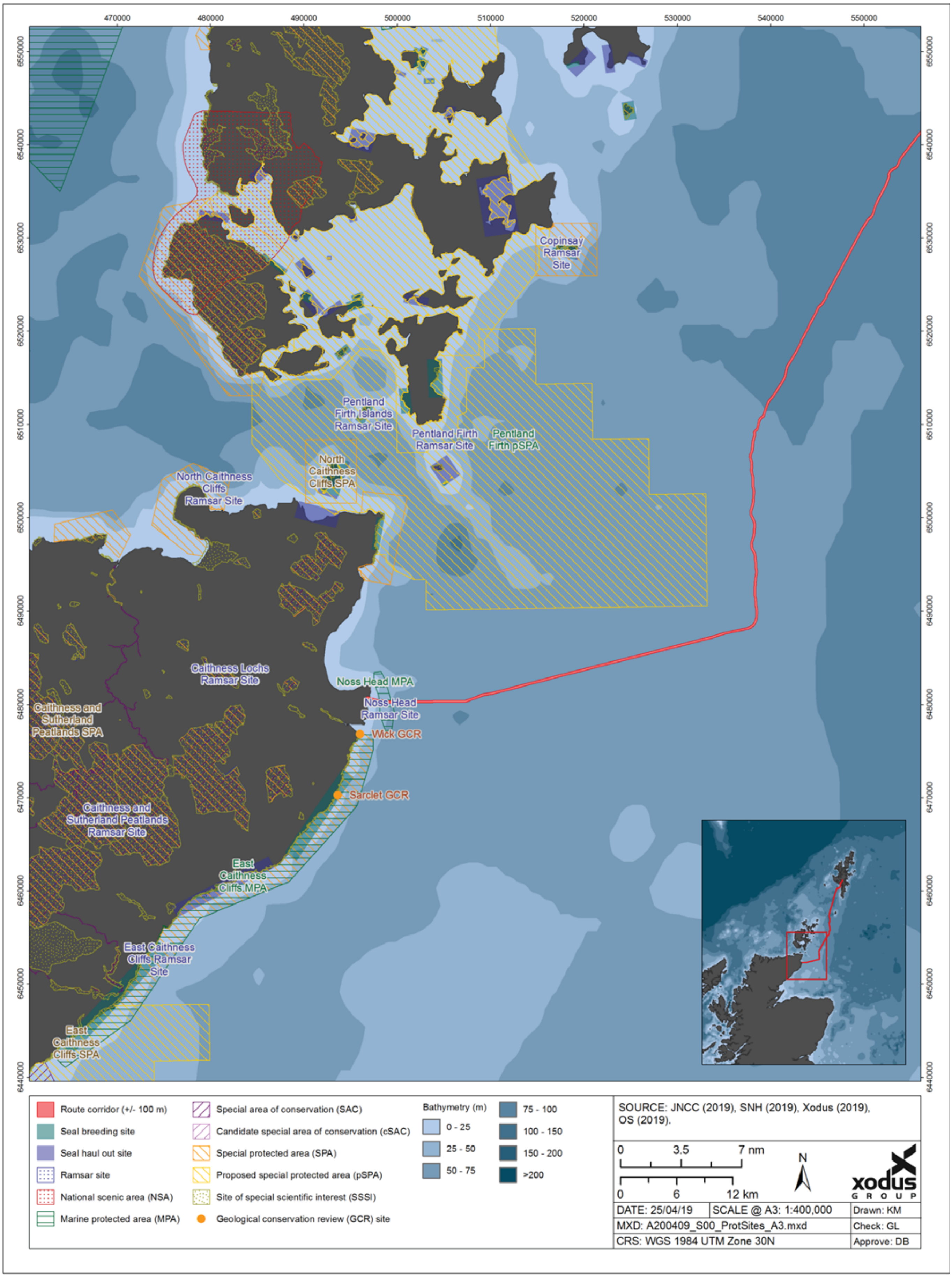

Figure 4-3 Designated sites that meet the selection criteria thresholds within the vicinity of the southern section of the Shetland HVDC Link subsea cable corridor

4.2.1 Scoping of potential impacts

Potential impacts on the protected sites and associated qualifying features / features of interest are discussed in the following specific sections of this report relating to the relevant chapters:

- Physical environment;
- Benthic ecology;
- Ornithology; and
- Marine Mammals.

Conclusion: Protected sites
Protected sites and species will be taken into account during the assessment of each topic area within the EA.

A Nature Conservation Appraisal (NCA) will assess the potential impact to protected sites and species specifically, see Section 5 for further information.

4.3 Physical environment and seabed conditions

4.3.1 Key data sources

- Marine Scotland National Marine Interactive Plan (NMPi)
- Caithness Mainland to Shetland Subsea Link Project marine survey reports (MMT, 2018; MMT, 2013).
- SEPA, 2008, Scottish Bathing Waters 2007, SEPA.
- Joint Nature Conservation Committee (JNCC) (1997). Coasts and seas of the United Kingdom, Region 1, Shetland.
- Joint Nature Conservation Committee (JNCC) (1997). Coasts and seas of the United Kingdom, Region 4, South-east Scotland: Montrose to Eyemouth

4.3.2 Baseline overview

4.3.2.1 Metocean conditions

The Shetland HVDC Link cable route is located between Weisdale Voe (Shetland) and Caithness (mainland Scotland), and is characterised by rocky coastline, cliffs and clear, unpolluted waters (JNCC, 1997a).

Winds within the north coast of Scotland and Shetland region are predominantly from the southwest; the result of low pressure systems that often approach from the west/southwest. Gale force winds have been observed within this area of the North Atlantic, particularly during winter. Mean wind speed throughout the year is 6.5 – 7.5 m/s, with gales occurring on average 58 days per year. The highest mean wind speed and the strongest gusts in Britain have both been recorded in Shetland (JNCC, 1997a). The wind speeds on the north coast of Scotland are influenced by local topography with mean hourly windspeeds of 3 – 3.5 m/s (JNCC, 1997b)

The northern Scottish waters form the boundary between the North Atlantic and the North Sea tidal systems resulting in complex hydrological dynamics. This is further exacerbated by the varied topography, water depths and numerous islands including Orkney and Fair Isle. The Shetland inshore area (within 22 km / 12 nm) has numerous voes (drowned river valleys with long steep-sided channels which can reach depths of up to 60 m). The tidal range at mean spring tides in the Shetland Islands is approximately 1.5 m (JNCC, 1997a). Tidal surges of between 0.75 m and 1 m occur in the region once in every 50 years on average. (JNCC, 1997a). Tidal ranges along the east coast of Scotland are greater than those found anywhere else in the UK, with a mean spring tide value of over 4.0 m (JNCC 1997b).

The area between the north coast of Scotland and the Shetland Isles has one of the highest wave energy climates in Europe. Significant fetch distances across the north of the proposed Shetland HVDC cable corridor results in large, long period swell waves. The annual wave height increases in a northern direction, from 1.5 m – 3 m along the proposed cable route (NMPi, 2019).

Mean spring tidal range ranges between across the proposed cable route, from approximately 2.1 to 3.0 m to the east of Noss Head, and Orkney Islands reducing to 0.1 to 1.0 m west of Fair Isle on the approach to Shetland. Strong tidal streams run through the sounds between the islands and around the headlands of Shetland (JNCC, 1997). Tidal steams reach up to speeds of 5 knots (approximately 2.6 m/s) or more between the sounds, channels and rocks within the North Scotland waters. The mean spring tidal range within the vicinity of the proposed cable route decreases in a northern direction; from 2.1 m at the Caithness (mainland Scotland) landfall, to 1.1 m at the Weisdale Voe (Shetland) landfall of (NMPi, 2019). Neap tidal ranges are approximately 0.55 m in the north and 1.23 in the south (SSE, 2013).

4.3.2.2 Geology

Shetland consists of an array of metamorphic, igneous intrusive, igneous extrusive and sedimentary rocks (JNCC 1997). There are several bedrock lithologies along the proposed cable corridor comprising predominantly of conglomerates, undifferentiated sandstones and siltstones of Permian – Triassic age (approximately 250 Ma). At the Noss Head landfall, and along areas of the proposed subsea cable route, mudstones, undifferentiated siltstones and sandstones deposited during the Devonian (approximately 419 Ma) are present. At the Weisdale landfall, the bedrock comprises of undifferentiated metamorphic basement rock, deposited pre-Devonian. There are several superficial deposits along the proposed cable route including; undifferentiated sandy gravel, undifferentiated gravelly sand, slightly gravelly sand, sand, gravel, gravelly muddy sand, all of which were deposited during the Holocene period approximately 12,000 years ago (NMPi, 2019).

During February – March 2013, MMT undertook marine geophysical seabed mapping, environmental and geotechnical surveys to investigate further route development in connection with previously planned and engineered routes. This survey followed on from previous surveys carried out along the route in 2008, 2010 and 2012. The scope of the surveys included MBES, SSS, SBP, Magnetometer, sediment sampling, seabed photography, vibrocoring and CPT. Along The survey corridor, water depths ranged between 0 m to approximately 124 m (LAT) (MMT, 2013). It was observed during this survey that there are a wide-range of habitats; from bedrock, boulders, sands to muddy sediments. The most common geology was sand and coarse sand, interrupted by mixed sediments including intrusions of fine sand and muddy sediments to the north and south of the surveyed corridor (MMT, 2013).

During October to December 2018, MMT carried out a further survey to determine the acceptability and confirm the viability of a route. This survey comprised of MBES, SSS, SBP survey techniques. On approach to the Shetland landfall (between Kilometre Point (KP) 0 and KP 55), the gradient of the slope is considered to be gentle. Moving south along the cable route, (from KP 55 to KP 205), the slope has a predominantly moderate gradient, however there are five occasions where the values become steep; the steepest slope is found at KP 124.473 with a value of 12.13 degrees (MMT, 2018). Moving further south, towards the mainland Scotland landfall (between KP 205 and KP 250.915), the slope values start off as moderate, and as the route approaches the coastline, they become steep to very steep in places. The steepest slope is found at KP 250.812 with a value of 50.60 degrees (MMT, 2018).

4.3.2.3 Conservation sites with geological features

There is one conservation site located in close proximity to the proposed cable corridor; Skelda Ness SSSI located 3.2 km from the cable corridor. The Skelda Ness SSSI is designated for its mineralogy; the area has abundant, excellent outcrops of coarse-grained, pink granite of Sandstine Complex.

Geological Conservation Review (GCR) sites have been identified as sites of national and international importance regarding British geology. There are three Geological Conservation Review (GCR) sites that have the potential to be impacted by the installation of the Shetland HVDC Link cable due to their proximity to the proposed cable corridor (see Table 4-2).

Table 4-2 Geological Conservation Sites in the vicinity of Shetland HVDC Link cable corridor

Site Name	GCR Code	Grid Reference	Distance from subsea cable route corridor (km)
Sarclet	3333	335200, 943300	10.8
Wick Quarries	1812	337700, 949800	3.9
Scalloway	3315	439000, 1139600	5

Shetland was awarded membership of the European Geoparks Network ion 2009, in recognition of its varied geological composition; with rocks from the Precambrian to the Carboniferous, the geology spans almost 3 billion years. As such, the geology of Shetland is considered to be an important feature of the area.

4.3.2.4 Water and sediment quality

The mean monthly sea surface temperatures in Shetland for summer and winter are 12.5°C and 7.5 °C respectively (JNCC 1997a). The average surface water temperature along the east coast of Scotland is 5.5 – 6°C in winter, and 13°C in summer (JNCC, 1997b). The Shetland Islands are surrounded by waters with salinity in excess of 35 g /kg in both summer and winter, whilst the east coast of Scotland has water salinity slightly below 35 g /kg (JNCC 1997a; JNCC 1977b).

The closest designated Bathing Water sites are located at Dunnet Bay, and Thurso, approximately 30 km and 40 km north-west from the mainland Scotland landfall site. Dunnet, Bay, is considered to have waters in "excellent" condition (SEPA, 2016). Thurso is considered to have waters in "sufficient" condition (SEPA, 2016). Given the large intervening distance between the proposed cable route and the Bathing Water sites, it is considered that the proposed works are unlikely to have significant impact on the Bathing Water sites.

There are no known sediment contamination 'hot spots' present along the proposed cable corridor, and known offshore disposal sites have been avoided through cable routing. As a result, mobilisation of historic contaminants from sediments is not expected to occur.

4.3.3 Scoping of potential impacts

There is one designated site of conservation importance that is located within the vicinity of the proposed cable route; Skelda Ness SSSI. However, given the intervening distance between the proposed works and this site, it is considered unlikely that the Project will have impact upon the integrity of the SSSI. The three GCR's situated within the vicinity of the proposed works are also unlikely to be impacted due to the intervening distance.

During the cable installation activities, there is the potential for accidental hydrocarbon spills; however, the cable installation vessels will comply with the international requirements of the MARPOL convention, as well as best practice for works in the marine environment. As such, the potential risk of any such accidental spills is reduced. Leaching of materials from the cable is also considered to be highly unlikely given the use of modern cable armour and protection (SHET, 2016)

Sediment resuspension and settlement is expected to be highly localised, therefore the installation of the cable is not expected to cause any significant impact on the physical environment and seabed conditions. The potential impacts of the proposed cable installation on benthic and intertidal ecology are covered in Section 4.4.

Table 4-3 Potential impacts summary

Potential impact	Relevant phase of cable installation			Scoping result
	Cable installation	Cable operation (Maintenance and Repair)	Decommissioning	
Modification of sediment transport pathways	✓	✓	✓	Scoped in
Scour due to the presence of cable protection	✓	✓	✓	Scoped in
Damage to geological features	✓	X	✓	Scoped in
Disturbance or damage to seabed morphology and features	✓	X	✓	Scoped in
Accidental spill	✓	✓	✓	Scoped out

Note: ✓ = potential impact is relevant to phase of Project

Conclusion: Physical environment and seabed conditions

Likely significant impacts upon the modification of sediment transport pathways have been identified as a result of the Project.

Further assessment work is required in support of the Marine Licence application including information to support a morphological assessment for any rock placed on the cable in coastal areas.

4.4 Benthic and intertidal ecology

4.4.1 Key data sources

The key data sources for benthic and intertidal ecology include:

- EUSeaMap 2016 Broad-scale seabed habitat classification (JNCC, 2017); and
- Caithness Mainland to Shetland Subsea Link Project marine survey reports (MMT, 2018; MMT, 2013).

4.4.2 Baseline overview

The seabed along the proposed cable corridor supports a diverse array of benthic habitats and species across its various biotopes. This includes species supported by intertidal ecosystems, offshore circalittoral habitats, and muddy and mixed sediment habitats. The most notable of these is probably the ocean quahog (*Arctica islandica*), which has distributions potentially overlapping the proposed cable corridor based on 2010 survey data for this slow-growing species.

More than thirty of the Scottish marine broadscale habitats and the benthic 'low mobility' species they support have been identified by SNH and the JNCC as Priority Marine Features (PMFs), several of which can be found along the cable route. The list of PMFs has been compiled from an evaluation of Scotland marine biodiversity interests that are on existing conservation lists, including Annexes I and II of the Habitats Directive, the OSPAR[1] list of threatened or declining habitats and species (OSPAR, 2012), and UK Post-2010 Biodiversity Framework priority species (JNCC, 2016a). The objective of the list of PMFs is to direct the implementation of conservation actions for the protection of these features, forming the basis of the list of 41 Marine Protected Area (MPA) search features (SNH & JNCC, 2012; Tyler-Walters *et al.*, 2016). These are marine features that have been identified as requiring protection through the designation of NCMPAs under the Marine (Scotland) Act 2010. In addition to the list of PMFs, the Scottish Biodiversity List (SBL) recognises animals, plants and

[1] The Convention for the Protection of the Marine Environment of the North East Atlantic

habitats that Scottish Ministers consider to be of principal importance for biodiversity conservation in Scotland; this list contains 20 Scottish marine habitats (Scottish Government, 2013).

The conservation site designated for marine habitat features positioned closest to the cable route is the Noss Head Nature Conservation Marine Protected Area (NCMPA), located within the proposed cable corridor. This site has been designated for the protection of horse mussel beds. All other conservation sites with benthic qualifying features fall more than 10 km from the proposed cable corridor. The cable corridor also has the potential to fall within areas of Annex I bedrock and/or stony reefs.

The EUSeaMap broad-scale seabed habitat classification, which uses the EUNIS system for classification of seabed habitats, indicates that the vast majority of the seabed along the proposed cable corridor is composed of deep circalittoral coarse sediment (A 5.15) and deep circalittoral sand (A5.27) (see Figure 4-4 and Figure 4-5). Along the nearshore waters of the Shetland landfall site, there is ample Atlantic and Mediterranean high energy circalittoral rock (A4.1; Figure 4-4), whilst the Caithness coastline where the cable route makes landfall is dominated by circalittoral coarse sediment (A5.14; Figure 4-5).

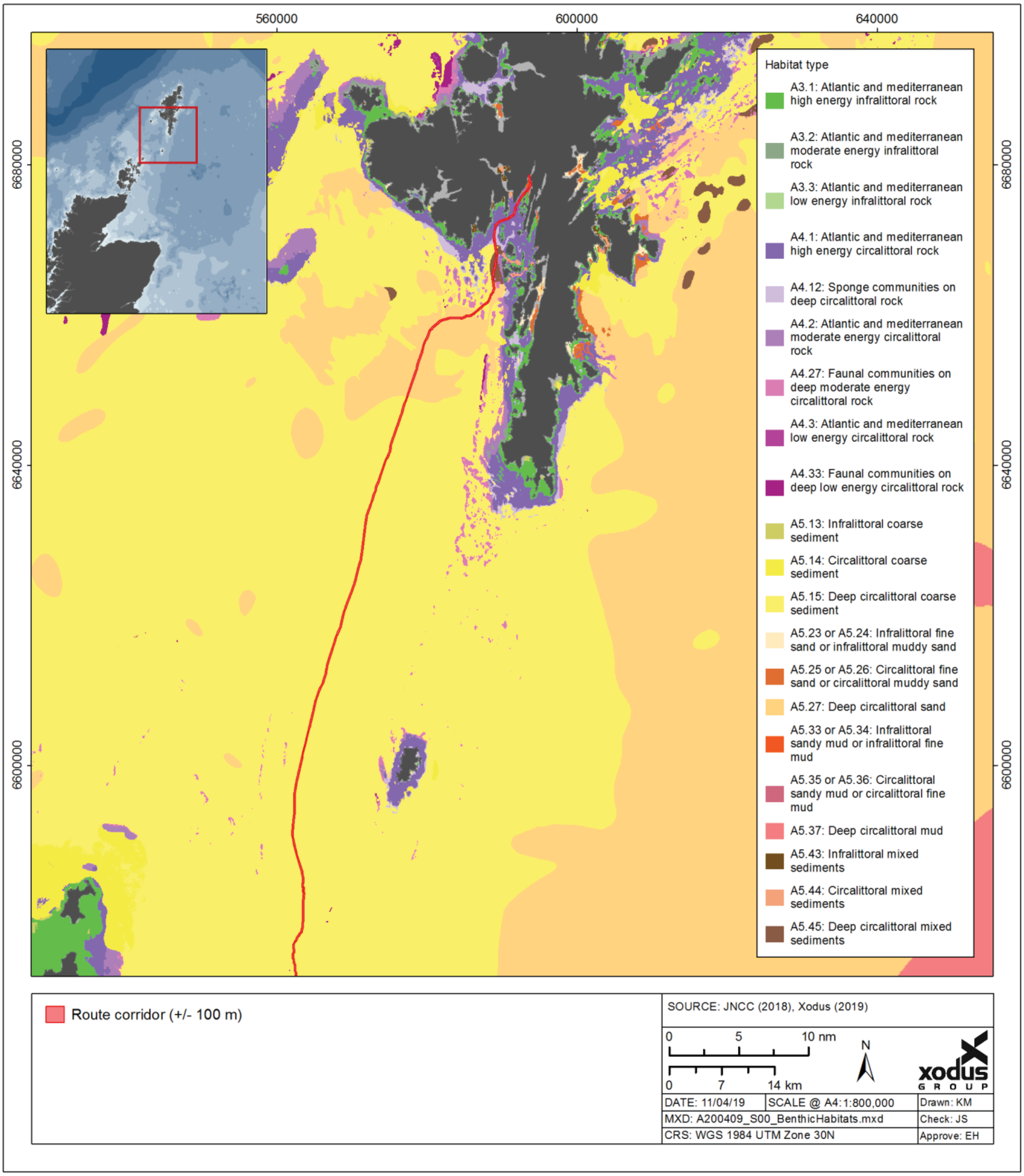

Figure 4-4 EUSeaMap 2016 Broad-scale seabed habitat classification: northern extent of the Shetland HVDC Link subsea cable route (JNCC, 2017b)

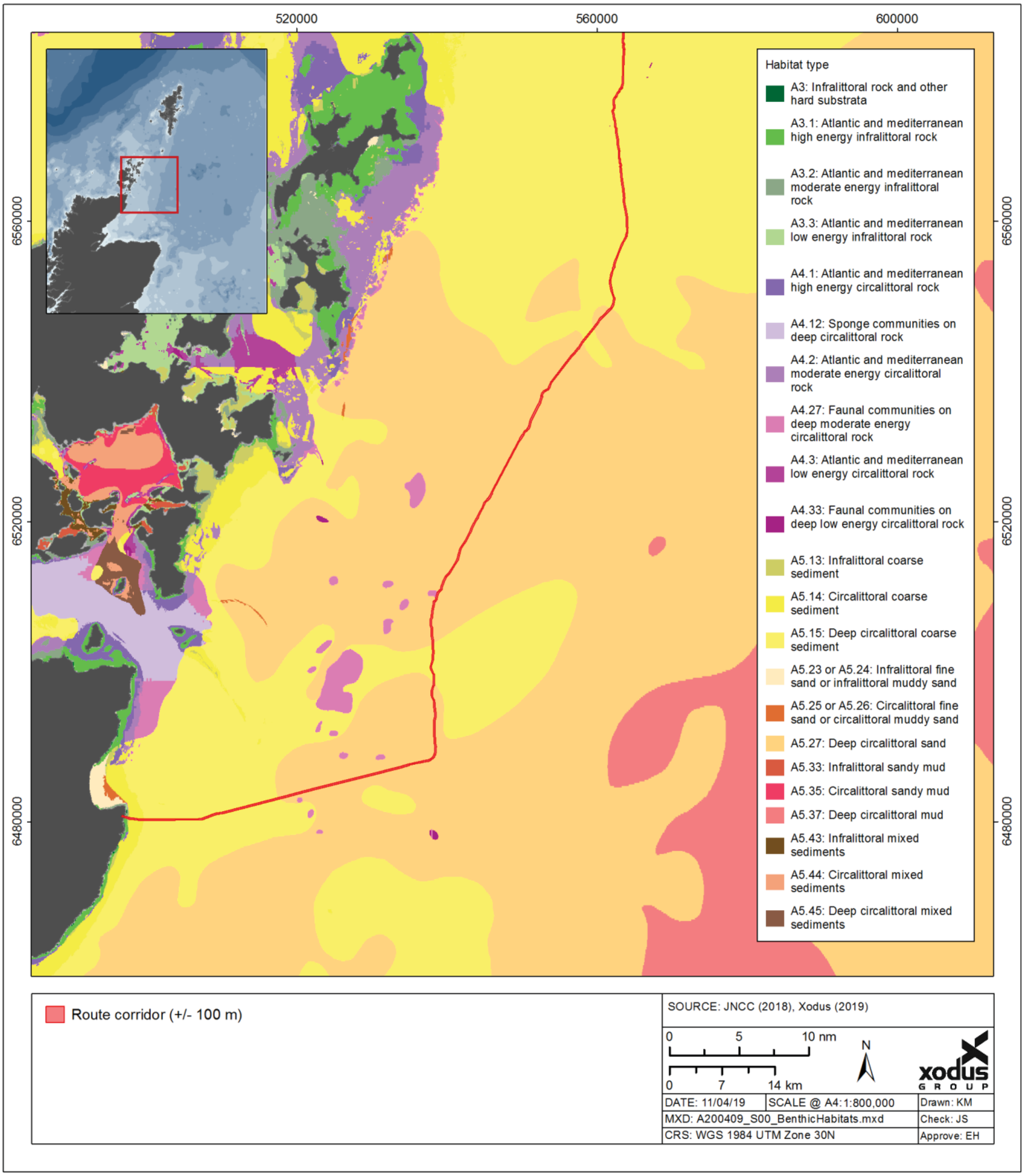

Figure 4-5 EUSeaMap 2016 Broad-scale seabed habitat classification: southern extent of the Shetland HVDC Link subsea cable route (JNCC, 2017b)

In the spring of 2013 and the autumn of 2018, MMT was commissioned to undertake marine surveys to characterise the benthos and geophysical features of the proposed cable corridor (MMT 2013 and 2018). The survey operations comprised geophysical and geotechnical survey methods, including deployment of a Multibeam Echosounder (MBES), Side Scan Sonar (SSS) and Sub-bottom profiler (SBP), as well as vibrocoring and Cone Penetration Testing (CPT) instrumentation. The 2013 survey additionally included the collection of seabed imagery (i.e. video and stills) and sediment grab sampling at 39 sampling stations (3 samples per station) along the cable corridor, from which particle size analysis (PSA), hydrocarbons and metals analyses where undertaken (MMT, 2013).

A total of 15 habitats were identified along the survey corridor, two of which are listed on Annex I of the EC Directive:

> ‘Bedrock reef’; and

> Medium graded ‘stony reef’.

Additionally, two protected species were identified within the cable survey corridor:

> The UK Biodiversity Action Plan (BAP) species, European plaice (*Pleuronectes platessa*); and

> The PMF and OSPAR listed species, Ocean quahog (*Arctica islandica*).

4.4.3 Scoping of potential impacts

There are no designated sites with benthic features in close vicinity to the proposed cable corridor. Nonetheless, the marine surveys conducted along the proposed cable route in 2013 and 2018 revealed the presence of Annex I habitats and two species of conservation value (MMT 2013 & 2018).

Potential impacts associated with cable installation, operation and decommissioning are presented in Table 4-4. This summary assumes that the cable will either be buried using recognised cable trenching methods or protected using recognised cable burial / protection techniques (e.g. concrete mattresses, rock placement, etc.) where trenching is not possible. Key potential impacts include direct physical disturbance and loss of seabed habitat; smothering due to sediment suspension and resettlement; and physical changes to the character of the seabed due to the presence of cable protection measures (e.g. concrete mattresses or rock placement).

A significant release of pollutants is likely to impact upon the survival of benthic communities. However, the potential for a project-related accidental fuel release to result in a pollution event is considered exceptionally low. In the event of an accidental fuel release, appropriate management procedures will be implemented as standard practice. Standard pollution prevention measures will be laid out in a Project Schedule of Mitigation and/or Construction Environment Management Plan (CEMP) and, for all vessels over 400 GT (gross tonnage), a Ship Oil Pollution Emergency Plan (SOPEP) will be in place.

Given the likely presence of seabed habitats and species of conservation value within the cable corridor, a more detailed assessment will be required as a part of an application for a Marine Licence. This assessment will evaluate the potential level and extent of identified impacts, once the preferred methods of installation and their respective locations have been defined.

Table 4-4 Potential impacts summary

Potential impact	Relevant phase of Project			Scoping result
	Cable installation	Cable operation (Maintenance and Repair)	Decommissioning	
Direct loss of, or disturbance to, benthic habitats and communities	✓	✓	✓	Scoped in
Temporary increase in suspended sediments and associated smothering	✓	✓	✓	Scoped in
Introduction of new substrate	✓	✓	✓	Scoped in
Increased risk of introducing or spread of Invasive Non-Native Species (INNS)	✓	✓	✓	Scoped in
Accidental release of pollution	✓	✓	✓	Scoped in

Note: ✓ = potential impact is relevant to phase of Project

Conclusion: Benthic and intertidal ecology

Further assessment work is required in support of the Marine Licence application.

The following impacts will be assessed further within the EA:

- Direct loss of, or disturbance to, benthic habitats and communities;
- Temporary increase in suspended sediments and associated smothering;
- Introduction of new substrate;
- Increased risk of introducing or spread of Invasive Non-Native Species (INNS); and
- Accidental release of pollution.

4.5 Fish ecology

4.5.1 Key data sources

The key data sources for fish ecology include:

- Scottish Government (2014). Updating Fisheries Sensitivity Maps in British Waters;
- Ellis *et al* (2012). Mapping the spawning and nursery grounds of selected fish for spatial planning; and
- Coull *et al.* (1998). Fishery sensitivity maps in British Waters.

4.5.2 Baseline overview

The vast majority of fish species are highly mobile. It is therefore highly unlikely that cable installation activities and cable operation would have any impact on the majority of fish species. It is only those species that are either directly dependent upon the seabed environment for important life-stages (e.g. spawning) or are considered to be sensitive to noise generated during cable installation or from electromagnetic fields (EMF) emitted from the installed cable that could potentially be impacted by the Project.

4.5.2.1 Spawning and nursery grounds

There are two key species of fish that are of commercial and conservation importance that depend on the seabed either throughout, or at key stages, in their life-cycle: herring and sandeels. Furthermore, the commercially important shellfish species, *Nephrops norvegicus*, inhabits burrows where their pre-larval offspring are incubated.

Data from Coull *et al*. (1998) and Ellis *et al*. (2012) indicate that there is potential for sandeel to spawn along the proposed cable corridor, the intensity of spawning is considered to be low (Ellis et al., 2012). Sandeels are the main feature of the Mousa to Boddam NCMPA, and one of the two protected features of the North-West Orkney NCMPA (the other feature being sandbanks, sand wave fields and sediment wave fields). The Mousa to Boddam NCMPA is located 12.4 km east-southeast and the North-West Orkney NCMPA is located 23.5 km to the west of the proposed cable corridor. The Mousa to Boddam NCMPA hosts the most reliable sandeel recruitment area in Shetland, whilst the North-West Orkney NCMPA has been identified as an important export ground for sandeels (JNCC, 2016b). The area is characterised by a mixed ground type (areas of rough substrate within the areas of sediment) which make it suitable for sandeel colonisation. These NCMPAs play an important role in supporting wider populations of sandeels in Scottish waters. Specifically, newly hatched sandeel larvae from this region are exported by currents to sandeel grounds around Shetland and the Moray Firth. This is supported by a time series of data on larval abundance that dates back to the 1950s, illustrating the continued importance of this area as an export ground for sandeels (JNCC, 2016b).

With regard to herring and *Nephrops*, Coull *et al*. (1998) indicate that there is potential for these species to undertake spawning in the area within the vicinity of the proposed subsea cable route; however, the intensity of such spawning is currently undetermined, based on the available data.

Other than sandeel and herring, the proposed cable corridor overlaps with the nursery grounds of several species namely whiting, common skate, spotted ray, blue whiting, hake, anglerfish, mackerel, sprat, plaice, Norway pout, Norway lobster, lemon sole and haddock. The cable route also coincides with spawning grounds of low intensity for whiting, cod, plaice and undetermined density for sprat, lemon sole and haddock (Ellis *et al*., 2012; Coull *et al*., 1998).

The Updated Fisheries Sensitivity Maps Report (Aires *et al.*, 2014) suggests that the average probability of 0 group fish (i.e. fish younger than 1 year) occurring in the proposed cable corridor area is extremely low for all species (i.e. < 5%) except the following, which are considered to have a low probability: whiting (6.7%); Norway pout (13.8%); and haddock (14.8%) (Aires *et al.*, 2014).

4.5.2.2 Noise sensitive species

Auditory detection in fish species remains poorly understood. Fish have an enormous diversity of inner ears and accessory hearing structures. While accessory hearing structures enhance hearing, the function of the diversity of inner ears is not completely clear (Ladich and Hulz-Mirbach, 2016).

Hawkins and Popper (2014) have divided fishes into several different categories based on the structures associated with hearing. The functional groups include:

> Low sensitivity to noise - fishes without a swim bladder (these can only detect kinetic energy – e.g., sharks, common skate complex, mackerel, whiting);

> Medium sensitivity to noise - fishes with a swim bladder that is far from the ear and thus not likely to contribute to pressure reception, so the fishes are primarily kinetic detectors (e.g., salmon, sea trout) and eggs and larvae that are less mobile than adult fish and therefore not able to readily move away from the noise source; and

> High sensitivity to noise - fishes with a swim bladder or other air bubble that is close to the ear and enables sound pressure to be detected, broadening the hearing range and increasing hearing sensitivity (e.g., herring, sprat, cod).

There is potential for a number of noise sensitive species such as cod, herring, sprat, and Atlantic salmon to be present along the proposed subsea cable route.

4.5.2.3 Elasmobranch and electro-sensitive species

There is also potential for several elasmobranch species to be present along the proposed cable corridor. These include common skate complex, spotted ray, spurdog and tope shark. Key species include Atlantic salmon, sea trout and European eel. Atlantic salmon and sea trout are diadromous in that they spend most of their lives at sea, only returning to freshwater rivers to spawn. European eels are also diadromous; however, the adults migrate out to sea to spawn with the larvae making the return journey back to freshwater.

The spawning migration of the European eel is not fully understood, and uncertainties remain on the duration and route of migration (Malcolm *et al*., 2010 and Righton *et al*., 2016). Potentially a significant proportion of the total European eel population, at the adult (silver eel) migratory stage, may pass through Scottish coastal waters. Waters bordering the northern coast of mainland Scotland, Orkney, Shetland and the Outer Hebrides are most likely to contain migratory eels from northern continental Europe as well as the UK. However, given the limited data on the subject it may also be that a migration route out of the North Sea tracks along the Scandinavian coast and crosses into the north Atlantic to the north of Shetland, meaning that continental European eels may by pass Scottish coastal waters or that the migration routes are not geographically confined (Malcom *et al*., 2010).

Although there is evidence to suggest that there are some rivers on Shetland within which salmon are present (Malcom *et al*., 2010), the evidence suggests that Atlantic salmon use the Pentland Firth, to the south of the Project area, as a key migration route between freshwater rivers on the north and east coast of Scotland and deeper offshore waters around Iceland and the north Atlantic Ocean (Godfrey *et al.,* 2014a, 2014b and Guerin *et al*., 2014). Therefore, the proposed cable corridor is not expected to be important for Atlantic salmon, compared to elsewhere in the north of Scotland, although it is recognised that there may be disturbance to individuals present near the proposed subsea cable route.

4.5.2.4 Basking sharks

Basking sharks are the second largest fish in the world, reaching up to 12 m in length (average length is usually 6 - 8 m). 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 they appear to be basking but are feeding on the surface plankton blooms (SNH, 2017a). Basking sharks are afforded protection in numerous ways, in the UK they are protected under Schedule 5 of the Wildlife and Countryside Act (1981) and the Nature Conservation (Scotland) Act 2004, they are also listed as a Priority Marine Feature (PMF) in Scottish waters. Globally they appear on the International Union for Conservation of

Nature (IUCN) Red List meaning they are considered to have a high risk of extinction in the wild, they also appear on the Convention on International Trade in Endangered Species (CITES) list, Appendices I and II on the Convention of Migratory Species (CMS) and Annex I (highly migratory species) of the United Nations Convention on the Law of the Sea (UNCLOS). 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 have been sighted along the proposed cable corridor although hotspots for basking shark sightings in the north of Scotland are off the Old Man of Hoy (Orkney) and the north-east coast of mainland Scotland (NMPi, 2019).

4.5.2.5 Other protected species

Certain species of fish found in Scottish waters are protected because they are either rare or vulnerable to certain activities. The only species listed on Schedule 3 of the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended) which is likely to be encountered in Caithness and Shetland waters is the Atlantic salmon (protected if fresh water only). Sturgeon is the only fish species listed as a European Protected Species (EPS) and the IUCN considers the species to be critically endangered. It is unlikely this species would be encountered with any frequency along the proposed cable corridor as this is considered to be at the very northern extent of its distribution (SNH, 2017b). Several fish species are listed as PMFs including some which are likely to be encountered near the proposed cable route including basking sharks, whiting, cod, Atlantic salmon and sea trout. Additionally, salmon are Annex II species which require protection through the designation of protected sites, namely SACs. The River Thurso SAC is the closest site with salmon features to the proposed cable route; it is located approximately 22.3 km from the mainland Scotland landfall area.

4.5.3 Scoping of potential impacts

As described above, given the mobile nature of fish, potential impacts associated with cable installation and operation are expected to be minimal on the basis that fish can readily move out of, or avoid the main area of potential impact.

With respect to direct impacts on spawning habitat (direct disturbance or smothering), data from Coull *et al.* (1998), Ellis *et al.* (2012) and the Scottish Governments Updated Fisheries Sensitivity Maps indicates that although there could be sandeel and herring spawning grounds along the proposed cable corridor, it is unlikely that these are key spawning grounds. Potential impacts on any spawning grounds associated with direct seabed disturbance during cable installation will be limited to the working corridor. Given the limited potential for significant sandeel spawning grounds along the subsea cable route and the localised nature and small scale of direct seabed disturbance the potential for significant impacts to occur is unlikely.

With respect to underwater noise, given the limited number of vessels expected to be involved in any seabed preparation and cable installation activities and the short duration and temporary nature of cable installation activities, the potential for significant impacts on fish is considered to be minimal.

Electromagnetic field (EMF) emissions are generated from the transmission of electricity through subsea cables. The cables produce electromagnetic fields which have both electric (E) measured in volts per metre (V m-1) and magnetic components (B) measured in micro tesla (µT). While the direct electric field is mostly blocked with the use of conductive sheathing, the magnetic field penetrates most materials and therefore are emitted into the marine environment with the resultant induced electric (iE) field.

It is commonly recommended that cable burial is used to increase the distance between the cable and the electro-sensitive species (Gill *et al.,* 2005; DECC, 2011). However, where burial is not an option due to nature of seabed cable protection, e.g. concrete mattresses or rock placement can also be used to increase the distance between marine species sensitive to EMF and the EMF source.

Where cables are buried to a depth of up to 1 m, the predicted magnetic field strength at the seabed is expected to be below the earth's magnetic field (assumed to be 50 µT) (MORL, 2012) and not detectable by elasmobranch or electro-sensitive species (fish and crustaceans). Given that the cable will be buried or protected for most of its length (in line with SHE Transmission overarching objective for installation of subsea cable) the potential for significant impacts due to EMF emissions are minimal and unlikely to occur.

Potential collision risk between basking shark and cable installation and support vessels is also limited and unlikely to occur due to the limited number of vessels involved in cable installation (cable lay vessel and guard vessel), the slow speed of the vessels (maximum of a few knots) and the short duration and temporary nature of cable installation activities. If required, SHE Transmission will apply for a basking shark licence.

Sediment disturbance will be limited to the direct vicinity of cable trenching operations and no impacts from the low levels of sediments disturbance by trenching activity are expected, including to diadromous fish or shellfish species. Any disturbed sediment is expected to be rapidly dispersed by tidal currents.

All fish species are considered to show a level of sensitivity to accidental pollution events. However, the potential for accidental fuel release resulting in an accidental pollution event as a result of the Project is very low. In the event of an accidental fuel release occurring appropriate standard practice management procedures will be implemented accordingly. Standard pollution prevention measures are laid out in the Schedule of Mitigation and/ or the CEMP and for all vessels over 400 GT (gross tonnage) a SOPEP will be in place.

Table 4-5 Potential Impacts Summary

Potential impact	Relevant phase of cable installation			Scoping result
	Cable installation	Cable operation (Maintenance and Repair)	Decommissioning	
Interaction with spawning/nursery grounds	X	X	X	Scoped out
Disturbance and possible alteration of migration routes due to vessel noise, noise generated during cable installation and sediment suspension during cable installation/decommissioning	X	X	X	Scoped out
Electro Magnetic Field (EMF) impacting migration	X	X	X	Scoped out
Collision risk for basking sharks	X	X	X	Scoped out
Accidental pollution	X	X	X	Scoped out

Conclusion: Fish ecology

No key and/or likely significant impacts have been identified as a result of the Project.

No further assessment work is required to support an application for a Marine Licence

4.6 Ornithology

4.6.1 Key data sources

Key data sources for ornithology include:

- Protected site information (e.g. SNH, 2016a; 2016b).
- (JNCC, 2016) Seabird Population Trends and Causes of Change: 1986-2015 Report;
- (Stone *et al.,* 1995) An atlas of seabird distribution in north-west European waters; and
- (Pollock *et al.,* 2000) The distribution of seabirds and marine mammals in the Atlantic Frontier, north and west of Scotland;

4.6.2 Baseline overview

The proposed subsea cable route extends for 253 km, passing through habitat recognised as important for a number of seabird species. The proposed cable corridor passes though or adjacent to a number of designated and proposed protected sites where seabirds are a qualifying feature.

The proposed cable corridor overlaps with a very small area of the Seas off Foula proposed Special Protection Area (pSPA). The site covers the waters around and to the northwest of Foula, the island hosts more than 190,000 breeding seabirds, making it one of the largest and oldest seabird colonies in Britain (SNH, 2017b). The site covers an area of 3,412 km^2, the proposed protected features are:

Breeding season:

- Great skua (*Stercorarius skua*)
- Northern fulmar (*Fulmarus glacialis*) (assemblage)
- Arctic skua (*Stercorarius parasiticus*) (assemblage)
- Common guillemot (*Uria aalge*) (assemblage)
- Atlantic puffin (*Fratercula arctica*) (assemblage)

Non-breeding season:

- Great skua (*Stercorarius skua*) (assemblage)
- Northern fulmar (*Fulmarus glacialis*) (assemblage)
- Common guillemot (*Uria aalge*) (assemblage)

Other important marine protected sites with seabird qualifying features which lie within 5 km of the proposed cable corridor are: Pentland Firth pSPA (3.3 km north-northwest), the East Caithness Cliffs SPA (3.6 km south-southwest) and the East Mainland Coast, Shetland pSPA (4.2 km east-northeast). The Pentland Firth pSPA has been proposed for the protection of breeding arctic skuas, arctic terns (*Sterna paridisaea*), common guillemots, and breeding seabird assemblages of international importance, whilst the East Caithness Cliffs has been designated for the protection of black guillemots (*Cepphus grylle*) and their coastal habitats. The East Mainland Coast, Shetland pSPA has been proposed primarily for the protection of various non-breeding waterfowl species, however, the site supports breeding red-throated diver (*Gavia stellata*), which have an unfavourable conservation status across Europe (Black *et al.*, 2015).

The proposed cable corridor also passes approximately 9.1 km west of the Fair Isle SPA which has an endemic species requiring protection, the Fair Isle wren (*Troglodytes troglodytes fridariensis*). The qualifying features of this site also includes arctic tern and breeding guillemot, as well as a seabird assemblage of international importance (SNH, 2005).

Table 4-6 Extent of the breeding season for breeding seabirds (adapted from SNH, 2017c)

Species	Breeding season dates																							
	J		F		M		A		M		J		J		A		S		O		N		D	
Arctic skua																								
Arctic tern																								
Northern Fulmar																								
Great black-backed gull																								
Great skua																								
Common Guillemot															M	M	M	M	M					
Black Guillemot																M	M	M	M	M	M	M		
Kittiwake																								

Species	Breeding season dates																							
	J		F		M		A		M		J		J		A		S		O		N		D	
Razorbill																M	M	M	M	M	M	M		
Peregrine																								
Atlantic Puffin			M	M	M																			
Red-throated diver																		M	M	M	M	M	M	M

Key	
Breeding period (strong association)	
Breeding site attendance	
Winter period	
Not present in significant numbers	
Flightless moult period	M

4.6.3 Scoping of potential impacts

Disturbance during the installation / maintenance / decommissioning of a subsea cable (vessel presence and activity) may displace birds from an area of sea, effectively amounting to habitat loss during the period of disturbance (Drewitt and Langston, 2006). Project activities may directly disturb / displace birds from foraging or loafing areas, thus causing the birds to move elsewhere and potentially affecting breeding productivity or survival rates of an individual or population. A single disturbance event does not have an immediate effect on the survival or productivity of an individual bird. Repeated disturbance or disturbance over an extended period can affect the survival and productivity of a bird.

Different bird species present in the vicinity of the proposed cable corridor are likely to have different relative sensitivities and responses to disturbance before individuals begin to experience reductions in relative fitness (Goss-Custard *et al.*, 2006). Disturbance would be restricted to the cable corridor and at any one time to the immediate vicinity of the Project vessels when they are operating. However, given the importance of the cable corridor for seabirds, including those of international importance, both during and outwith the breeding season, further assessment work is required to assess the potential impacts of disturbance and/or displacement of seabirds due to vessel presence arising from the Project.

There is potential for disturbance and/or displacement of seabirds due to increased turbidity in the water column. The increase in suspended sediment resulting from cable installation / maintenance / decommissioning activities has the potential to effect visual seabird foragers. However, because the increase will be temporary in nature and the suspended sediment will settle on the seabed (small spatial extent) it is not considered likely there will be a large effect on seabird foraging, especially considering the foraging range of seabirds and the alternate foraging habitat available. However, given the importance of the cable corridor for birds, including those of international importance, both during and outwith the breeding season further assessment work is required to assess the potential impacts of disturbance and/or displacement of seabirds due to increased turbidity in the water column arising from the proposed subsea cable.

Changes in the distribution of seabird prey species has the potential to have indirect effects on seabirds. The main impacts on prey species are likely to be as a result of construction noise and physical disturbance from cable installation. Some of the more mobile prey species such as fish are expected to be able to rapidly vacate the area of impact and are not expected to be significantly affected. However, some of the more sessile or sedentary prey species, such as some crustaceans and molluscs who are unable to vacate the area of physical disturbance from the cable installation have the potential to be impacted. Given the importance of benthic-demersal prey species (e.g. sandeels) for a number of the seabirds present in the vicinity of the proposed cable corridor, further assessment work is required to assess the potential indirect impacts on seabirds resulting from potential changes in the distribution of prey species arising from the Project.

Where cables are buried to a depth of 1 m, the predicted magnetic field strength at the seabed is expected to be below the earth's magnetic field (assumed to be 50 μT) (MORL, 2012) and not detectable by bird electro-sensitive prey species (fish and crustaceans). Given that the cable will be buried or protected for most of its length (in line with SHE Transmission overarching objective for installation of subsea cable) the potential for significant indirect impacts on seabird prey species due to EMF emissions are minimal and unlikely to occur.

All bird species are considered to show a level of sensitivity to accidental pollution events. However, the potential for accidental fuel release resulting in an accidental pollution event as a result of the Project is very low. In the event of an accidental fuel release occurring appropriate standard practice management procedures will be implemented accordingly. Standard pollution prevention measures are laid out in the Schedule of Mitigation and/ or the CEMP and for all vessels over 400 GT (gross tonnage) a SOPEP will be in place.

Table 4-7 Potential impacts summary

Potential impact	Relevant phase of cable installation			Scoping result
	Cable installation	Cable operation (Maintenance and Repair)	Decommissioning	
Disturbance and/or displacement of seabirds due to vessel presence	✓	✓	✓	Scoped in
Disturbance and/or displacement of seabirds due to increased turbidity in the water column	✓	✓	✓	Scoped out
Indirect effects on seabirds due to changes in distribution of prey items	✓	X	✓	Scoped in
Indirect effects on seabirds due to EMF emissions	X	✓	X	Scoped out
Accidental pollution	✓	✓	✓	Scoped out

Note: ✓ = potential impact is relevant to cable installation phase

Conclusion: Ornithology
Further assessment work is required in support of the Marine Licence application.

The following impacts will be assessed further within the EA:

- Disturbance and/or displacement of seabirds due to vessel presence;
- Disturbance and/or displacement of seabirds due to increased turbidity in the water column; and
- Indirect effects on seabirds due to changes in distribution of prey items.

4.7 Marine mammals

The key data sources for marine mammals include:

- Abundance and behaviour of cetaceans and basking sharks in the Pentland Firth and Orkney Waters (Evans *et al.,* 2011);
- Estimates of cetacean abundance in European Atlantic waters in summer 2016 from the SCANS-III aerial and shipboard surveys, (Hammond *et al*., 2017);
- Cetaceans of the Atlantic Frontier, north and west of Scotland, (Weir *et al*., 2001);
- Atlas of cetacean distribution in north-west European waters, (Reid *et al*., 2003);
- Estimated at-sea Distribution of Grey and Harbour Seals - updated maps 2017, (SMRU and Marine Scotland, 2017);

- Scientific Advice on Matters Related to the Management of Seal Populations: 2017; Report to the National Environment Research Council, (SCOS, 2017); and
- An estimate of numbers and habitat preferences of otters *Lutra lutra* in Shetland, UK (Kruuk *et al.*, 1989).

4.7.1 Baseline description

Marine mammals are afforded varying levels of protection under international and national legislation depending upon their genus. Within UK waters, cetaceans (whales, dolphins and porpoises) and otters *Lutra lutra* are protected through the listing of European Protected Species (EPS) under Annex IV of the Habitats Directive and are provided full protection within Scottish territorial waters through the Conservation (Natural Habitats, &C.) Regulations 1994 (as amended).

Bottlenose dolphin, harbour porpoise, grey and harbour seals, and otters gain additional protections through Annex II of the Habitats Directive, which includes provisions for their consideration in designating Special Areas of Conservation (SACs). Pinnipeds are also protected through provisions set out in Annex V of the Habitats Directive, which defines them as species of community interest, providing further support for the designation of SACs for seal qualifying features. Additionally, seals are also protected at designated seal haul-outs, which are coastal habitat locations that seals use to breed, pup, moult and rest designated through the Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 (as amended). All haul-outs in Scotland are protected under Section 117 of the Marine (Scotland) Act 2010.

Additionally, all marine mammal species which regularly occur within Scottish waters are designated as PMFs (Tyler-Walters *et al.*, 2016).

4.7.1.1 Cetaceans

Nineteen cetacean species have been recorded in the region covered by the proposed cable corridor (Evans *et al.,* 2011; Reid *et al.*, 2003). However, the following cetacean species are known to frequent or seasonally visit the waters of the north coast of Scotland and the Pentland Firth: harbour porpoise (*Phocoena phocoena*); bottlenose dolphin (*Tursiops truncatus*); short-beaked common dolphin (*Delphinus delphis*); white-beaked dolphin (*Lagenorhynchus albirostris*); white-sided dolphin (*Lagenorhynchus acutus*); Risso's dolphin (*Grampus griseus*); long-finned pilot whale (*Globicephala melas*); killer whale (*Orcinus orca*); and minke whale (*Balaenoptera acutorostrata*) (NMPi, 2018; Hammond *et al.*, 2017; Reid *et al.*, 2003; Barne *et al.*, 1997). Of these, the harbour porpoise, bottlenose dolphins, white-beaked dolphins, white-sided dolphins, Risso's dolphin, and minke whale regularly occur within the vicinity of the proposed cable corridor (Evans *et al.,* 2011).

Density estimates from the most recent Small Cetaceans in the European Atlantic and North Sea (SCANS-III) surveys indicated harbour porpoise as the most abundant species within the vicinity of the proposed cable corridor with density estimates ranging from 0.15 – 0.40 animals/km^2, decreasing from northeast to southwest along the cable route (Hammond *et al*., 2017). This estimate is very high compared with density estimates of other cetacean species taken from these surveys, namely: white-beaked dolphins (0.021 – 0.037 animals/km^2); white-sided dolphins (0.021 animals/km^2); bottlenose dolphins (0.004 animals/km^2); and minke whales (0.010 – 0.032 animals/km^2) (Hammond *et al*., 2017). The density of harbour porpoise in the vicinity of the proposed cable corridor is considered low to moderate compared to other regions of the North Sea (i.e. Blocks S and T; Hammond *et al*., 2017). While density estimates of minke whales in the region east of the cable route is higher than in other parts of the North Sea, this is likely a reflection of the high occupancy of minke whales in the southern Moray Firth. Minke whales are known to target prey aggregations in the Southern Trench, which falls within the survey block used to summarise the density of this species (i.e. Block T; Hammond *et al.*, 2017). Based on available sightings data, it is unlikely that minke whales would occur in such high densities across the proposed cable route (Evans *et al.,* 2011; Reid *et al.*, 2003; Weir *et al.*, 2001).

Based on available survey data, the waters in the vicinity of the proposed cable corridor support a relatively low density of cetaceans and are not considered to be of elevated importance to feeding, breeding, nursing or migrating cetaceans (Hammond *et al*., 2017; Evans *et al.,* 2011; Reid *et al.*, 2003; Weir *et al.*, 2001). The highly mobile nature of cetaceans and the temporary, spatially constrained conditions of the project dramatically reduce the likelihood of interactions between project activities and cetacean receptors resulting in significant impacts.

4.7.1.2 Pinnipeds

Two species of pinniped regularly occur in the North Sea: grey and harbour seals. Scotland supports the greatest numbers seals within the UK, providing habitat to approximately 86% of the grey seals and 80% of the harbour seals therein (SCOS, 2017). In general, northern Scotland remains a stronghold for both species of seal, despite declining numbers of harbour seals across the northeast and in the Northern Isles in recent decades (SCOS, 2017). These persistent declines in northern Scottish harbour seal populations are attributable to several interacting factors, including: climate change, increased predation from other species, increased prey competition with concurrent species, and direct mortality (e.g. shooting).

Grey and harbour seals forage in coastal and offshore waters, depending on the seasonal distribution of their prey. However, both species tend to be concentrated close to shore, particularly during the pupping seasons which occur from May to July for harbour seals and September to December for grey seals (Marine Scotland, 2014). Grey seals have larger foraging ranges than do harbour seals, often travelling hundreds of kilometres, whereas harbour seals will generally forage within 50 km of their selected haul out sites (Cronin *et al.*, 2012; Thompson *et al.,* 1996). There are three SACs designated for the protection of harbour seals (i.e. Mousa SAC, Yell Sound Coast SAC, and Sanday SAC) and one for the protection of grey seals (i.e. Faray and Holm of Fary SAC) within 50 km of the proposed cable route.

Tagging studies indicate that at-sea habitat use by harbour seals is an average of 17.5 animals/km^2 across the cable corridor, with the greatest densities of individuals likely to occur near the northern landfalls (Figure 4-6; Figure 4-7) (SMRU and Marine Scotland, 2017). At-sea density estimates for grey seals were higher further from shore than for harbour seals, with roughly 1.4 animals/km^2 on average across the proposed cable route (SMRU and Marine Scotland, 2017). Grey seal habitat use illustrated an opposite pattern to that of harbour seals, with the greatest density of individuals likely to occur near the southern landfalls (Figure 4-6; Figure 4-7). At-sea usage by grey seals is considered moderate to high across the Project area compared to other regions of the North Sea (SMRU and Marine Scotland, 2017).

The importance of northeast Scotland and the Northern Isles to harbour and grey seals is reflected in the number of designated haul-out sites across this region (Marine Scotland, 2018). Seals at designated haul-outs garner strict protection under Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 (as amended), and it is an offence to cause disturbance to any hauled-out seals. Several designated haul-outs are located in close proximity to the landfalls of the proposed cable route, the nearest of these being the Sanda and Score Islands haul-out located 0.1 km to the south-southeast of the cable corridor. Table 4-8 lists the designated haul-outs within 5 km of the proposed cable corridor and Figure 4-6 and Figure 4-7 display these sites referentially to the proposed project area.

Table 4-8 Seal haul-outs located within 5 km of the proposed cable corridor

Designated haul-out	Distance and bearing
Sanda and Score Islands	0.1 km south-southeast
Aa Skerry	1.9 km west-northwest
Effirth Voe and Bixter Voe	4.6 km west-northwest

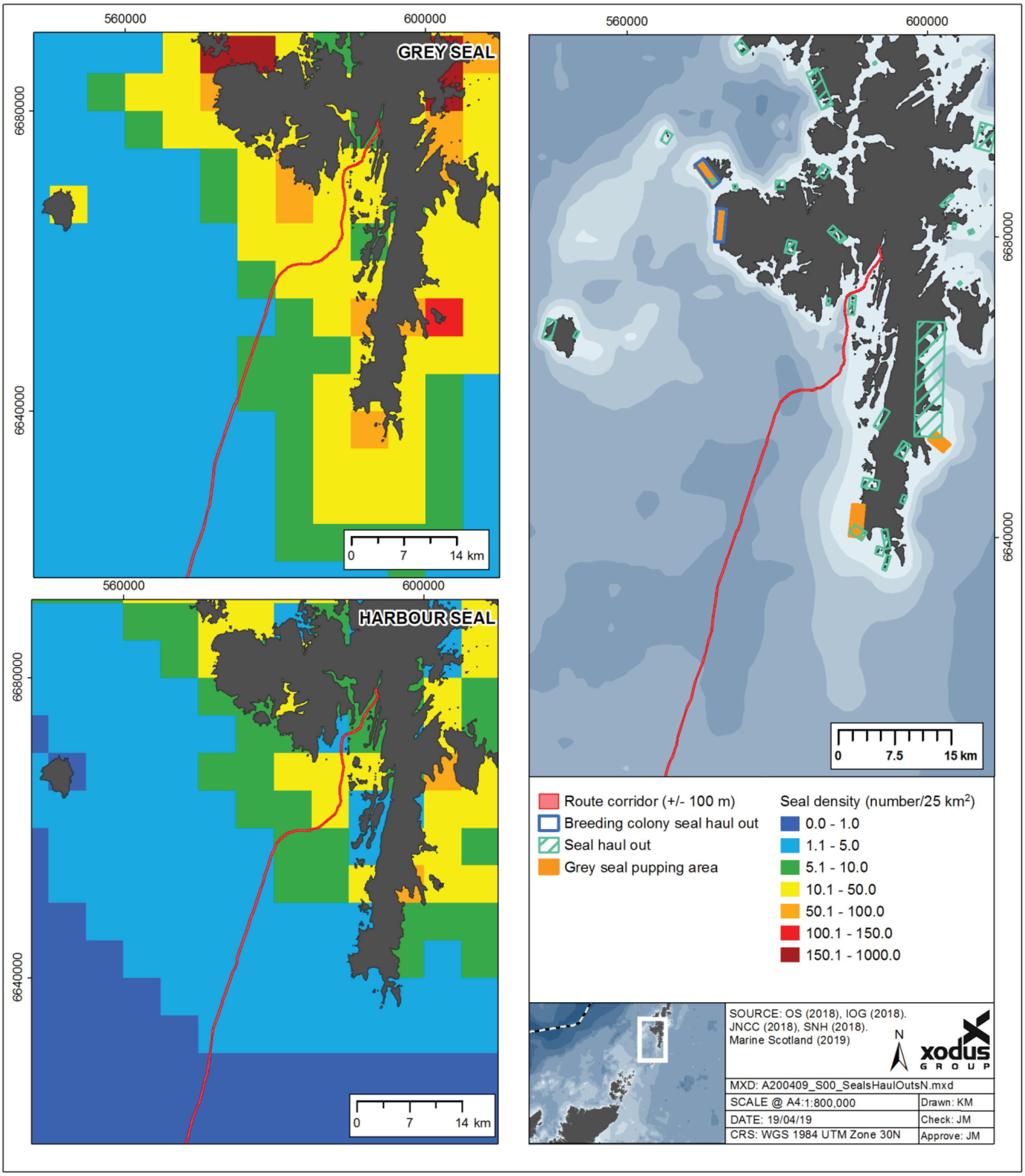

Figure 4-6 At-sea density of grey and harbour seals and designated seal haul-outs and breeding colonies: northern extent of the Shetland HVDC Link subsea cable corridor

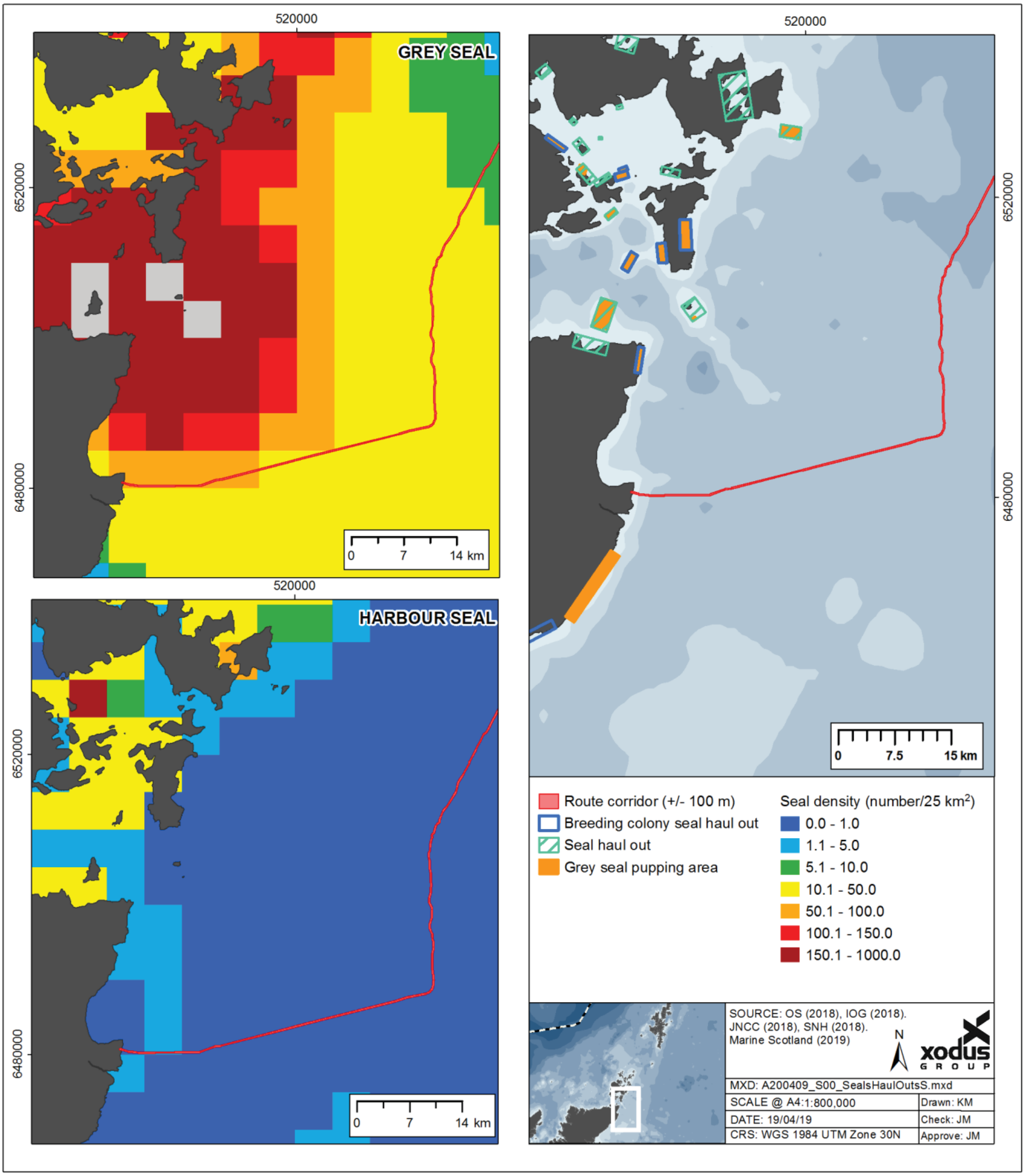

Figure 4-7 At-sea density of grey and harbour seals and designated seal haul-outs and breeding colonies: southern extent of the Shetland HVDC Link subsea cable corridor

Owing to the conservation significance of harbour and grey seals in the UK and the relative importance of the coastline and inshore waters of Shetland and the north-east mainland as seal habitat, further assessment is necessary to identify the likelihood and significance of potential impacts to seals from the proposed project activities.

4.7.1.3 Otters

Otters are semi-aquatic mammals which utilise both marine and freshwater environments as foraging habitat. Coastal otters occupy dens (known as holts) situated along coastlines and near a freshwater source (Nolet and Kruuk, 1989). There are no designated sites for otters in the immediate vicinity of the proposed cable corridor; the closest such site is the Caithness and Sutherland Peatlands SAC, located 7.3 km to the west-northwest of the cable corridor (Marine Scotland, 2019). However, otters have been recorded throughout Shetland and may occur along the coastline and in the very shallow waters comprising the proposed landfall area on the island (Kruuk *et al.*, 1989).

As described above, it is an offence to deliberately or recklessly capture, kill, injure, disturb or harass otters, which are designated EPS. Moreover, under the Wildlife and Countryside Act 1981, it is an offence to obstruct access or cause destruction to the breeding, resting or sheltering places of otters. For these reasons, further assessment work is required to assess the potential impacts on otters arising from the Project.

4.7.2 Scoping of potential impacts

The most likely potential impact to cetaceans and seals from project activities is disturbance resulting from underwater noise generated by pre-installation surveys and cable installation vessels, including those involved in trenching and cable laying activities. Pre-installation surveys may take place at predefined locations within the cable corridor using low to high frequency impulsive noise, such as multibeam sonars (MBES) or sub-bottom profilers (SBP). Additionally, cable laying equipment, such as the trenching plough or accompanying ROVs, may employ ultra-short baseline (USBL) technology to maintain station. These technologies all have the capacity to generate sounds which are audible to marine mammals, particularly high-frequency hearing specialists, such as harbour porpoise. However, technologies which employ high-frequency sound to collect data generally have noise emissions which attenuate over extremely short distances, which limits the potential for impacts to marine mammals. Nonetheless, a more detailed assessment of potential noise-generating survey techniques is required to quantify the potential significance of this impact pathway to protected marine mammal species.

The number of vessels anticipated to undertake cable installation will be limited to a cable lay or cable burial vessel and a guard vessel at any given time, and any pre-installation surveys will be limited to a single survey vessel. Moreover, pre-installation surveys and cable installation activities are due to be highly spatially and temporally constrained. Both the survey and the installation vessel will operate within the cable route, remaining within the proposed 200 m cable corridor for the duration of their respective activities. For these reasons, any potential disturbance from survey-technology or vessel-generated noise will be temporary in duration and are unlikely to lead to any changes in population numbers or affect breeding success of cetaceans or pinnipeds in the vicinity of the proposed cable route. Whilst it is an offence to cause disturbance to any cetacean within the Scottish Territorial Seas (STS), the moderate to high density of vessels across the project area falling within the STS reduce the likelihood that project-specific vessel noise emissions will be sufficiently above background levels to generate a disturbance offence (Marine Scotland, 2019; Merchant *et al.*, 2016). Nonetheless, the possibility of such an offence occurring remains for project activities occurring within the STS.

It is also an offence to cause disturbance to seals at designated haul-outs under the Protection of Seals (Designation of Haul-Out Sites) (Scotland) Order 2014 (as amended). Therefore, any vessels passing within proximity to a designated haul-out, particularly the Sanda and Score Islands haul-out located 0.1 km from the cable corridor, have the potential to generate a disturbance offence (McFarland *et al.*, 2017). It is recommended that any vessel movements around seal haul-outs adhere to Marine Scotland's (2014) 'Guidance on the offence of harassment at seal haul-out sites' to mitigate against the potential to cause an offence under this legislation. Given the high likelihood of seals being present in the waters surrounding the ends of the cable route and at haul-outs near their landfalls, there remains a potential for vessel presence to generate disturbance to seals at haul-outs during the cable laying, survey and maintenance and decommissioning periods of the Project.

Vessel presence during cable laying and trenching activities also poses a potential collision risk to marine mammals occupying the cable corridor. Collision risk associated with vessel strikes are greatest for large vessels (i.e. greater than 80 m) travelling at speeds in excess of 14 knots (Laist *et al.*, 1997). Erratic vessel movement, such as short, sharp turning, is also thought to contribute to collision risk with marine megafauna (Laist *et al.*, 1997). Cable laying and trenching vessel speeds are likely be limited during project activities and vessels will be travelling along a direct prescribed route. These vessel movement constraints, coupled with the low densities of cetaceans across the cable route, reduce collision risks to cetaceans to negligible. However, as vessels may be present in the immediate vicinity of designated seal haul-outs where seal densities are greatest, thus seals are still considered to be at minor risk of vessel collision.

Historical strandings data has indicated some level of geomagnetic sensitivity in cetaceans (Klinowska, 1985; Klinowska, 1988). However, experimental evidence of magnetoreception in cetaceans has only recently been confirmed (Kremers *et al.*, 2014). Dolphins have been shown to be able to detect and discriminate between magnetised objects, and it is likely that they are able to detect variations in magnetic fields (Kremers *et al.*, 2014). These observations present the possibility that dolphins, and perhaps other cetaceans, may be able to detect the electromagnetic fields (EMFs) emitted from the subsea cable whilst in operation. The repercussions of this detection may range from negligible (i.e. acknowledgement of its presence) to potentially more dramatic, such as interference with navigation or broad scale movement which may result in stranding incidences (NIRAS, 2-15). Given any EMFs emitted by the operational protected cables are anticipated to rapidly attenuate within the marine environment within a radius of approximately 1 m, it is unlikely that any cetaceans would be impacted by these magnetic fields. Moreover, in regions where cable burial is proposed (i.e. with sediment or rock placement), EMFs are unlikely to extend beyond the region of coverage to the water column. Therefore, impacts to cetacean behaviour and navigation from cable-generated EMFs are considered negligible.

Seabed sediment disturbance from cable installation activities has the potential to generate localised, short term increases in sediment suspension, known as turbidity. Increases in turbidity beyond ambient levels may reduce light penetration within the water column, thereby reducing visibility in species occupying those waters. Seals are most likely to be affected by such changes in visibility, as they are dependent upon visual cues to track prey (Scottish Executive, 2007). Grey and harbour seals have been identified as having a high sensitivity to reductions in light penetration, while cetaceans and otters have a moderate sensitivity to this impact (Dunstone and Gorman, 1998). Nonetheless, seals can be found inhabiting areas of near-persistent turbidity (e.g. the southern North Sea and The Wash, and the Thames Estuary on the south-east coast of England), so it appears unlikely that increased turbidity would place significant constraints on the foraging success of these species. In addition to using their eyesight to find prey and navigate, seals are also able to forage in turbid and unlit waters using tactile cues from their highly-sensitive whiskers (Mills and Renouf, 1986). There is evidence that harbour seals use their whiskers to sense very low frequency vibrations and minute movements in water, such as those generated by small fish (Dehnhardt *et al*., 1998). Cetaceans supplement deficits in their ocular abilities with auditory information, including sophisticated call signatures and, for the toothed species such as dolphins and porpoises, the employment of echolocation when foraging. Much like pinnipeds, semi-aquatic carnivore species, such as otters, forage underwater using a combination of vision and tactile features (Carss, 1995). Piscivorous species like the Eurasian otter have enhanced facial sensitivity, including extended vibrissae, which help them detect vibrational changes in the water column whilst foraging for mobile prey. When waters are turbid or murky, otters utilise their vibrissae to supplement the lack of available visual information (Carss, 1995). In this way, they have adapted to be less sensitive to changes in visibility from increased sediment suspension than other species (Dunstone and Gorman, 1998), and are therefore unlikely to be affected by this impact factor. As increases in turbidity from cable-laying are expected to be short-term and highly localised, there is very little potential for project activities to impact on the foraging ability of marine mammals occurring within the project area.

All marine mammal species are considered to possess some level of sensitivity to accidental pollution events. However, the potential for an unplanned fuel release to result in an accidental pollution event from the proposed project activities is very low. In the event of an accidental fuel release, appropriate standard management practice procedures will be implemented. Standard pollution prevention measures are laid out in the Schedule of Mitigation and/ or the CEMP and for all vessels over 400 GT (gross tonnage) a SOPEP will be in place.

Table 4-9 Potential impacts summary

Potential impact	Relevant phase of Project			Scoping result
	Cable installation	Cable operation (maintenance and repair)	Decommissioning	
Temporary disturbance / displacement due to noise emissions	✓	✓	✓	Scoped in
Collision risk	✓	X	✓	Scoped in for seals Scoped out for cetaceans
Increased sedimentation affecting ability to forage	X	X	X	Scoped out
Magnetic fields interfering with navigation	X	X	X	Scoped out
Accidental pollution	X	X	X	Scoped out
Disturbance at landfall (seals and otters only)	✓	✓	✓	Scoped in

Note: ✓ = potential impact is relevant to cable installation phase

Conclusion: Marine mammals

Further assessment work is required in support of the Marine Licence application.
The following impacts will be assessed further within the EA:

- Temporary disturbance / displacement due to noise emissions;
- Collision risk (seals only); and
- Disturbance at cable ends and near landfalls (seals and otters only).

4.8 Commercial fisheries

4.8.1 Key data sources

Key data sources for commercial fisheries include:

- Scottish Government (2018) ICES rectangle landings and effort statistics; and
- Kafas (2014) ScotMap project on fishing activity in Scotland by vessels under 15 m in length.

4.8.2 Baseline description

4.8.2.1 Commercial fisheries

The proposed cable corridor is located in waters that are exploited by commercial fisheries. Cable installation activities have the potential to temporarily modify access to fishing grounds and / or the abundance and distribution of target species. As such, it is important to consider the relative commercial importance of the proposed cable route to the fishing industry to determine whether an impact assessment is required.

Commercial fisheries data is geographically divided using the International Council for the Exploration of the Sea (ICES) rectangle grid system to enable comparisons of fisheries productivity on an international scale. The UK Marine Management Organisation (MMO) publishes its fisheries data using the ICES grid system (also known as ‘ICES Rectangles’). The proposed cable corridor lies within ICES Rectangles 47E8, 48E8, 49E8, 45E6, 45E7, 46E7, and 47E7.

Marine Scotland uses Vessel Monitoring System (VMS) data to determine fishing effort and landings from vessels over 15 m in length for each ICES rectangle within Scottish waters and the United Kingdom Continental Shelf (UKCS). The most recently published fisheries data from 2013 to 2017 suggests that the area in the vicinity of the proposed cable route experiences low to moderate fishing effort. However, the northern extent of the proposed cable route lying within ICES Rectangles 47E8, 48E8 and 49E8 has dramatically higher annual fisheries landings tonnage and value than does the southern extent (Scottish Government, 2018). This region, which covers the Shetland mainland directly southward past Fair Isle, is particularly important to demersal and pelagic fisheries, which have very high average catches (i.e. > 20,000 tonnes per annum) compared to the rest of the UKCS (Scottish Government, 2018).

In 2017, trawling accounted for the majority (60%) of gear use in Rectangles 47E8, 48E8 and 49E8, although dredging dominated gear use and seine nets were deployed nearly four times more often within Rectangle 49E8, exclusively (Scottish Government, 2018). Comparatively, ICES Rectangles 47E7 and 46E7, which lie within the southern extent of the proposed cable corridor, are predominantly targeted by trap fisheries (75%), followed by dredgers and trawlers, with some minor pelagic seine fishing, and very low (i.e. disclosive) levels of hook and line, harvesting and miscellaneous gear fishing (Scottish Government, 2018).

Fishing takes place year-round within ICES Rectangles 47E8, 48E8, 49E8, 45E6, 45E7, 46E7, and 47E7, with no clear seasonality in fisheries landings (Scottish Government, 2018). In 2017, mackerel accounted for 52% of the total landings value across the entire pipeline (£48.6 M), 99.8% of which was caught in ICES Rectangles 47E8, 48E8, and 49E8. Herring, cod and haddock formed other important species caught within this region. Whilst scallops formed important shellfish catches in ICES Rectangles 49E8 and 45E7, and crabs and lobsters (e.g. *Nephrops*) being important species in 47E7 and 49E8. Locations within Shetland which are important for shellfish creeling, as illustrated within the Shetland Marine Spatial Plan, have been compiled and validated by North Atlantic Fisheries College (NAFC) Marine Centre. The data sources were interviews with local Shetland fishermen and predictive mapping. These data indicate that the proposed subsea cable route passes through or close by to areas which are classed as important shellfish dredging sites for scallops and important creeling areas for Norway lobster (NMPi, 2019).

The ScotMap project (Kafas, 2014) provides spatial information on fishing activity in Scotland by vessels under 15 m in length, which is relevant to the mainland Scotland inshore areas of the proposed subsea cable route. The data indicates that the inshore area is considered to have a relatively low value for Norway lobster pots, this value increases in the area of the proposed cable landfall on the mainland. Trawling for *Nephrops* and other species has minimal importance. A moderate number of vessels (approximately 11) with a relatively high value are reported for crab and lobster pots operating in the inshore waters, especially in the coastal waters of the proposed subsea cable landfall (Kafas, 2014).

Given the potential importance of the areas of the proposed cable route to commercial fisheries, it is proposed that commercial fisheries are addressed in more detail as part of future impact assessment work for the proposed cable route, and in particular the areas covered in the northern extent of the proposed cable corridor.

4.8.2.2 Aquaculture

There are a number of aquaculture sites in Shetland waters and around the north coast of mainland Scotland. Aquaculture in these areas can be divided into:

- Finfish in cages, or land-based tanks with pumped seawater; and/or
- Shellfish either on trestles on the seabed, attached to vertical ‘dropper’ ropes suspended from horizontal longlines or rafts, or grown directly on the seabed without equipment.

There are ten active aquaculture sites within the immediate proximity (i.e. < 1 km) of the proposed cable corridor, predominantly in the inshore waters of the Shetland landfall area. The closest active site is Oxa Geo, a shellfish aquaculture in the southwest of mainland Shetland, located approximately 0.15 km west-northwest of the Shetland landfall (Scotland’s Aquaculture, 2019 and NMPi, 2019).

4.8.3 Scoping of potential impacts

Key potential impacts on fisheries include possible disruption to fishing activities during cable installation and longer-term impacts on fishing activities due to presence of the cable and associated protection measures. Longer term impacts relate specifically to reduced fishing effort within traditional fishing grounds, particularly for trawl fisheries where there is an increased risk of gear being snagged on the subsea cable (if surface laid) and associated cable protection measures (e.g. concrete mattresses or rock placement). Presence of the cable could also lead to localised changes in the abundance and distribution of target species due to the effects of EMF from the operation of the cable, although this is considered to be highly unlikely due to the attenuation of EMF effects at the seabed due to cable burial and protection.

With regard to short term impacts during cable installation, there will be a requirement to apply a safety zone around the cable installation vessels. Safety zones are required to ensure the safety of all personnel involved in cable installation and generally cover a 500 m radius from the cable installation vessel. Given that fishing activities will not be permitted in the safety zone, this will lead to a temporary exclusion from fishing grounds within the 500 m radius. However, due to the linear nature of the cables, the location of the safety zone will change as the cable lay vessel moves along the cable route. It is therefore expected that access to certain areas along the route will only be restricted for very short periods of time e.g. a few days to a week, with full access resuming once the cable lay vessel has moved to the next section of the cable route.

Depending on the selected cable installation method, there is potential that, if trenching of the cable route and cable lay activities occur consecutively rather than simultaneously, (e.g. cable trench created first, followed by installation of the cable a few weeks later) then there could be potential restrictions on fisheries activities along the cable route for the period between trenching being completed and cable installation commencing. The potential for these restrictions would be communicated to local fishermen once installation method and programme has been fully defined.

With regard to longer term impacts, the objective for the proposed project is to trench and bury the cable and allow the sediment to naturally back fill or be actively buried for the majority of the cable's length. The designed protection levels and associated trench depths will take demersal fishing gear into consideration and trenching will occur to a depth which will not be penetrated by fishing gear. All protection will be designed to have a smooth overtrawlable profile, with the rock grade utilised suitable for the nature of fishing activity typically undertaken in the area. As such mobile fishing vessels will not be excluded from the cable corridors during the operational phase. Static gear such as pots are also not anticipated to be affected during the operational phase, since the cable protection design accounts for the placement of static gear over the cable. Potential long-term impacts on fisheries along the proposed subsea cable route are therefore expected to be minimal.

As identified above, the proposed cable route is used by demersal fishing gear and as such there is potential, albeit low for demersal fishing gear to snag on the seabed under which the cable is laid. This could pose both a risk to fish catch but also to the gear and safety of the fishing vessels.

In terms of potential long-term impacts on fisheries, trawlers, which form the dominant gear type, may be affected by the presence of subsea cables, and the overtrawlability of the cable and any cable protection must be guaranteed to protect against any potential snagging risks to fisherman. Traps, which comprised the vast majority of fishing gear use in the southern extent of the cable route, are much less influenced by cable presence, on the basis that they can generally fish around the cable and associated cable protection. The remaining demersal gear types included dredgers and harvesters, with other potential gear types which make contact with the seabed falling within the 'miscellaneous' category.

As identified above, the proposed cable route is used by demersal fishing gear and therefore there is potential for fishing gears to snag on the cable, although this will be mitigated by burial and protection. This could pose both a risk to fish catch and to the fishing gears and the safety of the fishing vessels and their crew. As such, this potential impact pathway requires a more detailed assessment to ensure commercial impacts and human safety are considered in detail, and appropriate mitigation measures are identified.

During cable installation, there is potential for a temporary increase in suspended sediments within the water column which could introduce detrimental impacts to surrounding aquacultures sites. Given the importance of the mainland Shetland waters to aquaculture, and the close proximity of several sites to the proposed cable landfall, further assessment work is required to assess the potential impacts on aquaculture arising from the Project.

Table 4-10 Summary of potential impacts

Potential impact	Relevant phase of Project			Scoping result
	Cable installation	Cable operation/maintenance	Decommissioning	
Temporary loss of access to fishing grounds	✓	✓	✓	Scoped in
Snagging risk	X	✓	X	Scoped in
Permanent loss of access to fishing grounds	X	X	X	Scoped out
Changes in distribution of target species	✓	✓	✓	Scoped in
Sediment redistribution (aquaculture)	✓	X	✓	Scoped in

Note: ✓ = potential impact is relevant to phase of Project

Conclusion: Commercial fisheries

Further assessment work is required in support of the Marine Licence application.
The following impacts will be assessed further within the EA:

> Temporary loss of access to fishing grounds;
> Snagging risk; and
> Changes in the distribution of target species;
> Sediment redistribution (aquaculture).

4.9 Shipping and navigation

4.9.1 Key data sources

The key data sources for marine mammals include:

> Anonymised Automatic Identification System (AIS) derived vessel transit data (Marine Management Organisation, 2015); and
> Marine Scotland National Marine Plan Interactive (NMPi), 2018

4.9.2 Baseline description

There are numerous established shipping routes which traverse area in the vicinity of the proposed cable corridor. Vessels using routes around the north of Scotland include vessels transiting from the Western Atlantic to the Baltic States and Russia, many of which will use the Pentland Firth, making this one of Scotland's busiest seaways

An initial high-level screening of shipping activity in the vicinity of the proposed cable corridor was undertaken for an area covering an 18.52 km (10 nm) buffer of the cable route. Automatic Identification System (AIS) data were used to identify all AIS registered shipping passing within the initial 10 nm area. During the winter of February 2016, there was on average, 37 unique vessels per day were recorded within the study area during the winter period, the majority of which were cargo vessels (38%) and fishing vessels (32%). During the summer of June 2016, there was on average 51 vessels per day, the majority being cargo vessels (33%) and fishing vessels (18%).

There are two ports which are located within 10 nm of the proposed cable route; Wick Harbour (mainland Scotland) and Scalloway Harbour (Shetland). Traffic travelling from these ports are likely to intersect the cable route. There are also a number of ports within the vicinity of the cable route, but outwith 10 nm of the cable route, however traffic travelling to/from these ports have the potential to intersect the proposed cable route.

There are a number of “Areas to be Avoided” and “Restricted Areas” in the vicinity of the proposed cable route. These are associated with the Orkney Islands, Shetland Islands and the Fair Isle. These restrictions impose constraints on the traffic travelling in an east to west direction between Orkney and Shetland Islands. The recommended routes cross the proposed cable route.

There is one military practice area (PEXA) that intersects the cable route and the 10 nm buffer area. This area is a firing practice area and has no restrictions on the right to transit at any time.

At the Noss Head landfall, two anchorages were identified; Sinclair’s Bay and Wick anchorage sites. Additionally, there are a number of anchorage sites off the Shetland coast, however the cable is protected from the majority of these by land excluding one anchorage site identified which is in direct proximity to the cable route in Weisdale Voe.

4.9.3 Scoping of potential impacts

Given the moderately-high number of vessels that pass through the waters between north coast Scotland and Shetland, there is the potential for the presence of a slow-moving cable lay vessel transiting perpendicular to the main flow of traffic to present a potential risk to navigation. However, with the implementation of standard industry practice mitigation measures as outlined below, potential impacts associated with an increased risk of collision between the survey vessel and other vessels transiting the area will be reduced:

- Implementation of safety zones (500 m) around the cable lay vessel;
- Notices to Mariners issued prior to cable installation;
- Ensuring the cable lay vessel is fitted with Automatic Identification System (AIS) so that it can be easily detected by other vessels transiting through the area; and
- Providing details of the schedule for cable lay activities to local ports, ship operators, fishermen and recreational sailing organisations.

Given the short duration of the cable installation activities, potential impacts in terms of shipping and navigation are considered to be minor and not significant. However, with respect to navigational safety, it is proposed that a navigational risk assessment (NRA) is carried out to support the Marine Licence application as it will be necessary to agree specific safety measures as described above with the Maritime Coastguard Agency (MCA) and Northern Lighthouse Board (NLB) and for these to be communicated with the Royal Yachting Association (RYA), Royal National Lifeboat Institute (RNLI) and other mariners.

A summary of the potential impacts on shipping and navigation is presented in Table 4-11.

Detail on the additional information to be provided in support of the Marine Licence with respect to potential effects on shipping and navigation is provided in Section 5.

Table 4-11 Potential impacts identified and scoped in or out of further assessment

Potential impact	Relevant phase of Project			Scoping result
	Cable installation	Cable operation	Decommissioning	
Loss of access to anchorage areas	✓	✓	✓	Scoped in
Change in shipping/ferry routes during cable installation/ maintenance/ decommissioning	✓	✓	✓	Scoped in

Note: ✓ = potential impact is relevant to phase of Project

Conclusion: shipping and navigation

Further assessment work is required in support of the Marine Licence application.
A specific NRA will assess the potential impact to shipping and navigation specifically, see section 5 for further information.

4.10 Marine archaeology

4.10.1 Key data sources

Key data sources for marine archaeology include:

- Marine Scotland National Marine Plan Interactive (NMPi)
- Caithness Mainland to Shetland Subsea Link Project marine survey reports (MMT, 2018; MMT, 2013).

4.10.2 Baseline description

An initial archaeological assessment of the baseline environment was carried out to assess the potential effects of the cable route on marine cultural heritage assets within the vicinity of the proposed cable corridor.

No marine cultural heritage statutory designations were identified along the proposed cable route route. The closest designated site was identified as HMS Duke of Albany, located approximately 3.2 km west of the proposed cable route (NMPi, 2018). This site consists of a WWI wreck protected under the Protection of Military Remains Act 1986. However, given the intervening distance between the Project and this site, it is considered unlikely for the proposed works to have any impact on the site.

Twenty-two wrecks were identified as having the potential to be located close to the proposed cable route. The precise locations of their sinking are unknown. There are nine regional wrecks pre-dating 1913 located within 500 m of the proposed cable corridor; the location of these five wrecks is unknown. Nine regional wrecks that pre-date 1913 are located within 500 m of the proposed cable corridor. These wrecks are considered to be of low importance. There are three wrecks from the 16th and 17th centuries potentially lost in proximity to the cable route have been identified within the initial archaeological assessment and are considered to be of high importance. A fourth wreck was identified during the 2006 Netsurvey Multibeam Echosounder survey; a U87 U boat lost in 1918 located 1.4 km west of the cable route. This wreck would represent a war grave and is considered to be of high importance. Debris that has the potential to represent a wreck site was identified and is located 425 m north-east of the cable route. This wrecksite was considered to be of uncertain importance.

From the initial archaeological assessment, three known aircraft losses were identified as having the potential to be located within proximity to the cable route, however the exact location of their loss is unknown. These aircraft would be considered to be of high importance.

The proposed cable corridor crosses two minefield areas; Minefield 8 and 9 of Area B. In Minefield 8 a total of 4,920 mines were laid, and in Minefield 9, a total of 5,5250 mines were laid during September 1918. Following minesweeping activities 1,156 mines were recorded as destroyed in Minefield 8, and 2,240 mines were destroyed in area. The remainder of the mines are still thought to be present on the seabed.

From the 2008 and 2013 MMT geophysical surveys carried out along the proposed cable route, a total of 353 potential anthropogenic anomalies were identified; a total of 2102 SSS contacts were identified of which 1988 were classified as boulders, and 112 were classified as man-made objects (MMT, 2018). It has not yet been possible to confirm at this stage whether these anomalies represent, as yet unidentified features of cultural heritage value.

4.10.3 Scoping of potential impacts

A desk-based assessment (DBA) will be undertaken to review key existing data sources within a 1 km wide corridor along the proposed cable route to identify known and the potential for unknown marine historic environment assets.

Geophysical and geotechnical data collected from the marine survey will be analysed to detect and identify potential unknown sites, features or submerged deposits for archaeological importance located along the marine survey corridor.

The intention is to re-route the proposed subsea cable route where at all possible to specifically avoid all potential and known wrecks and features of archaeological importance in the area covered by the proposed cable route identified by the DBA and review of the geophysical and geotechnical survey data.

If by any chance avoidance is not possible, an appropriate mitigation / management strategy will be proposed to eliminate or reduce any adverse impacts to an insignificant level.

In order to manage the potential for impacting unknown heritage, a reporting protocol should be instigated for the discovery of previously unknown marine cultural material during the development. The reporting protocol produced by Wessex Archaeology (2014) for the Crown Estate would be sufficient (http://www.wessexarch.co.uk/protocols-archaeological-discoveries-pad).

It is intended that the above process will result in no significant impacts on the marine historic environment.

Table 4-12 Potential impacts identified and scoped in or out of further assessment

Potential impact	Relevant phase of Project			Scoping result
	Cable installation	Cable operation	Decommissioning	
Direct damage to or destruction of known marine historic environmental assets including geophysical anomalies or UXO, and submerged landscapes.	✓	✓	✓	Scoped in
Direct damage to or destruction of unknown marine historic environment assets including geophysical anomalies or UXO	✓	✓	✓	Scoped in

Note: ✓ = potential impact is relevant to cable installation phase

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Conclusion: Marine archaeology
Further assessment work is required in support of the Marine Licence Application. The following impacts will be assessed further within the EA:

- Direct damage to or destruction of known marine historic environmental assets including geophysical anomalies or UXO, and submerged landscapes
- Direct damage to or destruction of unknown marine historic environment assets including geophysical anomalies

4.11 Other sea users

4.11.1 Key data sources

- KIS-Orca
- Marine Scotland National Marine Plan Interactive (NMPI)

4.11.2 Baseline overview

There are a number of other sea users in the vicinity of the proposed cable corridor, as shown in Figure 4-8. These include:

- Renewable energy projects (operational / consented / planned);
- Cables and pipelines including SSE assets and telecommunications;
- Other infrastructure – oil and gas;
- Aquaculture sites;
- Aggregate extraction and disposal sites;
- Potential UXO munitions; and
- Recreational activities.

Figure 4-8 Other infrastructure and other sea users in the vicinity of the northern section of the Shetland HVDC Link subsea cable route

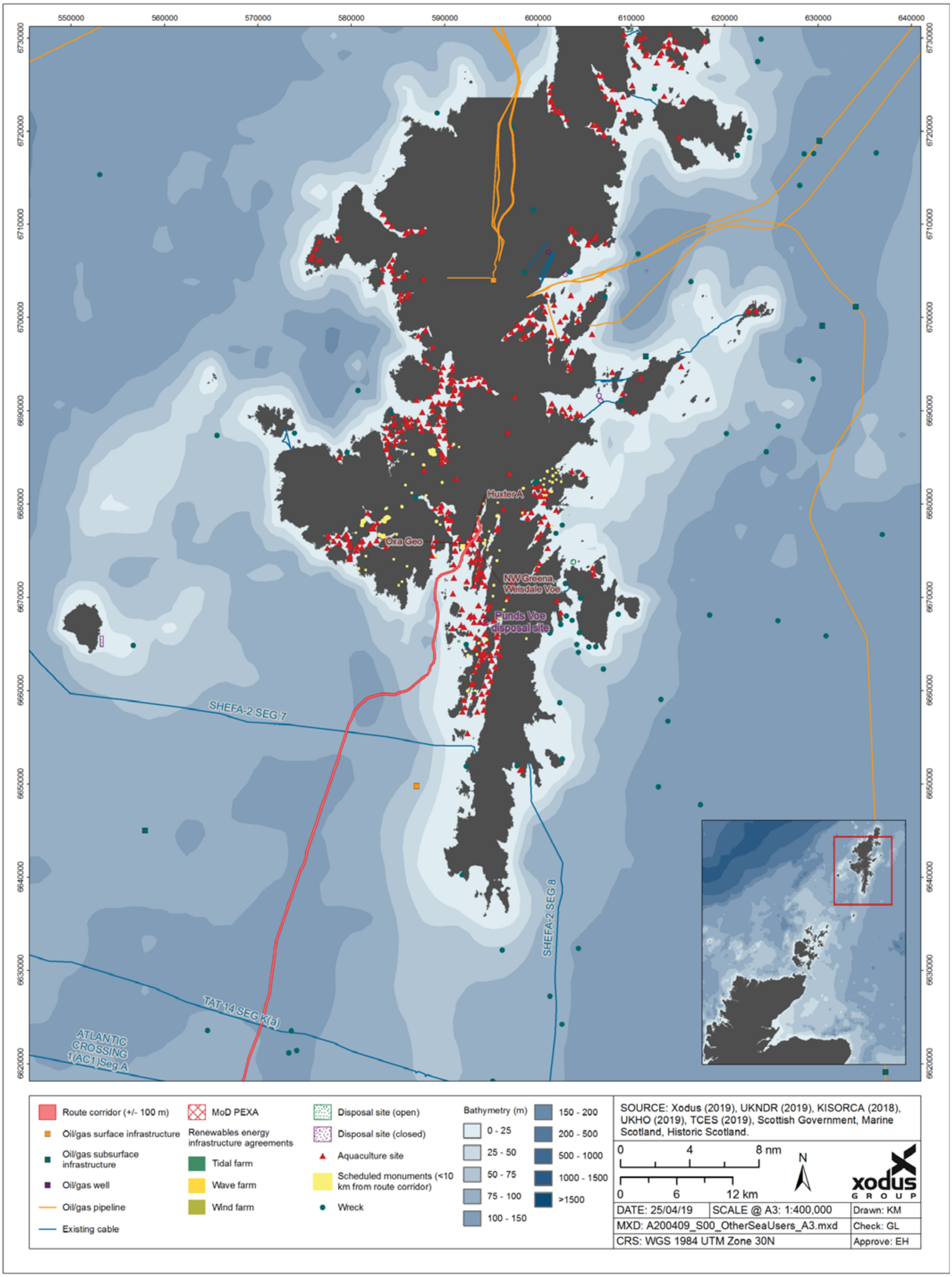


Figure 4-9 Other infrastructure and other sea users in the vicinity of the central section of the Shetland HVDC Link subsea cable route

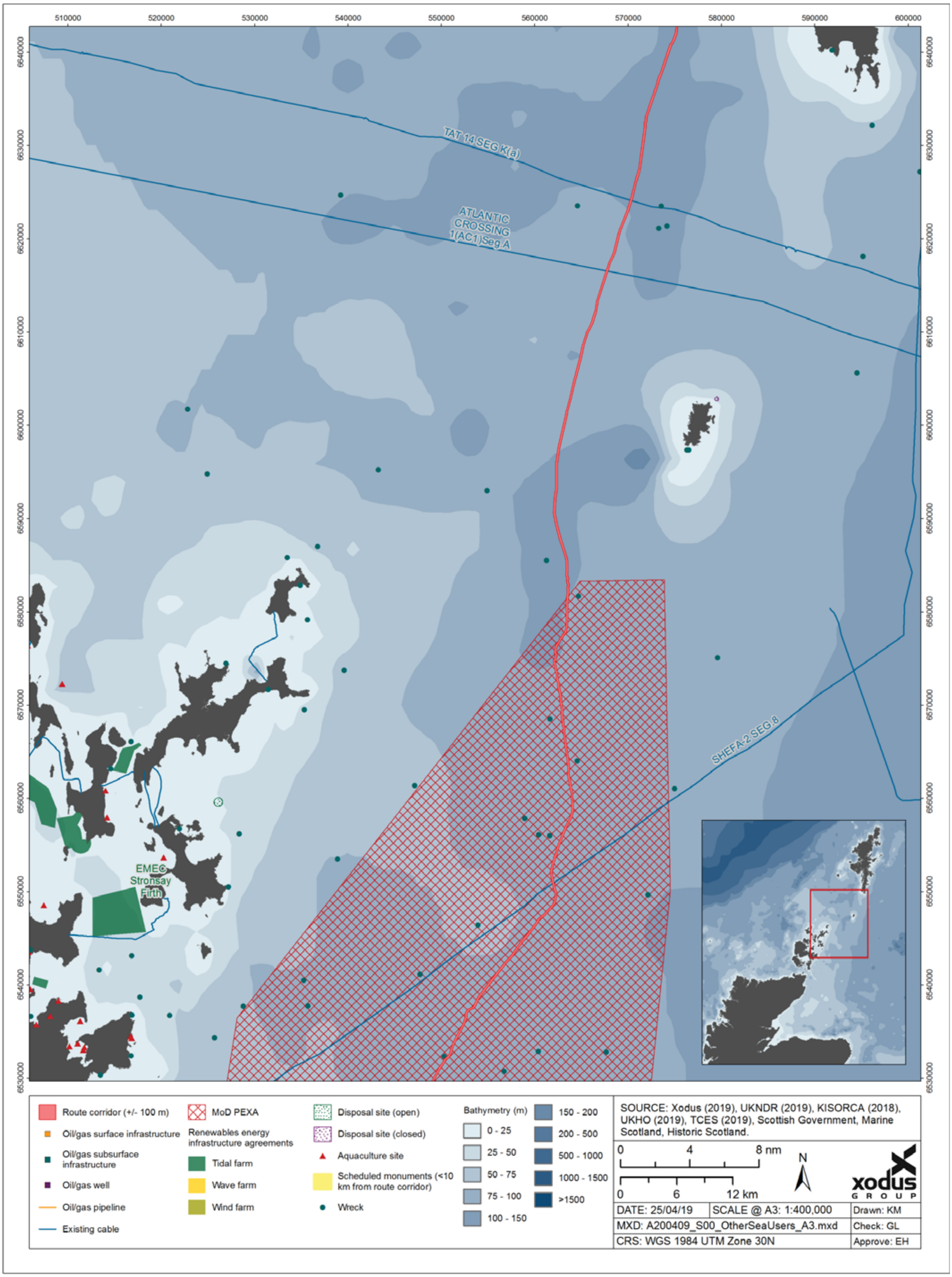
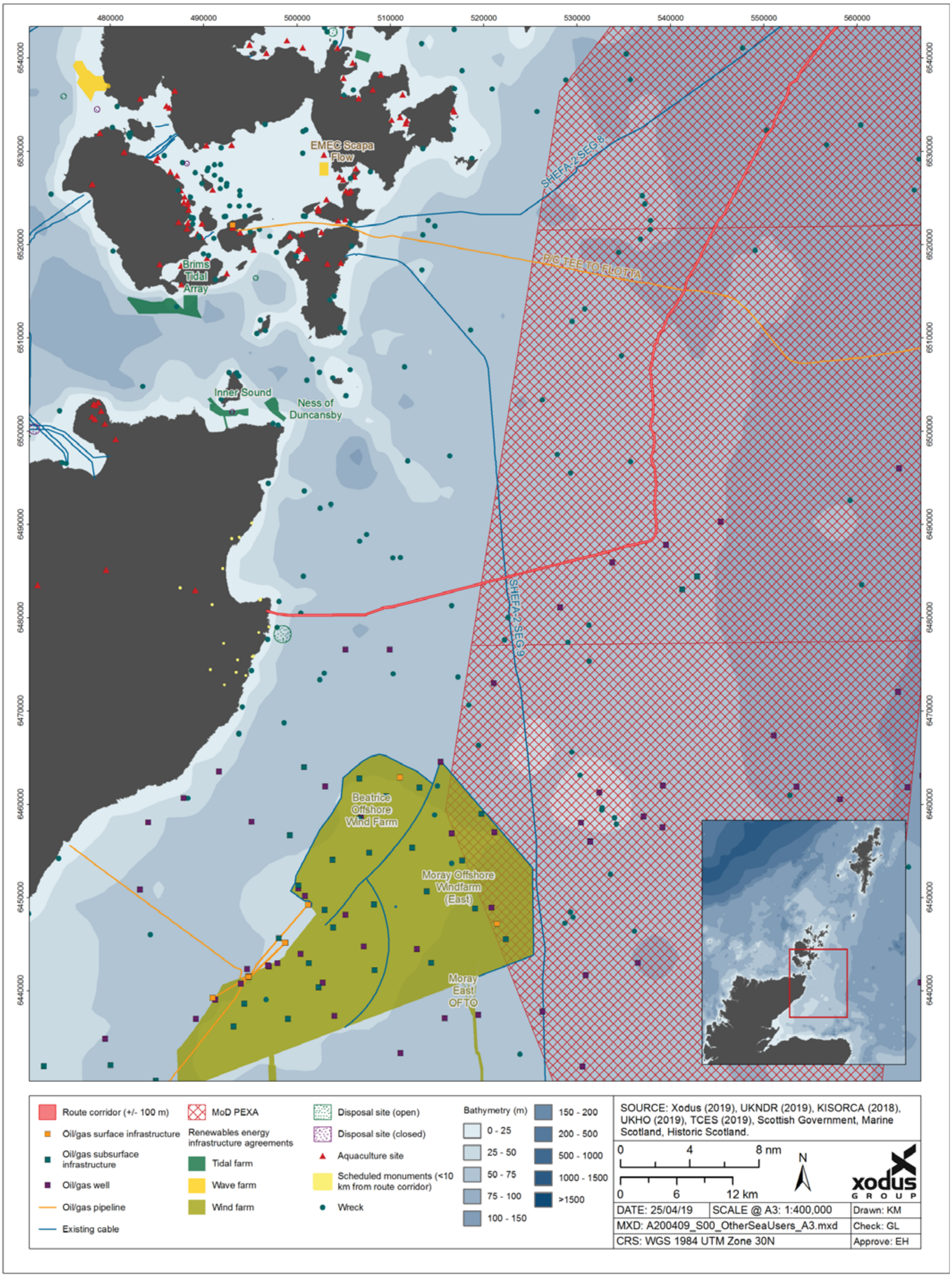


Figure 4-10 Other infrastructure and other sea users in the vicinity of the southern section of the Shetland HVDC Link subsea cable route



4.11.2.1 Renewable energy projects

There are 14 renewable energy projects within 40 km of the proposed cable corridor, as detailed below within Table 4-17, and shown in Figure 4-8.

Table 4-13 Renewable energy projects within 40 km of the proposed Shetland HVDC Link cable corridor

Name	Operator	Sector	Status	Distance from proposed cable corridor (km)
Beatrice Nav Aids 20161219	Beatrice Offshore Wind Farm	Wind farm	Occ Licence / Minute of Agreement	14.1
Beatrice Offshore Wind Farm	Beatrice Offshore Wind Farm	Wind farm	Lease - Marine	14.9
Moray Offshore Windfarm (East)	Moray Offshore Wind Farm	Wind farm	Lease - Marine	17.1
Designated Area for cable route for Inner Sound	MeyGen Limited	Wind farm	Lease - Marine	20.0
Ness of Duncansby	Duncansby Tidal Power Limited	Tidal farm	Agreement / Option for Lease	20.3
Inner Sound	MeyGen Limited	Tidal farm	Lease - Marine	21.0
Designated Area for cable route for Beatrice O/Shore W/F	Beatrice Offshore Wind Farm	Wind farm	Lease - Marine	22.6
Beatrice O/Shore W/F	Beatrice Offshore Wind Farm	Wind farm	Lease - Marine	22.8
Z1 WDA	Moray Offshore Windfarm (West)	Wind farm	Agreement / Option for Lease	28.1
Moray East OFTO	Moray Offshore Wind Farm	Wind farm	Lease - Marine	28.5
Z1 Moray Firth Met Mast	Moray Offshore Wind Farm	Wind farm	Lease - Marine	31.3
Brims Tidal Array	Brims Tidal Array Limited	Tidal farm	Agreement / Option for Lease	32.1
EMEC Stronsay Firth	EMEC Ltd	Tidal farm	Agreement / Option for Lease	34.5
EMEC Scapa Flow	EMEC Ltd	Wave farm	Lease - Marine	39.1

4.11.2.2 Pipelines and subsea cables

There are a total of 61 cables and pipelines (34 cables and 27 pipelines) within 40 km of the proposed cable corridor, seven of which are located within 10 km. Six of these cables / pipelines overlap with the proposed cable corridor, as detailed within Table 4-14, and shown on Figure 4-8, Figure 4-9 and Figure 4-10.

Table 4-14 Hydrocarbon pipelines and subsea cables within 10 km of the proposed Shetland HVDC Link cable corridor

Cable/Pipeline	Operator	Type	Status	Distance from cable corridor (km)
P/C Tee to Flotta	Repsol Sinopec	Pipeline	Active	0
Atlantic Crossing 1 (AC1) Seg. A	Level 3	Cable	Active	0
SHEFA-2SEG.7	Faroese Telecom	Cable	Active	0
SHEFA-2 SEG.8	Faroese Telecom	Cable	Active	0
SHEFA-2 SEG.9	Faroese Telecom	Cable	Active	0
Tat 14 SEG K(a)	Telia Carrier	Cable	Active	0
Clift Sound	Scottish and Southern Energy Networks	Cable	Active	4.6

4.11.2.3 Other infrastructure – oil and gas

Within 40 km of the proposed cable route, there are 9 oil and gas surface infrastructure as detailed within Table 4-15, below.

Table 4-15 Other infrastructure within 40 km of the proposed Shetland HVDC Link cable corridor.

Infrastructure name	Operator	Status	Distance from cable corridor (km)
Aegir Waverider Buoy West St Ninian KFB21/2012 Area 1	Unknown	Active	8.8
Moray Firth Waverider Buoy: KFB 08/2010	Partrac	Removed	17.7
Sullom Voe Oil Terminal	Unknown	Active	25.4
Jacky Wellhead Platform 12/21C	Ithaca	Active	31.0
Beatrice CSS	Repsol Sinopec	Active	35.0
Beatrice B	Repsol Sinopec	Active	35.1
Moray Firth Waverider Buoy: KFB 12/2010	Partrac	Removed	35.7
Beatrice AD	Repsol Sinopec	Active	38.9
Beatrice AP	Repsol Sinopec	Active	39.0

4.11.2.4 Aquaculture sites

Aquaculture is an important industry in the north of Scotland, and as such, there are on average 410 aquaculture sites within 40 km of the proposed cable corridor. There are no aquaculture sites that overlap with the proposed cable corridor. The three closest aquaculture sites are the Oxa Geo, Huxter A, and NW Greena, Weisdale Voe located 0.15 km, 0.17 km and 0.22 km, respectively, from the cable corridor, as shown in Figure 4-8, Figure 4-9 and Figure 4-10.

4.11.2.5 Disposal sites

There are 17 dredge disposal sites located within 40 km of the proposed cable corridor. The closest open disposal site to the proposed cable corridor is the Punds Voe, located 2.4 km, as shown in Figure 4-8.

Table 4-16 Aggregates and Dredge Spoil Disposal Sites within the vicinity of the proposed Shetland HVDC Link cable corridor

Site	Status	ID	Distance from cable route (km)
Atlantic-Fish Waste	Closed	CR010	1.1
Punds Voe	Open	FI095	2.4
Punds Voe	Closed	FI090	4.5
Skerries	Open	FI080	10.2
North Haven	Closed	FI110	14.9
Symbister	Closed	FI060	17.8
Symbister a	Closed	FI065	18.0
Gills bay	Closed	FI030	21.3
North Haven	Closed	FI125	27.4
Punds Voe	Closed	FI100	27.4
North Haven	Closed	FI120	29.1
Thurso	Closed	FI010	31.0
Scrabster	Open	FI008	31.4
Scrabster	Closed	FI005	31.6
Thurso	Open	FI020	34.3
Stromness B	Open	FI055	35.4
Skerries	Closed	FI068	38.3

4.11.2.6 Coastal defence features and wrecks

There are two protected wrecks within the vicinity of the proposed cable corridor; a 20th century steamship located at North Head, Wick Bay, approximately 2 km south from the route, and the HMS Duke of Albany, another 20th century steamship located approximately 15 km east of the proposed cable route (NMPi, 2019). There are an additional two NAFC wrecks located 0.2 km and 7.4 km from the proposed cable route.

4.11.2.7 Recreational activities

There are a number of marinas within the vicinity of the proposed cable corridor, the majority of which are located on Shetland and include; Bridge End Marina, Hannovoe Marina, Skeld Marina and Scalloway Port Arthur Marina. Towards the Caithness landfall, there is the Wick Marina, situated approximately 1 km south of the landfall, as well as the Fair Isle Marina located 10 km east of the cable route. The high concentration of marinas indicates that this region of Scottish waters is used frequently for recreational activities such as sailing, boating and yachting. Recreational AIS Intensity data shows a route from Shetland - Fair Isle - Orkney - mainland Scotland which has a moderate to high level of intensity. On Shetland there are a number of sailing clubs; of particular note is the Scalloway Boating Club, located approximately 5 km from the proposed cable corridor. As such, the area in which the proposed cable will be installed is considered to have relatively high levels of recreational marine activity (NMPi, 2019).

From the high-level shipping and navigation analysis, it was identified that the majority of recreational activity was recorded coastally near the Noss Head landfall. Activity was also noted off the west coast of Shetland, as well as further offshore on Fair Isle and off Orkney.

4.11.3 Scoping of potential impacts

Although the proposed installation works will be highly localised and temporary, there are a number of receptors in highlighted in Section 4.11.2 that are situated within close proximity to the proposed cable corridor including, but not limited to, Beatrice Offshore Windfarm, Oxa Geo, Huxter A aquaculture site, Atlantic Fish Waste and Punds Voe disposal sites as well as recreational users of the area.

A summary of the potential impacts associated with the proposed cable route on other sea user receptors is detailed within Table 4-17. Detail on additional information to be provided in support of the Marine Licence is provided in Section 5.

Table 4-17 Potential impacts summary

Potential impact	Relevant phase of Project			Scoping result
	Cable installation	Cable operation	Decommissioning	
Disruption to renewable energy projects planned routes and access to working areas	✓	✓	✓	Scoped in
Disruption or damage to existing subsea cables	✓	✓	✓	Scoped in
Disruption or damage to oil and gas assets	✓	✓	✓	Scoped in
Disruption to aquaculture sites	✓	✓	✓	Scoped in
Disruption to disposal sites	✓	✓	✓	Scoped in
Disruption to coastal historic defence features	✓	✓	✓	Scoped in
Disruption to recreational activities	✓	✓	✓	Scoped in

Note: ✓= potential impact for the given phase of cable works, and that it will be assessed further.

Conclusion: Other sea users
Further assessment work is required in support of the Marine Licence application.

5 ENVIRONMENTAL INFORMATION REQUIRED TO SUPPORT MARINE LICENCE APPLICATION

5.1 Introduction

The following section identifies the main receptors, where due to sensitivity of the receptor and potential impact on the receptor, it is anticipated that additional information will be required to support the Marine Licence application.

5.2 Additional information requirements

Table 5-1 below summarises the findings from Section 4 and identifies whether, based on those findings, additional information is required to support the Marine Licence application.

Table 5-1 Additional information requirements

Receptor	Potential for significant impacts	Additional information required for marine licence application?	Comments
Protected sites and species	Yes	Yes	The NCA will assess the potential for the project to affect protected site and species
Physical environment and seabed conditions	Yes	Yes	Baseline information will be presented to provide a complete characterisation and inform related assessments. Geological features are considered to be a technical constraint or hazard to cable installation. Where present, it is highly likely that the cable will have to be surface laid with additional protection for burial. Potential for any direct impacts on geological features associated with substratum disturbance/removal (e.g. trenching) is very limited. Geological features identified will be assessed further within a morphological assessment. This assessment will determine the potential impact that the Project may have on the hydrodynamic, physical processes and water quality of the area.
Benthic and intertidal ecology	Yes	Yes	The Noss Head NCMPA is located within the project area and is designated for benthic habitat features. The MMT environmental and geophysical surveys identified two Annex I habitats along the survey corridors; bedrock reef and medium graded stony reef. Additionally, two protected species were identified within the cable installation corridor; European plaice *Pleuronectes platessa,* and Ocean Quohog *Arctica islandica.* A full assessment of impacts to benthic and intertidal ecology will therefore be undertaken. NCA will consider potential effects to protected sites and species.

Receptor	Potential for significant impacts	Additional information required for marine licence application?	Comments
Fish and shellfish ecology	No	No	Limited potential impacts due to mobile nature of fish and short duration of cable installation activities. Potential impacts associated with EMF will be mitigated through burial and/or protection of the cable along the majority of the proposed route. No impacts to fish and shellfish are expected from low levels of sediment disturbed by trenching activity. Disturbed sediment will be rapidly dispersed by tidal currents. The NCA will consider potential effects to protected sites and species.
Ornithology	Yes	Yes	Limited potential impacts due to short duration of cable installation activities and limited number of vessels involved in cable installation. However, the cable route passes through the Seas Off Foula pSPA. The NCA will consider potential effects on designated conservation sites and species.
Marine Mammals	Yes	Yes	Potential impacts on marine mammals with respect to underwater noise and disturbance at the landfall will be assessed further within the Environmental Appraisal. The NCA will consider potential effects on designated conservation sites and species.
Commercial fisheries	Yes	Yes	Although the cable will be buried where possible along the route, there is potential for some disruption to fishing activities during cable installation. This will be assessed in more detail in support of the Marine Licence application.
Shipping and navigation	Yes	Yes	Although the potential for impacts on navigation safety due to presence of slow moving cable lay vessels in busy shipping lane are limited due to short duration of the cable installation works and low number of vessels (e.g. cable lay and guard vessel), due to the importance of the Pentland Firth as a major shipping route, it is proposed that a desk based Navigational Risk Assessment (NRA) is undertaken.
Marine Archaeology	Yes	Yes	A marine historic environment DBA and archaeological review of geophysical and geotechnical survey data will be conducted to inform a technical report supporting the marine licence application.

Receptor	Potential for significant impacts	Additional information required for marine licence application?	Comments
Other sea users	Yes	Yes	There is potential for other users to be impacted by the proposed cable works during installation, maintenance and decommissioning, as the presence of additional vessels may limit the access to the waters along the proposed cable route and may represent a collision risk with the other sea users. Potential impacts on fisheries and aquaculture will be assessed as part of the commercial fisheries assessment. Potential impacts on other sea users will be assessed in the NRA.

5.3 Proposed supporting information for Marine Licence applications

5.3.1 Environmental Appraisal

This Environmental Appraisal (EA) will form the supporting information to the Marine Licence application. The EA will assess the potential significant impacts of the project on the baseline environment. The EA will present specific topic assessments on:

- Physical Environment and Seabed Conditions;
- Benthic and intertidal ecology;
- Ornithology;
- Marine Mammals;
- Commercial fisheries;
- Marine Archaeology; and
- Other sea users.

To support the environmental appraisal a NCA and NRA will be produced.

SHE Transmission are happy to discuss this approach with MSLOT in order to ensure that the information provided meets MSLOT requirements with respect to the Marine Licence application and to agree the content and structure of the report.

5.3.1.1 Nature Conservation Appraisal (NCA)

A Nature Conservation Appraisal (NCA) will be produced and submitted as an appendix to the Environmental Appraisal. The NCA will consider the potential effects to key protected sites and species. This will provide Marine Scotland with the information they require in order to undertake a Habitats Regulations Appraisal (HRA) and a Nature Conservation Marine Protected A\rea (NCMAP) appraisal (as required).

The NCA will incorporate the following:

- HRA as required under the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended):
  - Screening to determine whether there is a potential for a Likely Significant Effect (LSE) on designated Natura 2000 sites.
  - If an LSE is identified, then the NCA will provide additional information in order to allow Marine Scotland to carry out an appropriate assessment.

- NCMPA Appraisal as required under the Marine (Scotland) Act 2010:
  - Initial screening to determine whether a project is reasonably capable of affecting a protected site; and
  - If it is concluded that a project is capable of affecting a protected site, the main assessment to determine whether the exercise of a function would or might significantly hinder, or there is or may be a significant risk of the act hindering the achievement of the conservation objectives.

5.3.2 Navigational Risk Assessment (NRA)

In order to assess potential risks associated with the Project in terms of Navigation Safety, it is proposed that a desk-based NRA is carried out. This would involve:

- Review of AIS vessel tracking data from past 12 months with a minimum of 2 x 6-week periods analysed from this 12 months of data (summer and winter period);
- Identification of key characteristics for shipping and navigation in the area including:
  - Vessel routes;
  - Number of vessels transiting the area;
  - Types of vessels transiting the area (e.g. cargo, tankers, ferries);
  - Vessel draught distributions;
  - Recreation vessels (based on review of data from RYA Coastal Atlas);
  - Aids to navigation;
  - Anchorages; and
  - Ports and harbours.

Assessment of potential risks to navigation with respect to collision risk and anchor strike.

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