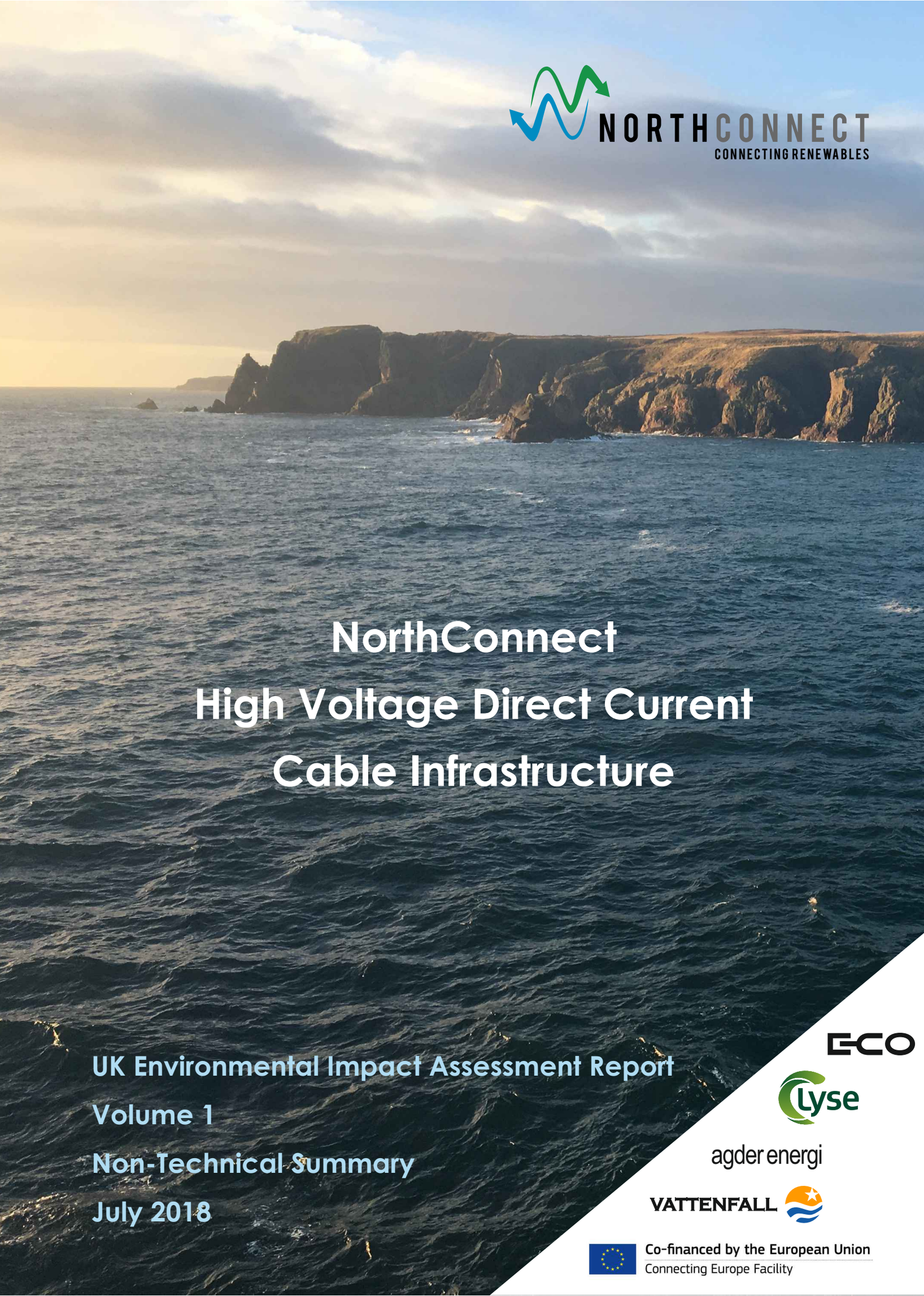

NORTHCONNECT
CONNECTING RENEWABLES

NorthConnect
High Voltage Direct Current Cable Infrastructure

UK Environmental Impact Assessment Report
Volume 1
Non-Technical Summary
July 2018

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Co-financed by the European Union
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NorthConnect HVDC Cable Infrastructure EIAR: Volume 1 – Non-Technical Summary

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HVDC Cable Infrastructure EIAR Volume 1: Non-Technical Summary

Co-financed by the European Union
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Contents

1 Introduction

NorthConnect is a project set up to develop, consent, build and operate a High Voltage Direct Current (HVDC) electrical interconnector between Peterhead in Scotland and Simadalen in Norway. The 665km long, 1,400Megawatt interconnector will provide an electricity transmission link allowing the two nations to exchange power and increase use of renewable energy. The intention is for the HVDC interconnector to be operational by 2023.

NorthConnect is a Joint Venture (JV) project company owned by four community and state-owned partners from Norway and Sweden: Agder Energi AS, E-CO Energi AS, Lyse Produksjon AS and Vattenfall AB. The partnership was established on 1st February 2011.

Figure 1.1 details the main elements of the project, however, this document focuses on the HVDC cabling and associated infrastructure from the UK Converter Station Building to the limits of the UK Exclusive Economic Zone (UK EEZ).

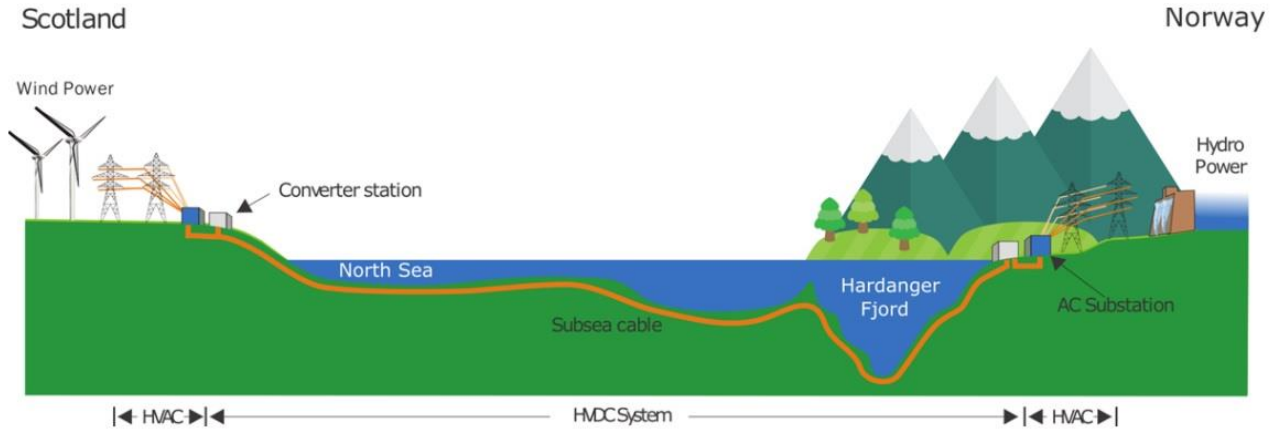

Figure 1.1: Main Project Elements

The onshore HVAC cable burial from Peterhead substations to the UK Converter Stations and the construction of an onshore Converter Station at Fourfields located near Peterhead, Aberdeenshire, have been covered in a separate Environmental Statement (NorthConnect, 2015), and were granted planning permission in September 2015 by Aberdeenshire Council.

Although applications for the HVDC cable connection works alone would not automatically trigger the need for Environmental Impact Assessment (EIA) under the relevant EIA Regulations, NorthConnect have elected to carry out an EIA and submit an EIA Report (EIAR) in respect of the current planning and marine licence applications.

This EIAR focuses on the following parts of the project:

- Onshore HVDC buried cabling from the UK landfall to the converter station;
- Subsea HVDC interconnector from the UK to the UK-Norwegian median line (eastern extent of the UK Exclusive Economic Zone (UKEEZ));
- Fibre Optic cabling between the UK converter station and the UK-Norwegian median line; and
- Temporary construction requirements.

This Non-Technical Summary summarises the main findings of the EIAR. This EIAR is made up of 4 Volumes:

- Volume 1: Non-Technical Summary;

- Volume 2: Main Assessment;
- Volume 3: Appendices; and
- Volume 4: Drawings.

The main section numbers of this Non-Technical Summary mirror the Chapter numbers of the Main Assessment provided in Volume 2, hence, if the reader requires additional detail, please refer to the Chapter in Volume 2 of the same number as the relevant Section.

Copies of the full EIAR are available to view in the following locations:

- Boddam Library, 26 Queens Rd, Boddam, Peterhead AB42 3AX
- Fishermen's Mission Café, 8 Union Street, Peterhead, AB42 1JN

The library opening hours are as follows:

- Monday, Closed
- Tuesday, 11am-2pm
- Wednesday, Closed
- Thursday, 3pm-6.30pm
- Friday, 3pm-6.30pm
- Saturday/Sunday Closed.

The Fishermen's Mission Cafe is open between 7.30am and 3pm Monday to Friday and 9am to 3pm on Saturday. It is closed on Sunday.

Electronic copies of the full Marine Licence and planning consent application documents can be downloaded from the NorthConnect website: www.northconnect.no.

A pen drive containing the full marine licence and planning consent application documents can be obtained by contacting the NorthConnect Communications Manager on 07825 744712 or by emailing fiona.milligan@northconnect.no Hard copies of the EIAR can also be obtained by contacting the Communications Manager at a cost of £500 plus postage, if required.

2 Project Description

2.1 Project Need

As long ago as 2002, the European Council set European Union Member States a target of having electricity interconnections equivalent to at least 10% of their (installed production) capacity by 2005. Currently, Great Britain is only halfway to meeting this target. In May 2014, as part of its work on European energy security, the European Commission proposed an interconnection target of 15% for 2030. This was adopted by the European Council in its 23 October 2014 conclusions on the European Union's 2030 Climate and Energy Policy Framework (European Commission).

Numerous targets have been set at a European and at a Scottish level with regard to increasing the renewable power sources in the energy mix. The Scottish Government updated its energy strategy at the end of 2017 (Scottish Government, 2017). The Scottish Energy Strategy set two new targets for the Scottish energy system to achieve by 2030:

- The equivalent of 50% of the energy for Scotland's heat, transport and electricity consumption to be supplied from renewable sources; and
- An increase by 30% in the productivity of energy use across the Scottish economy.

The NorthConnect project proposes to provide a link between the electricity grids of Scotland and Norway. By linking wind and hydro generation resources between the two countries, NorthConnect will strengthen the security of power supply for consumers in both Scotland and Norway and will support the achievement of Scottish, Scandinavian and European renewable energy targets.

There are three key drivers associated with the NorthConnect project:

- Security of Supply: Linking the Scottish and Norwegian networks will support energy security in both regions, compensating for fluctuations when future Scottish energy demand is met by a higher proportion of wind energy. The link will also compensate for low Norwegian precipitation and low hydro storage levels, enhancing the electricity transmission infrastructure for both countries;
- Green Battery: Wind power is subject to fluctuations in production. These fluctuations make a 'Green Battery' energy storage approach attractive to ensure renewable power is available for consumers when the wind is not blowing. About half of Europe's reservoir capacity lies in Norway which also has good potential for energy storage, to provide on demand renewable electricity and the long-term realisation of a low carbon electricity supply for Europe; and
- Reduced Price Fluctuations: The project will stabilise electricity prices in the UK and Norwegian markets, leading to increased power exchange and competition in European energy markets.

2.2 Consideration of Alternatives

NorthConnect have considered alternatives at every stage of the design process. Initially to identify the best UK landing point, then to provide a specific location for the UK converter station, landfall point and onshore cable routing. Alternative landfall locations and converter station sites in Norway were also considered. Potential cable route options across the North Sea between the two landfall points were considered, with greater resolution provided with each step of the process. Survey work has informed the final cable consenting corridor and design and programming elements, to minimise effects on the environment.

The consenting corridor and associated survey results will be provided to the cable supply and installation contractor. The contractor will identify their proposed cable routing, within the consented corridor. They will then carry out their own surveys of their proposed route to inform the final cable route.

2.3 Project Location

The Scottish Interconnector Converter Station is located at a site called Fourfields, which is approximately 2.6km south of the outskirts of Peterhead, 4.5km south of Peterhead town centre and 1km southwest of the village of Boddam. The Fourfields site is located to the south of Lendrum Terrace and Highfield, east of the Den of Boddam, Sandfordhill and Denhead and west of the Hill of Boddam and Stirling Hill Quarry. The cable landfall site is at Long Haven Bay, to the south of the village of Boddam and east of the village of Longhaven. The onshore cable corridor links the landfall site to the Converter Station at Fourfields.

The marine cable consenting corridor heads north-easterly from the Scottish Landfall for approximately seven nautical miles (NM) then in an east-north-east direction across the North Sea towards the Norwegian Coast. The corridor has been specifically selected taking account of:

- Existing infrastructure including pipelines, cables, and offshore installations;
- Bathymetry;
- Seabed geology and sediment characteristics;
- Commercial fisheries, shipping and navigation;
- Cultural heritage and marine archaeology;
- Benthic ecology and habitat types; and
- Designated sites and protected habitats.

As such, the consenting corridor is not a straight route and, although the majority of it is 500m wide, the width varies to avoid features such as wrecks and to provide additional options for routing in challenging areas such as large sand-waves.

2.4 Project Components

2.4.1 Cables

There will be two HVDC cables connecting the two converter stations. The exact cable details will depend on which specialist cable manufacturer is involved, but the cables used will be Mass Impregnated (MI) in design. A cross section example of an MI HVDC cables is shown in Figure 2.1. For the onshore cabling, it will be similar in components to Figure 2.1, but without the same level of armouring.

Figure 2.1 Indicative MI HVDC Cross-Sectional Diagram

A fibre optic cable will be installed along with the two HVDC cables, so there can be instant communication between the two converter stations in Scotland and Norway. The cable is likely to be armoured with layers of steel wire and sheathed with either a polypropylene or polyethylene material for outer protection. The offshore section of the cable will be bundled with one of the HVDC cables. The fibre optic cable will not have any repeaters within the marine environment and is landed at the Norwegian coastline where it will connect into the wider Norwegian fibre optic network. The fibre optic cable will be routed to the converter station in Fourfields.

2.4.2 Onshore Cabling

Onshore HVDC Cables have a different armour protection composition to offshore cables, so there will be a joint pit (Jointing Pit 1) approximately 450m from the landing point to the south of the disused railway, where the transition between the two cable types will be located. Limitations on the maximum length of onshore HVDC cable that can be delivered means the maximum deliverable cable lengths are likely to be in the range of 850m – 1000m. As the proposed route is approximately 2km, a second onshore HVDC cable joint pit will be required to join the sections of onshore HVDC cables together. Jointing Pit 2 will be located just to the south of Fourfields. The Jointing pits are below ground with suitable depths of soil cover to allow agricultural activities to continue.

The onshore cables trench will be approximately 1.3m deep and 4.5m wide, with an approximate distance of 1m between the two HVDC cables and the fibre optic laid between them. The two HVDC marine cables

will be laid in separate trenches from the landfall to Joint Pit 1. The two trenches will be approximately 1.3m deep and 4m wide, and approximately 3m apart.

Horizontal directional drilling will be carried out under the A90 and the disused railway line which runs parallel to the A90, with ducts inserted into the drilled holes which the cables can then be pulled through. This will avoid any disturbance to road users and to the archaeological asset of the disused railway line.

2.4.3 Cable Landfall

Horizontal directional drilling will also be utilised at the landfall. The marine cables will be pulled ashore through ducts installed into holes drilled from a point 100-120m inland from the cliffs, under the cliffs and with a marine exit point approximately 190m offshore. The marine exit point will be in approximately 26m of water depth. There will be 3 boreholes drilled: one for each of the HVDC cables; and one for the fibre optic cable. However, all three holes will be drilled to a diameter suitable for an HVDC cable. This is to provide redundancy such that, if there is an issue with one of the HVDC ducts preventing the cable pull, there is a backup route available. In this instance, the fibre optic would be bundled with an HVDC cable for pulling through the same duct.

2.4.4 Offshore Cables

The HVDC offshore cabling will be around 665km from the UK to Norway. The offshore cabling from the HDD marine exit point to the UK median line is approximately 230 km. The cable installation will begin more or less simultaneously at both the Scottish and Norwegian landfall sites, and then will meet in the North Sea.

It is likely that cable joints will be required at intervals of between approximately 150km to 170km for the two cables. The number of joints will be dependent mainly on the loading capacity of the installation vessels. Joints in the offshore cables are normally made inline on the ship as the cable is being laid and do not require any additional marine infrastructure.

The HDD marine exit point is located in water depths of approximately 26m. If the fibre optic cable is in a separate HDD, it will be routed towards one of the marine HVDC cables and bundled with it for the remainder of the route. It is assumed that the two HVDC cables will be installed separately. There is, however, a small potential that they could be bundled together and laid in the same trench.

The cables will be laid in water depths varying between 26m at the UK landfall to 860m in the deepest part of the Hardangerfjord in Norway. The distances between the two HVDC cables will vary based on seabed conditions, water depth and Magnetic Field requirements. Typical separation in the North Sea will be between 20m-100m depending on the seabed conditions. In waters up to 12NM, the proposed cable corridor width will be 60m, with a cable separation of 20m as a minimum and 40m as a maximum. In waters outwith the 12NM limit, there will be a variable corridor width, with a minimum of 20m.

2.4.5 Cable Protection

To ensure the cable is protected from damage by anchors, fishing activities and sediment movements, and conversely to ensure that the cable does not cause damage to anchors, fishing equipment or vessels, the cable needs to be appropriately protected. The level of cable protection is determined by the risks posed and the geological conditions encountered. A detailed assessment has been carried out to understand the protection levels required and the techniques that may be utilised to achieve these.

Cables can be protected by installing them at sufficient depths of lowering below the sea bed and/or by achieve an appropriate depth of burial, which may be achieved by rock placement. To minimise effects on fishing, the preference is to install the cable below the seabed in a trench. In some seabed conditions the trench will naturally infill, thereby burying the cable naturally. In stiffer sediments, backfill rock placement

is required to infill the trench and cover the cables. In some instances, the cable cannot be lowered into the seabed as it is too hard, e.g. rock.

The first 12nm of the cable corridor from Scotland are known to pose challenging conditions but, assessment carried out indicates that it should be possible to protect the cable in this area by ploughing and backfill rock placement to original seabed levels, for around 90 to 95% of the route. The remaining 5 to 10% will require remedial rock placement above existing sea levels to obtain the appropriate protection levels. From 12nm out to the limits of the UK EEZ, it is predicted that only 1% of the route will require remedial rock placement, and no backfill rock placement should be required at all.

There are 18 cables and pipelines to be crossed in UK waters and agreements will be put in place with the owners of these assets with regard to the details of these crossings. Normal crossings are facilitated by the placement of rock on top of the existing asset. The HVDC cables are then laid and rock is placed on top of them to provide protection.

All rock placement will be designed to be over trawlable to minimise effects on fishing activities.

2.5 Project Phases

2.5.1 Construction

The following main construction activities are required to facilitate the installation of the cables:

- Onshore Enabling Works – including the creation of a temporary access road to the landfall drilling area and working areas for the drilling operations;
- Onshore Cable Installation – including the excavation of cable and drainage trenches, storage of topsoil and soil from the trenches, joint pit formation, horizontally directionally drilling the road crossing, laying of the cables and reinstatement of the trenches;
- Landfall Horizontally Directional Drilling - drilling the holes, inserting the ducts and installing temporary protection at the marine exit points;
- Offshore Preparations – sea trials, to ensure that the proposed cable installation and protection techniques are effective, will be carried out. Then removal of the temporary marine exit point protection and preparing the ducts for the cable pull, clearing debris from the cable route and placing rock at cable and pipeline crossing points. Trenches may be ploughed for the cable to be laid in;
- Marine Cable Pull – pulling the marine cables ashore through the ducts;
- Onshore Demobilisation and Reinstatement – removal of all equipment, temporary access and working areas, and reinstating the onshore areas to allow them to return to their former use;
- Offshore Cable Installation – the cables will be laid, ploughed into place and cable protection placed; and
- Reporting – once the cables are installed, their exact locations will be reported to the appropriate authorities to allow them to be included on maps and charts of the area.

Throughout the installation works, marine surveys will be completed to ensure that the seabed is suitably prepared, the cable is laid, lowered into the seabed and buried appropriately.

Overall, a 54 month period of construction work is expected. Some activities are limited as to when in the year they can occur. For example, the Landfall HDD will be drilled in the winter months to avoid disturbance to breeding birds.

2.5.1 Operation

The onshore HVDC and Fibre Optic cables should not generally require significant operational maintenance once successfully installed and commissioned, but they will be monitored remotely for condition and function.

Regular marine cable surveys will be carried out to assess the status of the cable, cable protection and to identify any potential risks to the cable system or other users of the sea. If required, maintenance will be completed to rectify the issue identified.

If the cables were damaged in any way, they would need to be accessed and repaired. Onshore, this will involve digging up the cable to gain access. On the offshore sections, the cables will be cut to allow them to be brought to the surface for repair and a new section of cable would then be jointed into the cable, prior to them being re-laid and protected.

2.5.2 Decommissioning

The lifespan of the project is 40 years. The decommissioning plan will be fully developed prior to decommissioning. The likely approach, at a strategic level, will be to remove cables where economically viable, environmentally acceptable and practicable to do so. Due to the value of the metals in the cables, it is highly likely that it will be economically viable to remove the cables to allow them to be recycled. Ecological surveys may be required to ensure it is environmentally acceptable, as there is a potential that over 40 years the habitats will have changed and protected habitats or species may have colonised the area.

3 Methodology

One of the main purposes of the EIA process is to influence and improve design through iteration. Environmental impacts have been considered throughout the project, from the development option stage through to the initial design stages of the project. Where possible, environmental considerations have been incorporated into the design. The siting and design of the NorthConnect development has been heavily influenced by aspects identified through the EIA process, including possible ecological impacts, and the potential for disturbance of marine activities.

Environmental specialists have been involved throughout the design process and, where necessary, appropriate topic experts have been consulted to inform the design. The project design therefore has avoided and minimised impacts wherever possible and, as such, there are embedded 'primary mitigation measures' to avoid or reduce negative effects. These have been incorporated within the assessment of effects.

In addition, it is assumed that standard construction practices, such as those outlined in Guidance for Pollution Prevention documents (tertiary mitigation), have be applied in the assessment process and these are captured within the Schedule of Mitigation.

A methodical and robust assessment of environmental impacts has been used across all chapters of the EIAR, with topic-specific variations incorporated as required. The methodology considers a receptor's value or sensitivities, the magnitude and likelihood of the impact and, through a matrix-based approach, whether or not the impact is significant. If the effect is above a defined threshold, then it is deemed to be adverse and significant, and additional mitigation procedures are put in place where possible to reduce the potential impact.

Mitigation identified through the assessment process has been incorporated into the Schedule of Mitigation. The effects are reassessed taking account of the secondary mitigation identified, to identify whether or not they are still significant with the mitigation in place.

4 Consultation

Consultation has been a key part of the NorthConnect design development and EIA process. Formal scoping opinions were sought from Aberdeenshire Council and Marine Scotland who, in turn, consulted with various consultees to develop a scoping opinion. Scoping is the mechanism by which it is agreed what needs to be considered during the EIA process.

In addition to the formal EIA scoping process, there have been meetings and communications with Aberdeenshire Council, Marine Scotland and Statutory Consultees. The aim of these has been to ensure that the EIAR covers all relevant topics and that effects could be designed out wherever practicable.

There has been dialogue with the local community, including commercial fishery stakeholders, through workshops and exhibitions, as part of the Pre-application Consultation process. Full details are provided in the Pre-application Consultation Report submitted in support of the marine licence and planning consent applications.

5 Planning and Marine Policy

National and local planning policy and policies included in the National Marine Plan have been considered. The NorthConnect project aligns with policy at all levels.

Scotland's third National Planning Framework (NPF3) includes a section entitled, 'A Low Carbon Place' it identifies a number of key themes which align to the NorthConnect project drivers as shown in Table 5.1.

Table 5.1 NorthConnect Drivers Compared to NPF3 Themes

NorthConnect Driver	NPF3 – Quote
Security of Supply	Maintaining security of supplies and addressing fuel poverty remain key objectives.
Move to a Low Carbon Future	Our ambition is to achieve at least an 80% reduction in greenhouse gas emissions by 2050.
Reduced Price Fluctuation	Maintaining security of supplies and addressing fuel poverty remain key objectives.

Aberdeen City and Shires Strategic Development Plan specifically cites Peterhead as an area of key importance in the energy future due to its suitability for interconnectors:

'Peterhead also has the potential to be an important hub in transmitting renewable energy both within the UK and more widely as part of a European network. Its coastal location and existing connections make it an attractive choice for subsea cables and their onshore infrastructure'.

The Aberdeenshire Local Development Plan is founded on the principle of supporting and encouraging sustainable development. In addition to policies relating to economic growth, sustainable communities, designated sites and housing, the plan seeks to take on the challenges of sustainable development and climate change. The NorthConnect project aids in tackling climate change by facilitating an increase in renewable power.

In addition to policies that NorthConnect will aid in progressing, there are policies which the project needs to ensure it meets, and these cover a full range of topics from marine litter to the protection of the historic environment. NorthConnect have taken these into account in the project development and in the topic specific assessment completed as part of the EIA process.

6 Cumulative Effects

A review of other planned onshore and offshore developments was conducted in order to identify potential cumulative impacts, and these projects were scoped in or out based on their potential to contribute to in-

combination effects with the installation of the HVDC cable infrastructure. Developments scoped in were then assessed within the relevant topic specific chapters in Volume 2. The only project that could give rise to cumulative significant effects is the other elements of the NorthConnect project. Together they give rise to a beneficial significant effect in terms of Carbon Dioxide savings and associated climate change benefits.

7 Seabed Quality

The EIAR assessed the potential impacts on seabed quality that may result from the installation of the NorthConnect marine HVDC cables. Impacts on seabed quality during the operation and decommissioning phases were scoped out of the assessment in agreement with Marine Scotland. Hydrology and coastal process were also not assessed, since the nature of the proposed subsea cabling means no effects on hydrodynamic regimes are expected.

Identification of the baseline conditions to understand the seabed quality along the consenting corridor involved marine surveys. These consisted of geophysical and geotechnical surveys along the UK subsea survey corridor (from the UK landfall to the limits of UK Exclusive Economic Zone). Seabed sediment samples were analysed for heavy metals and hydrocarbon contamination. A desktop study was also undertaken to identify the risk of encountering Unexploded ordnance (UXO) along the UK consenting corridor.

The assessment was based on the information available to date in relation to methods of installation of the marine HVDC cable and considered the identified baseline conditions of the seabed. Potential effects on the seabed that may result from the installation of the marine HVDC cables were assessed in this chapter, and included disturbance and loss of seabed features, release of hazardous substances and contact with UXO.

The disturbance and loss of seabed features will occur during cable installation operations and will affect approximately 2.3km^2 of surficial and shallow geology within the consenting corridor. A further 0.4km^2 of seabed will be disturbed during removal of out of service cables, crossing of surface laid cables and pipelines and from cable protection that will involve rock placement. No features of significant geomorphological interest were identified in the consenting corridor during the survey operations, and the area of seabed affected is very low in the context of the wider North Sea. As such, the disturbance and loss of seabed features resulting from the installation of the marine HVDC cables is not expected to result in a significant impact.

With regard to a potential release of hazardous substances, the cable installation will utilise vessels and remotely operated vehicles (ROVs). Mechanical failure of vessels or ROVs, or other associated equipment, may result in release of harmful substances including hydrocarbons. The magnitude of potential impacts arising from a release of contaminants would depend on the nature and quantity of material released into the environment. However, all vessels working on the project will be compliant with international pollution prevention standards and will have rigorous pollution prevention and incident response procedures, which significantly reduces or removes the risk of a release of hazardous substances occurring. As such, it is considered extremely unlikely that release of hazardous material of a scale with the potential to negatively impact sediment quality will occur.

The risk from inadvertent contact with UXO is primarily to personnel and equipment, although secondary effects on seabed quality may occur through potential destructive disturbance during an explosion. The marine survey identified no UXO but it is recognised that risk during installation of contact with UXO remains. Therefore, a UXO survey will be conducted prior to installation works commencing. Where an UXO is identified, appropriate safety measures will be employed.

Overall the EIAR identified no potential significant effects on seabed quality as a result of the installation of the NorthConnect marine HVDC cables. No cumulative impacts were identified.

8 Geology and Hydrogeology

The EIAR assessed any potential environmental impacts on soil and groundwater quality. The assessment utilised the results from desk-based studies and ground investigations to determine baseline conditions of the soil and groundwater resources at the site, in order to assist in the identification of potential impacts and the assessment of their significance. Ground investigations included both trial pits (1 to 3m deep pits dug by excavator) and boreholes which are drilled with the recovery of a core and can be analysed to understand the geology to an appropriate depth below ground level.

The Fourfields site and majority of the HVDC cable route sits within the Skelmuir Hill, Stirling Hill and Dudwick Local Nature Conservation Site (LNCS). The main interest of the site is the pre-glacial Buchan Gravels Formation, which is deemed unique in nature in a Scottish Context. Any impacts on this receptor will be temporary during construction, as material excavated will be reinstated.

Bullers of Buchan Coast Special Site of Scientific Interest (SSSI) is designated for its coastal geomorphology and the cables will run under the cliffs in ducts, through horizontally directional drilled holes. The impacts on the SSSI itself will be negligible due to the installation technique utilised.

The land is classed in agricultural terms, in the vicinity of the cable route, the highest classification present is class 3.2: Land Capable of Supporting mixed Agriculture. The design of the cable route has ensured that the minimal amount of agricultural land will be affected, even temporarily, by the HVDC cabling. Once the HVDC cables are installed, the fields will be fully returned to agricultural use.

The topsoil along the majority of the route is relatively shallow at around 0.3m in depth. This is generally underlain by Hatton Till Formation, a type of soil deposited by glaciers which is a mainly clay matrix containing varying amounts of sands, gravels and cobbles. Bedrock of Peterhead Pluton Granite can be found between 0.5m and 1.6m below the surface and was proven to extend down to depths of up to 64.2m. Rock varied in strength and weathering both at different depths and between different boreholes.

Groundwater was encountered at depths between 1 to 2m below ground level, coinciding with the boundary between glacial till and weathered rock, and mainly as seepages in trial pits located along the onshore HVDC cable corridor. Shallower groundwater was encountered at the landfall site between 0.2 and 0.35m below ground level, either in weathered rock or perched on the glacial till. It is possible, therefore, that limited groundwater could be encountered during the excavation works, particularly in the southern most stretches of the cable route. Where encountered in excavations, this will be managed as part of the surface water management plan, possibly requiring small pumps.

At Fourfields where the HVDC cables enter the converter station site, groundwater levels were recorded at between 0.25 and 3.78m below ground in all but one location tested. This indicates a limited potential groundwater body within the near surface weathered rock zones, with anticipated groundwater flow north east within the Fourfields Site, generally following surface topography. Artesian groundwater conditions were recorded at one location, which may indicate fracture flow between 4.5 and 18m below ground level. The deeper excavation required to install the cable ducting into the Fourfields site has the potential to encounter these groundwater bodies and is likely to require active management (dewatering pumps) to facilitate construction works. With regard to the cable ducts' installation in isolation, the requirement to actively manage groundwater will be temporary and, hence, any effects on hydrogeology will be temporary and localised.

Groundwater recovered from the selected boreholes was subject to chemical testing and all were found to have concentrations of contaminants below the relevant assessment limit. This is consistent with the SEPA overall classification of the Peterhead bedrock aquifer as 'good'.

Soil samples were also taken and analysed for a wide range of contaminants. No samples were found to contain concentrations above the generic assessment criteria used and many of the results were found to be either below the method limit of detection, or within anticipated background concentrations. Therefore, there is not considered to be a contamination source present which could present a risk during, or on completion of, the proposed installation works.

Due to the uncontaminated status of the groundwater, if it were to be polluted the resultant impact would be significant. Appropriate materials storage and spill management plans will be in place throughout construction and operations to minimise the chance of a pollution incident, giving rise to land or groundwater contamination and, with this mitigation in place, residual effects are not significant.

9 Air Quality

Two topics were considered within air quality, dust and carbon dioxide (CO_2) emissions.

During the enabling works and cable installation, soil will be stripped to allow access roads and works areas to be established and for the cable trenches to be dug. Exposing soil and storage of soils can give rise to a dust source. In dry and windy conditions, dust can be spread causing a nuisance effect. Due to the scale of the works the effect of dust without mitigation has the potential to give rise to significant effects on the Buchan Ness to Collieston Coast Special Area of Conservation, the Bullers of Buchan Coast Site of Special Scientific Interest designated sites and the Longhaven cliffs Scottish Wildlife Trust nature reserve. Dust can smother plants and affect their ability to photosynthesise.

Dust can be effectively mitigated against and so a dust mitigation plan will be put in place for the project, which will include mitigation such as:

- Minimise the number of times material is moved and the time material is stored and ground left bare;
- Compacting stored soils to help reduce the amount of loose material, reducing the potential for dust;
- Allowing vegetation will to establish on soils that are to be stored for long periods of time; and
- If required, utilising mobile water bowsers or equivalent in dry weather conditions to damp down potential dust sources and, where possible, they will utilise runoff water (grey water) gathered on the site.

With mitigation there are no residual significant effects of dust.

The NorthConnect project has the potential to contribute towards a reduction in CO_2 emissions. CO_2 is the primary greenhouse gas emitted through human activities. Global climate change is the most obvious consequence of the increasing levels of CO_2 and, some of the effects associated with this phenomenon are rising sea levels and structural changes to ecosystems, amongst others. CO_2 calculations and estimates have been carried out to estimate the carbon cost of construction. This was offset against the potential CO_2 savings predicted by energy supply-demand mix modelling, to provide an understanding of the overall effect of the project.

Conversion factors are available for various materials to allow the CO_2 equivalent (CO_{2e}) emissions to be calculated. These were utilised to gain an understanding of the construction CO_{2e}. The HVDC cables require large quantities of metal and the production of metal is energy intensive, hence, they are the main source of CO_{2e} associated with the construction phase. It was estimated that around 35,000 tonnes of CO_{2e} is expected for this element of the project, primarily due to the cable.

The estimated carbon cost of the HVAC cables and converter station site was previous calculated as 11,925 tonnes of CO_{2e}. Assuming similar values for the Norwegian elements of the project a cumulative total CO_{2e} for construction of the full NorthConnect project is in the region of 100,000 tonnes.

The CO_{2e} saving associated with facilitating an increase in renewable power production due to the NorthConnect project during its 40-year operational life, has been modelled by a number of organisations, based on a range of scenarios that may occur in the future. The worst-case scenario from the National Grid modelling is 4.76 million tonnes, this would result in an overall saving of 4.66 million tonnes for the project. The best-case model is for an operational saving of 52.92 million tonnes of $CO_{2e,}$ a lifetime saving of 52.82 million tonnes of CO_{2e}. This is a significant beneficial effect.

10 Water Quality (On-Shore)

The EIAR assessed any potential environmental impacts on onshore water quality. Assessment utilised the baseline conditions of the existing hydrological features in the vicinity of the development, to assist in the identification of potential impacts and their significance.

A literature review identified limited data on the aquatic environments near the proposed development, with no assessment of their water quality available due to all the hydrological features' small size. However, an Otter, Water Vole and Eurasian Badger survey was conducted for the EIA of the NorthConnect Interconnector Converter Station and High Voltage Alternating Current Cable Route on the 29th of September 2014 by Tracks Ecology. The walkover survey identified and assessed, indirectly, aquatic habitats quality, as Water Vole and Otter have specific aquatic habitat requirements. In 2017, a further Otter, Water Vole and Eurasian Badger survey was conducted for this EIAR by Tracks Ecology, which again indirectly assessed the quality of identified aquatic habitats of the HVDC cable route.

The assessment identified multiple potential risks to the onshore water quality related to the installation and operation of the HVDC cable. Risks identified and assessed included: release of hazardous substances, surface water runoff from HDD site setup, HDD operation, cable trenching, temporarily modification of watercourses and flood risk.

Potential effects associated with release of hazardous substances arise from the utilisation of fuel and hydraulic fluids by trenching machinery. Spillage of these substances has the potential to reach water with possible effects on flora and fauna which are dependent on the aquatic environment. The utilisation of drilling fluid, likely to be bentonite, may also see release during the HDD operation, with the potential to increase sediment loading of the water environments affected.

Requirements for earthworks for the HDD site setup and cable burial may see silt laden runoff into hydrological features. Silt can discolour water courses and impact the photosynthesis of flora present, increase suspended solid loadings and sedimentation of the stream beds. Silt laden runoffs may also contain other contaminants such as inorganic metals or hydrocarbon-based pollutants. Watercourses requiring crossing by the trenching works are particularly at risk due to their immediate proximity to the earthworks, but these are only exposed to a fraction of the earthworks along the proposed onshore cable route. The crossing of the watercourse will see re-routing of the watercourses, leading to a modification of the watercourse and physical disturbance. However, the watercourses crossed will be reinstated.

Impacts resulting from maintenance and operation of the development will see similar impacts as arising from construction, though at much smaller scale as the cable is to be buried, with excavations only occurring at the repair locations.

The assessment identified no significant effects on terrestrial water quality arising from the HVDC cable development where mitigation measures are appropriately applied.

11 Water Quality (Marine Environment)

The EIAR assessed potential impacts on marine water quality which may result from the installation of the NorthConnect marine HVDC cables. Impacts from operation and decommissioning of the project were scoped out of the assessment in agreement with Marine Scotland.

Baseline data collection involved the undertaking of a marine survey that ran along the consenting corridor from the landfall site at Longhaven to the limits of the UK exclusive economic zone (UKEEZ). The survey involved sediment sampling which underwent chemical analysis to identify potential sediment bound contaminants. In addition, a literature review of reports, research articles and other subsea cable projects was undertaken to identify baseline conditions present in the consenting corridor.

The assessment identified potential environmental impacts on marine water quality, including:

- Discharges from horizontal directional drilling to the marine environment;
- Increased water column sediment loading;
- Remobilisation of sediment bound contaminants;
- Release of hazardous substances including accidental damage to subsea gas and oil infrastructure; and
- Potential introduction of invasive non-native species.

The HDD operation will result in some drilling fluid entering the marine environment, and this fluid is a combination of water and a non-toxic clay. The release of drilling fluids will result in localised and short-term increased sediment loading of the water column in the vicinity of the HDD exit location. Similar increased sediment loading effects are expected from the cable burial in the seabed, resulting in disturbance of seabed. The seabed disturbance may see remobilisation of sediment bound contaminants that can affect marine flora and fauna, and this impact is assessed in relevant topic specific chapters. While analysis of the seabed sediment samples identified some area containing heavy metal and hydrocarbon contamination, the concentrations of these contaminants were below levels like to result in environmental harm if remobilised by the installation works.

Cable installation will utilise vessels and remotely operated vehicles (ROVs). Mechanical failure of vessels or ROVs, or other associated equipment, may result in an accidental release of harmful substances. The magnitude of potential impacts arising from a release of contaminants would depend on the nature and quantity of material released into the environment. However, all vessels working on the project will be compliant with international pollution prevention standards, and will have rigorous pollution prevention and incident response procedures, which significantly reduces or removes the risk of a release of hazardous substances occurring. As such, it is considered extremely unlikely that a significant release of hazardous material will occur.

Ships will discharge waste waters; however, vessels will adhere to appropriate pollution prevention legislation, and no significant reduction in water quality will result. Installation works could in theory lead to accidental damage of subsea oil and gas infrastructure that could see widespread oil pollution. Appropriate communication with asset owners, establishment of crossing agreements including proximity limits, and adherence to international cable installation best practice make this extremely unlikely.

The assessment also considered the potential introduction of invasive, non-native species from vessels via ballast water exchange or biofouling of vessels hull and equipment. Invasive species introduction can result in significant ecosystem impacts and financial implications. However, the likelihood of an introduction as a result of the project is extremely unlikely, as relevant prevention legislation and best practice will be adhered to.

Overall the EIAR identified no potential significant effects on marine water quality as a result of the installation of the NorthConnect marine HVDC cables. No cumulative impacts were identified.

12 Archaeology and Cultural Heritage

The Archaeology and Cultural Heritage report details the assessment undertaken to consider the Historic Environment in respect of the installation and operation of the proposed NorthConnect High Voltage Direct Current (HVDC) Cables, from the Converter station near Boddam to the UK-Norway median line. This assessment has been informed by consultation with Aberdeenshire Council, Marine Scotland, and Historic Environment Scotland.

The appraisal established a baseline of terrestrial and marine historic environment assets within the HVDC Cable Corridor for the proposed Project. Within the terrestrial section ten sites were identified, none of which were protected for their significance. These sites are a mixture of 19th and 20th century activity including buildings, quarries and their related buildings, agricultural buildings and a dismantled railway.

Within the marine section five historic environment assets were identified. Two wrecks of 20th century fishing vessels, two items of debris and one possible wreck or aircraft loss. The possible aircraft loss, in the absence of records, will be treated on a precautionary basis as a Protected Place under the Protection of Military Remains Act 1986.

The project has been designed in a manner that safeguards these historic environment assets from construction-related impacts. For both terrestrial and marine sections, archaeological mitigation has been defined to ensure that any unexpected discoveries are appropriately responded to.

There are no nationally significant historic environment assets that will be subject to significant visual or setting impacts from the proposed development.

The development will be compliant with the Local Development Plan, Planning Guidance and the National Marine Plan by not generating any new significant effects.

13 Terrestrial Ecology

To understand the terrestrial ecology in the vicinity of the consenting corridor, a range of ecological studies have been carried out. The consenting corridor passes through the Buller to Buchan Ness Site of Special Scientific Interest, designated for its Maritime Cliff, and the Buchan Ness to Collieston Special Area of Conservation, designated for its vegetated sea cliff. The habitat survey provided an understanding of the habitats. The dominant habitat types along the HVDC cable corridor are arable land and neutral grassland (semi-improved and improved) which, combined, relate to 63.7% of the total area surveyed. Marshy grassland is also present within the HVDC corridor (12.69% across the whole survey area) and, thereafter, all other habitat types were less than 10% of the Survey Area.

Detailed vegetation studies identified three Annex 1 habitats, all of which were along the cliffs and associated with the designated site. No individual flowering or lower plant species of conservation concern were recorded, i.e. rare, threatened or nationally scarce conservation status. The installation of the cable will require areas to be disturbed causing localised temporary habitat loss. The HVDC cable will pass under the cliffs and, as such, will not affect the designated sites or associated flora. The areas affected are primarily arable and grasslands which are not of ecological importance and can be effectively reinstated once the cable is installed.

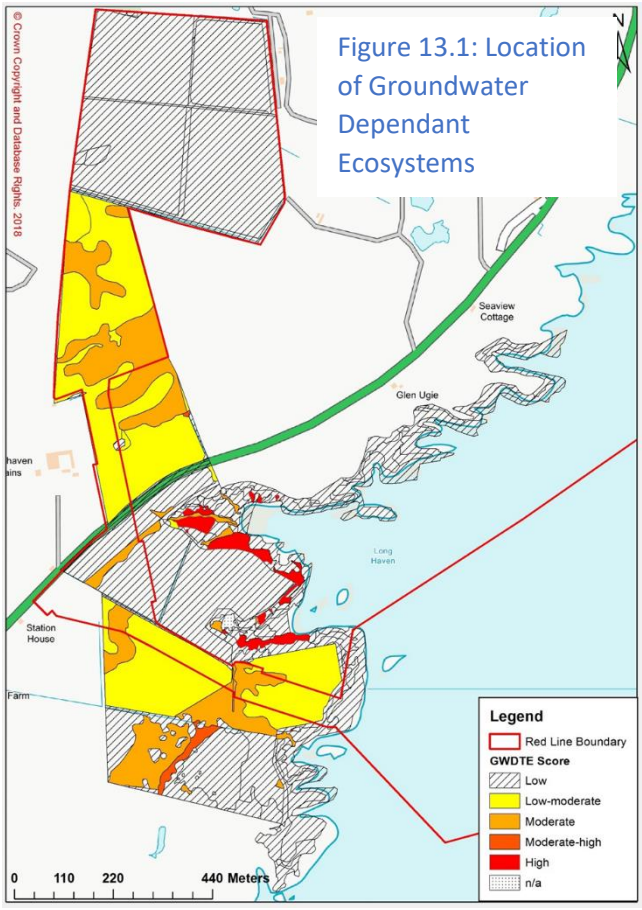

Figure 13.1: Location of Groundwater Dependant Ecosystems

Habitats which are dependent on ground water were identified (Figure 13.1). Those most highly dependent on ground water are to the north of the construction works red line boundary. There may be a requirement to maintain field drains in the vicinity of the cable route, the HDD work site, the access road and the cable installation works. This could have localised effects on groundwater, however, the areas that could be affected do not include any moderate to high, or high, groundwater dependant ecosystems and, as such, no significant effects are expected.

Protected mammal surveys have identified signs of mammal presence. No badger setts have been found in the area, but there were limited signs of badgers, including snagged hair and a latrine. Effects on badgers are therefore unlikely, however, pre-construction surveys for badgers will be carried out and, if setts are found, appropriate mitigation and exclusion zones will be put in place in line with the Badger's Act.

Signs of water vole utilising streams in the vicinity of the development have been detected. The temporary access track to the Landfall HDD and the cable route will cross streams which provide water vole habitat. Disturbance of the water vole habitat could give rise to a significant effect. As such, mitigation in the form of pre-construction surveys to understand the location of water voles at the time of the works, appropriate crossing design and management of the installation works, will reduce the effects to non-significant levels.

An otter holt was found within the survey area and this was taken account of in the identification of the cable corridor, such that there is a sufficient buffer between the holt and the construction works. Otters could be significantly affected by disturbance due to the works, for example, by accidental physical damage if they were to come into contact with machinery, or by water pollution. Pre-construction surveys will provide up to date information on areas the otters are utilising so that appropriate exclusion zones can be enforced to minimise disturbance. If there is a potential for disturbance, then a European Protected Species licence will be sought from Scottish Natural Heritage and a protection plan will be agreed with them as part of this process. An ongoing watching brief will be in place for otters to avoid the potential for physical damage. Measures will be taken to prevent entrapment, which includes ensuring stored equipment is sealed such that otters cannot get inside and installing temporary ramps to facilitate escape from trenches. Mitigation in place to prevent pollution, as discussed in Section 10, will minimise risks associated with pollution. With the appropriate adaptive mitigation in place, there is no residual significant effect to otters.

14 Benthic Ecology

Species and habitats inhabiting the seabed within the North Sea are protected under a range of national and international legislation and policy. This protection covers habitats such as pockmarks and reefs, and species such as the ross worm and slender and phosphorescent sea pens.

An assessment of the effects of the NorthConnect project upon seabed habitats and species within the North Sea has been conducted. This assessment has followed the appropriate guidance for ecological assessments from the Chartered Institute of Ecology and Environment Management (CIEEM). The assessment approach was consulted upon with Aberdeenshire Council and Marine Scotland, who subsequently consulted a wide range of other parties. To inform this assessment, a seabed survey of the cable corridor was undertaken to identify the seabed habitats present.

Seabed habitats and species considered within this assessment cover the range of habitats found during the seabed survey, and the species that these habitats may support. Seabed habitats found during the survey were predominantly soft sediments (mud, sand and mixed/coarse sediment), with limited areas of hard and rocky substrates. These habitats were found to potentially support reefs, sea cucumbers, horse mussel and sea pens.

The assessment has considered the range of activities involved with the installation, operation and decommissioning of the cable as described within the Project Description Section 2, and their effects upon seabed habitats and species. During installation, effects from loss of habitat, creation of habitats, changes to water quality, physical disturbance and displacement, and introduction of invasive non-native species (INNS) have been considered. During operation, effects from changes to the currents and flows, sediment heating, magnetic fields, introduction of INNS and physical disturbance during inspection and repair have been considered. Decommissioning effects are likely to be similar to, or less than, installation effects.

The NorthConnect project has put in place measures to reduce the effects upon seabed habitats and species. A number of sensitive habitats have been excluded from the cable corridor, burial and armouring of the cable will be undertaken to reduce magnetic fields, and control measures to reduce the risk of introduction of INNS and water quality incidents will be implemented. These measures have been considered within the assessment.

The assessment has considered the effects of the project alone upon seabed habitats and species and also has considered the effects of the project along with the other planned projects that may affect the same seabed habitats and species.

The assessment has detailed both adverse and beneficial effects of the project upon seabed habitats and species. The assessment has not predicted any effects that are significant upon seabed habitats and species, either from the project alone, or from the project along with other planned projects. The loss of habitats during the installation phase will be limited in extent and habitats are likely to recover, and the operational phase effects are low. Therefore, no further actions to reduce these effects upon seabed habitats and species are required or proposed.

15 Fish and Shellfish

Fish and shellfish species within the North Sea are protected under a range of national and international legislation and policy. This protection covers migratory species such as the Atlantic salmon and European eel, but also marine species such as Atlantic herring and sandeels.

An assessment of the effect of the NorthConnect project upon fish and shellfish species within the North Sea has been conducted. This assessment has followed the appropriate guidance for ecological assessments from the Chartered Institute of Ecology and Environment Management. The assessment approach was consulted upon with Aberdeenshire Council and Marine Scotland, who subsequently consulted a wide range of other parties. To inform this assessment, data was sought from a range of sources including Scottish Natural Heritage, the Scottish Environmental Protection Agency, Marine Scotland and the local District Salmon Fisheries Boards.

Fish species considered within this assessment were: relevant migratory species (Atlantic salmon, sea trout, European eel, sea lamprey and river lamprey); elasmobranch species including basking shark, common skate and sandy ray; near-bed species such as Atlantic cod, sandeels and flatfish; species inhabiting the water column such as herring, sprat and mackerel; squids, nautiluses and octopuses; and crustaceans and molluscs.

The assessment considered the range of activities involved with the installation, operation and decommissioning of the cable as described within the Project Description Section 2, and their effects upon fish and shellfish species. During installation, effects from loss of habitats, creation of habitats, changes to water quality, underwater noise and vibration and introduction of invasive non-native species (INNS) have been considered. During operation, effects from changes to the currents and flows, sediment heating, magnetic fields, introduction of INNS and physical disturbance during inspection and repair have been considered. Decommissioning effects are likely to be similar to, or less than, installation effects.

The NorthConnect project has put in place measures to reduce the effects upon fish and shellfish species. These include timing restrictions for drilling and cable installation activities to avoid herring and sandeel spawning periods respectively, burial and armouring of the cable to reduce magnetic fields, and implementing control measures to reduce the risk of introduction of INNS and water quality incidents. These measures have been considered within the assessment.

The assessment has considered the effects of the project alone upon fish and shellfish species, and also has considered the effects of the project along with the other planned projects that may affect the same fish and shellfish species populations.

The assessment has detailed both adverse and beneficial effects of the project upon fish and shellfish species. The assessment has not predicted any effects that are significant upon fish and shellfish species, either from the project alone, or from the project along with other planned projects. The effects during the installation phase will be temporary in nature and the operational phase effects will be low, and many of the fish and shellfish species assessed are mobile and wide-ranging in nature. Therefore, no further actions to reduce these effects upon fish and shellfish species are required or proposed.

16 Marine Mammals

Marine mammal species within the North Sea are protected under a range of national and international legislation and policies. This protection covers both cetacean and seal species. Two protected areas designated for marine mammal features were identified as being relevant to the NorthConnect Development: the consenting corridor crosses the Southern Trench proposed Marine Protected Area (pMPA), designated for minke whales; while the Moray Firth Special Area of Conservation (SAC), designated for bottlenose dolphins, is located approximately 105km to the north.

A comprehensive desktop study of the current scientific literature was conducted in order to identify which marine mammal receptors may be affected by the NorthConnect Development. The study included opportunistic marine mammal sightings made during the ornithological surveys. It was established that four species of cetacean occur commonly, or are resident, within the consenting corridor, including harbour porpoise, bottlenose dolphin, minke whales and white beaked dolphin. A further five species are considered regular but less common, including short-beaked common dolphin, Atlantic white-sided dolphin, long-finned pilot whale, killer whale and Risso's dolphin. In addition, both grey hand common seals are likely to be present in the vicinity of the development. Reference was also made to the underwater noise model to predict the potential impacts on marine mammals resulting from underwater noise.

During the installation of the marine HVDC cables there is the potential for the marine mammal species identified above to be impacted through disturbance due to foraging impairment from increased water column sediment loading during cable trenching operations, injury and displacement due to potential spills of hazardous substances, disturbance due to noise from vessels and cable installation works, injury through interactions with cable installation equipment and indirect effects on prey species. However, when the findings of relevant topic specific chapters, including Water Quality (Marine), Noise (Underwater) and Fish and Shellfish were considered, the above impacts are assessed as minor and non-significant.

Only one effect resulting from the installation phase was assessed as having the potential to result in moderate significant impacts in the absence of specific marine mammal mitigation. This was the disturbance due to underwater noise emissions from the Sub-Bottom Profiler (SBP) which will be used during both pre and post installation survey operations. It was noted that, even in the absence of mitigation, the SBP noise impacts on marine mammals does not have the potential to adversely affect the conservation objectives of either the Moray Firth SAC or the Southern Trench pMPA.

To mitigate the potential impacts resulting from underwater SBP noise, Marine Mammal Observation (MMO) and Passive Acoustic Monitoring (PAM) protocols will be employed to ensure marine mammals are not in the zone where disturbance is likely to occur prior to the operation commencing. After the implementation of the above mitigation, the residual impacts on marine mammals associated with construction are assessed as minor, non-significant.

Impacts on marine mammals during the operation of the NorthConnect Marine HVDC cables were also assessed, including effects of electromagnetic fields, water quality effects and underwater noise emissions. The effects of electromagnetic fields on marine mammals were found to be non-significant, while the water quality and underwater noise effects were found to be broadly similar to those identified during the installation phase, except limited to periods of survey and maintenance on the cables. Only underwater noise associated with the use of SBP for survey operations during the operational phase had the potential to result in significant impacts on marine mammals. However, the implementation of MMO and PAM protocols outlined above reduce this impact to non-significant.

As such, no significant residual effects were identified following the implementation of appropriate mitigation. In addition, no significant cumulative impacts are anticipated.

17 Ornithology

There are legal obligations under UK law to ensure that any wild birds utilising the development area may not be taken, injured or killed without a licence at any time (with exceptions) and that nests are protected from damage or destruction. The development sits within the Buchan Ness to Collieston Coast Special Protection Area (SPA) and Bullers of Buchan Coast SSSI, both of which have designated seabird species as part of their qualifying features, and the Scottish Wildlife Trust Longhaven Cliffs Reserve.

A number of bird surveys were carried out both for terrestrial-based species and marine-dependent species in order to assess the potential impacts on the ornithological receptors using the HVDC cable corridor and the surrounding cliffs.

The bird surveys for the terrestrial bird species revealed a total of 23 different bird species, including passerines, birds of prey, waders and geese. A total of 16 passerine species were recorded as having territories within 500m of the onshore HVDC cable corridor, the most common of which were skylarks having 18 territories recorded. Waders and geese were infrequent visitors to the fields over the autumn months. A breeding peregrine falcon pair were recorded at a confidential location.

The main potential effects on the terrestrial species relate to temporary habitat displacement during the installation activities and disturbance due to noise, light and human presence. Pre-construction surveys will ensure that any nests are identified before the installation works begin, thus mitigating against the potential significant negative effect of accidental nest site damage.

Extensive seabird surveys took place, including a year-long cliffside survey, vantage point surveys up to 500m out to sea and time-lapse photography study. From these surveys spatial, seasonal and diurnal differences in seabird attendance along the cliffs could be analysed. The busiest months for seabird activity on the cliffs were May to July, which corresponds to their peak breeding period. It was noted that from September to March bird numbers were lower, but birds were still present over the winter months, particularly fulmars, herring gulls, guillemots and shags.

Analysis of the spatial distribution of the seabird species revealed that the landfall site was chosen well for being a quieter section of the cliffs for seabirds. Within 200m of the main cable installation techniques, very few nests are likely to be disturbed due to noise or light pollution during the installation activities. The timings of the horizontal directional drilling activity has been specifically programmed to be outwith the bird breeding season, thus minimising any potential effects of this activity. The cable pull and cable laying activities will take place during the breeding period. Though two cable pulls are required they will each only take up to 7 days, close in to the cliffs, and will be spaced apart by between 4-12 months. Thus, it is not predicted that this activity will have a long-term effect on the seabird species within the vicinity of the activity. As the cable laying vessel will be travelling at a slow speed, from 280m from the cliffs out to the UK EEZ line, the amount of habitat disturbance for seabirds foraging across this area of the sea will be minimal in the context of the whole of the North Sea. No effects on seabird prey items are expected and with primary and tertiary mitigation measures laid out to prevent water quality effects, no effects on water quality are expected to impact upon the seabird receptors.

With appropriate mitigation in place, no significant effects were identified for any of the terrestrial or marine-dependent species. No cumulative effects with other developments were identified.

18 Electric and Magnetic Fields

Electric fields are produced by voltage. Direct Current voltages produce static electric fields, and Alternating Current voltages produce alternating (fluctuating) electric fields. For insulated cables, the electric fields are contained inside the cable, hence, there will be no external electric field caused by the NorthConnect HVDC cables and, as such, electric fields were not considered.

Magnetic Fields are produced by electric current flow and are measured in Tesla (symbolised as T), being the standard unit for magnetic flux density. Magnetic Fields are not easily screened and can pass through buildings and cable screens. The Earth's core produces a magnetic field, which is oriented in a north-south alignment, and gives rise to varying magnetic field strengths across the globe. The Earth's magnetic field is strongest towards the poles and weakest at the equator, as represented in Figure 18.1.

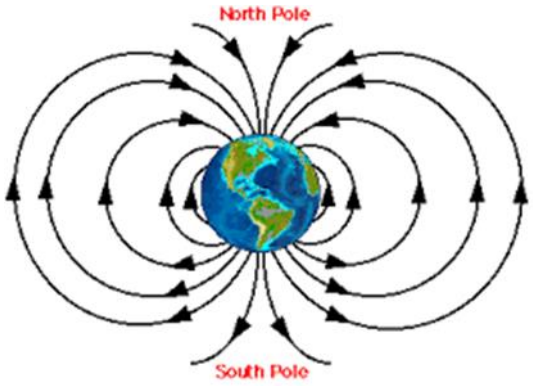

Figure 18.1 Representation of the Earth's Magnetic Field (The University of North Carolina, 2004)

HVDC cables produce static magnetic fields, which decrease with distance from the cable. The static magnetic field generated is added to or subtracted from the earth's natural. local static magnetic field. Where the outgoing and return paths of a DC circuit (2 cables) are in close proximity, their magnetic fields cancel within relatively short distances from the cables.

Calculation of the magnetic fields arising from the cables were made, and compared with published reference levels provided in Table 18.1.

Table 18.1: Magnetic Flux Reference Levels

Level Description	Magnetic Flux Density (B) [µT]	Source
Worker Exposure Level Values Sensory Effect – Limb	8,000,000 µT	The Control of Electromagnetic Fields at Work Regulations 2016, and ICNRIP Guidelines on Limits of Exposure to Static Magnetic Fields (International Commission on Non-Ionizing Radiation Protection, 2009)
Worker Exposure Level Values Sensory Effect – Head and Trunk	8,000,000 µT	
Worker Exposure Level Values Health Effect - Any part of the Body	2,000,000 µT	
Interference with active implanted medical devices.	500µT	
General public Exposure of any part of the body.	400,000µT	ICNRIP Guidelines on Limits of Exposure to Static Magnetic Fields (International Commission on Non-Ionizing Radiation Protection, 2009)

The maximum magnetic flux values experienced at ground level directly above one of the cables in the two-trench design, and between the two cables in the single trench design, were 270µT and 180µT respectively. The peak magnetic flux for the two-trench design is 270µT including the Earth's magnetic field. This is 230µT below the level that causes interference with active implanted medical devices and more than 1000 times lower than general public exposure levels (see Table 18.1). The peak levels dissipate rapidly with distance, halving in both scenarios within 2 meters, as shown in Figure 18.2.

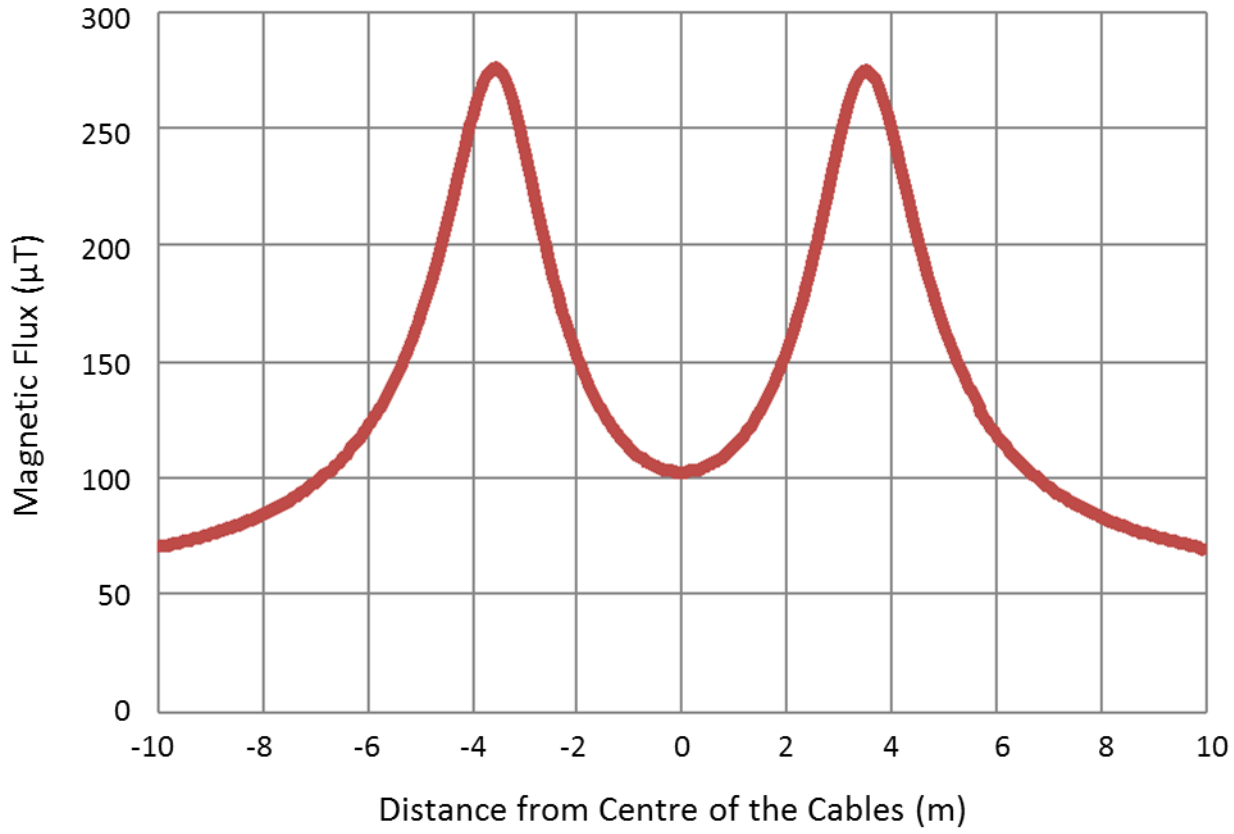

Figure 18.3: Magnetic Flux when Crossing Perpendicular to the Marine HVDC Cables in Two Trenches

It should, however, be noted that implanted medical devices are likely to be in the torso not the feet so, for people standing above the cables, magnetic field at the torso >1m above ground level will be less than 150µT for the two-trench design and 100µT for the single trench.

Considering the cables are located in grazing fields, then there are unlikely to be human receptors in the immediate vicinity of the cables for more than a few moments at a time. The cables will be ducted under the core paths and planned Fourfields paths and, as such, will be deeper and hence give rise to even lower magnetic flux levels in these locations. The effects of onshore cable magnetic fields on human receptors were considered to be negligible and non-significant due to their low levels.

Magnetic fields were also calculated for the marine cables, the results of which were utilised in the relevant ecological assessments. Assuming a 0.4m depth of burial the peak magnetic flux is 640µT, with levels reducing to <300 µT within 2 m of the seabed.

Magnetic fields can give rise to compass deviation but, as the field strength reduces with distance, the effects are less in deeper waters. Laying the cables closer together in shallow waters helps to reduce compass deviation effects. Calculations were made to identify the maximum cable separation that will give rise to a compass deviation of less than 5 degrees in various water depths. This information was utilised in the navigation and shipping assessment.

The cables can also give rise to localised sediment heating and a change in seabed temperatures could have consequential ecological effects. Hence, sediment heating was modelled to inform the Benthic Ecology assessment. Increases of greater than 1 degree are localised to a circle centred below the cable with a radius of less than 2.5m.

19 Navigation and Shipping

The Navigation and Shipping Assessment for the NorthConnect project was carried out by Anatec Limited. The assessment followed the available UK guidance, notably from the Maritime and Coastguard Agency (MCA).

The study involved extensive baseline data collection on vessel activity in proximity to the cable corridor. The primary source was twelve months of vessels tracking data for the whole of 2017, based on Automatic Identification Syste (AIS) technology which covers the vast majority of vessels transiting the area. This ensured the data used was up-to-date and accounted for seasonal variations in activity. Supplementary data sets and stakeholder consultation were used to characterise smaller vessels not broadcasting on AIS (generally smaller fishing vessels and recreational vessels).

The baseline data analysis identified that the area is mainly used by oil & gas industry vessels and fishing vessels, with lower proportions of cargo ships, tankers and other types. The busiest month was August and the quietest January.

The busiest section of the corridor was within UK territorial waters due to vessels heading to/from Peterhead Port as well as vessels transiting off the east coast, e.g., associated with ports further afield such as Aberdeen Harbour.

Fishing vessel activity was recorded all along the cable corridor both from vessels transiting on passage and vessels engaged in fishing, most notably demersal (bottom) trawlers. Again, the highest intensity was in coastal waters off Peterhead which tended to be from creelers and scallop dredgers.

The recreational vessel activity mainly comprised vessels navigating along the east coast to locations such as the nearby Peterhead Bay Marina. Further offshore, beyond 12 miles, there were occasional transits from yachts crossing the North Sea.

A review of anchoring activity identified five occasions during 2017 when vessels anchored over the cable corridor. All were oil & gas industry vessels anchored to the south of Peterhead.

The assessment of potential impacts / risks to vessels posed by the Project was informed by the baseline analysis, stakeholder consultation and experience of similar projects. Impacts reviewed included fishing and anchoring interaction with the cable and risk of collision during laying and maintenance.

The assessment concluded that all the impacts are broadly acceptable or tolerable with mitigation, which will include cable protection (e.g., burial to appropriate depth), chart depiction, notices to mariners and guard vessels present during installation when the cable is exposed. Ongoing communications with marine sector is planned, the detail of which is provided in the UK Marine Communication Strategy which has been submitted in support of the marine licence application.

20 Commercial Fisheries

A detailed baseline description and impact assessment have been prepared for commercial fisheries in the vicinity of the Consenting Corridor. A number of data sources and consultation with local fishing organising were used to inform the baseline and assessment.

The commercial fishing activities in the vicinity of the Consenting Corridor include those undertaken by smaller, inshore vessels and larger vessels which operate further offshore. The Consenting Corridor runs across seven International Council for the Exploration of the Sea (ICES) statistical rectangles (grid system used to define sea areas) in the UK. Vessels under 10 m typically operate in an area extending approximately 14 km from shore. Landings by these vessels are dominated by shellfish and pelagic (living in the water column) species, whilst the value and tonnage of demersal (living near the seabed) species comprises less than 1% of landings.

There is a small area of mobile fishing activity approximately 10 km from the coastline which the Consenting Corridor passes through. The Consenting Corridor also passes through more significant areas of mobile fishing (vessels over 15 m) further offshore (approximately 90 km) (MMO, 2017). No vessels over 15 m utilising passive gear (left in place for a period before retrieval) were active along the Consenting Corridor for the period analysed between 2012 to 2016. In the coastal ICES rectangles the value of landings for vessels under 10 m from 2012 to 2016 were dominated by brown crab. Lobsters, mackerel, velvet crab and langoustine comprised the remaining top five species in terms of value and liveweight of landings. For vessels over 10 m the dominant species was scallops. Haddock and langoustine dominate the landings for the offshore areas of the Consenting Corridor, with other notable species including demersal whitefish species such as monkfish, whiting and cod. Fishing activity takes place all year round in all ICES rectangles that intersect with the Consenting Corridor. As the Consenting Corridor extends across a range of depths and habitat types, numerous gear types are in use across the Consenting Corridor, targeting a variety of different species.

Potential impacts that were assessed included loss of access of fishing ground during installation and operation and maintenance, change of distribution of commercial species during installation and operation and maintenance and risk of snagging as a result of rock placement or areas of exposed cable.

It has been assessed that loss of access to fishing ground during installation will have a non-significant impact on mobile gears operators. However, the impact to static gear is classed as a significant impact, because of the value of the fishing grounds within the Consenting Corridor to static operators and the limited availability for alternative grounds. NorthConnect recognise the significance and will work closely with individual fishing operators to ensure they have a full understanding of the Project, its timescales and to ensure the impact is tolerable. During operations and maintenance, loss of access to fishing grounds to both mobile and static operators will be non-significant.

Although there may be a temporary change in the distribution of commercial species during installation, this will not have a long-term impact on the populations in the area and is considered non-significant. Changes to distribution of commercial species as a result of operations and maintenance is considered negligible.

The risk of snagging on areas of rock placement and any sections of cable that become exposed may have financial implications. However, rock placement will be designed to be overtrawlable and areas of exposed cable will be notified to fishermen should these be identified during cable inspection surveys and rectified promptly. Fishing will be temporarily excluded from these areas while maintenance is undertaken. This impact is non-significant.

No cumulative impacts are predicted as a result of the Project and other developments currently operational, undergoing installation or soon to be installed.

In conclusion, only one significant impact is recognised as a result of the Project on commercial fisheries, namely exclusion of static gear operators during installation. However, NorthConnect and their Fisheries Liaison Officer (FLO) will work closely with all affected operators to reduce the effects to non-significant levels. The UK Fisheries Liaison and Mitigation Action Plan submitted with the marine licence application details mitigation that will be put in place to minimise effects on fishing interests. Following mitigation where relevant, no significant impacts are predicted as a result of the Project on commercial fisheries.

21 Local Community and Economy

The Local Community and Economy report details the assessment undertaken to consider local socio-economic impacts in respect of the installation and operation of the proposed NorthConnect High Voltage Direct Current (HVDC) Cables, from the Converter station near Boddam to the UK-Norway median line. This assessment has been informed by consultation with Aberdeenshire Council as well as relevant stakeholders including the Boddam and District Community Council and recreational users such as Aberdeen Divers and RYAS.

The appraisal established a baseline of assets within the HVDC Cable Corridor for the proposed Project as well as the wider socio-economic situation in the area.

During preparation and installation of the onshore HVDC cable route, the report outlines the potential for a range of jobs to be created and estimates up to 398 FTE posts required during construction. It is NorthConnect's intention to encourage and support the local workforce to tender for work packages where possible.

Due to the nature of the works involved in the laying of the HVDC cables, there may be the need for specialist teams to be brought into the area including the NorthConnect Project Management team. These individuals will require accommodation, food and drink and other services, therefore local hotels, restaurants and entertainment venues are likely to benefit from the influx of people and additional revenue generated.

Within the terrestrial area, recreational assets were identified which include Core Paths (Stirling Hill and Coastal Path) and climbing crags in Long Haven Bay. This element of the project as a whole could have a short-term negligible effect on amenity for both recreational users and a small number of local residents, giving rise to a low magnitude of effect and a minor/negligible effect significance.

Within the marine section, impact is assessed on both commercial and recreational activity including commercial fishing, recreational sailing and sub-aqua diving. Again, this element of the project as a whole could have a short-term, negligible effect on the local economy in relation to commercial activity and a short-term effect on the amenity of recreational users, giving rise to a low magnitude of effect and a minor/negligible effect significance.

The project has been designed in a manner that minimises disruption from construction-related impacts. The mitigation identified aims to minimise negative effects and maximise positive effects in line with best practice and the aspirations of the local economic development plans and partnerships, as well as those of the Scottish Government.

22 Noise (In-Air)

A noise impact assessment was undertaken to determine the potential noise effects from the construction of the onshore elements of the Proposed Development. The assessment considered construction noise only and the following elements were scoped out:

- Operational Noise – As the cable would be buried for the entire length of the onshore cable corridor, no operational noise effects were anticipated;
- Decommissioning Noise – As the cable is not intended to be decommissioned, no noise decommissioning effects were anticipated.
- Vibration - Significant vibration effects from construction activities typically come about from either piling activities or blasting. No piling or blasting is proposed for this development. Localised vibration impacts may occur in the immediate vicinity of Horizontal Directional Drilling (HDD) rig locations, however, due to the separation distances between the HDD rig and any sensitive receptors, significant vibration impacts are unlikely to occur.

The noise impact assessment considered a number of Noise Sensitive Receptor types, including residential buildings, users of the Longhaven Nature Reserve footpath and local rock climbing routes. In addition, the predicted construction noise levels were used to inform the Ornithology assessment (see Section 17).

The noise impact assessment was undertaken with due cognisance given to Scottish Government requirements and guidelines, as set out in PAN *1/2011 – Planning and Noise'* and the associated '*TAN – Assessment of Noise'.* The assessment criteria was set as detailed within *British Standard 5228-1:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites. Noise'* (BS5228).

BS5228 sets noise level threshold values for a number of time periods (weekdays, evenings, night-time and weekends) based on the existing sound levels in the area. A baseline sound level survey was undertaken in 2014, with supplementary monitoring undertaken in 2017, in order to determine the existing levels. The data from the survey was used to determine the appropriate threshold levels for the assessment.

Noise modelling software was used to predict whether the noise levels attributable to various proposed construction activities was above or below the threshold values at each noise sensitive receptor. The predictions assumed that all construction plant was operating continually and concurrently in full operational mode in order to provide a worst-case scenario, whereas in reality only a proportion of the plant would be operating for a proportion of time.

Noise levels along the path were anticipated to exceed the threshold levels during horizontal drilling activities, but only for short sections of the path. Given that the threshold levels are based on noise exceedances occurring for a number of hours, rather than a few minutes as would be the case here, the assessment concluded that construction noise impacts along the path were Non-Significant.

The predicted noise levels for all construction stages were below the daytime, evening and weekend threshold levels at all of the assessed residential receptors and at the location of the closest climbing routes, therefore the assessment concluded that construction noise levels at these receptors was Non-Significant.

The cable contractor may wish to work 24 hours a day during horizontal directional drilling to ensure the works can be completed in the winter months to avoid disturbance of breeding birds. Modelling suggests that night-time noise thresholds could be reached at three residential properties. If 24-hour working is required then noise will be remodelled utilising the specific equipment to be employed, and if require noise mitigation measures will be implemented prior to works commencing. Best practice noise mitigation

measures such as maintaining equipment were detailed within the noise impact assessment to reduce noise levels and affects on amenity where practicable.

23 Noise (Underwater)

The relatively high density of water means that underwater noise is readily transmitted in the marine environment. This means there is the potential for underwater noise emissions resulting from the installation and operation of the NorthConnect HVDC marine cables to disturb, or injure, sensitive receptors at extensive distances from the working areas. The noise sensitive receptors likely to be present in the vicinity of the consenting corridor include marine mammals and fish. This chapter outlined the predicted noise levels resulting from the installation and operation of the NorthConnect HVDC cables, ascertained the potential effects on marine mammals and fish that could result from the noise emissions, and estimated the range from source where each affect can be expected.

The consenting corridor in general passes through open water, with only three main types of anthropogenic acoustic source. The predominant acoustic sources that are present along the cable corridor include shipping, fishing grounds (and associated fishing vessels) and oil and gas installations. Due to the importance of areas in the vicinity of the consenting corridor to offshore oil and gas operations, as well as commercial fisheries, it is expected that ambient underwater noise levels are likely to be relatively high in comparison to less industrially active areas.

A literature review was conducted in order to ascertain the characteristics (frequency and volume) of underwater noise sources likely to be present during the installation and operation of the marine HVDC cables. The sources included, installation vessels, subsea survey equipment, horizontal directional drilling equipment, cable burial tools and rock placement vessels. The frequency of these noise sources was then compared against published fish and marine mammal hearing thresholds, in order to determine whether they would be detectable by the noise sensitive receptors.

Where a noise source was identified as being detectable to marine mammal or fish receptors, the volume of the noise source was compared against published auditory injury and disturbance criteria for marine mammals and fish, in order to ascertain the magnitude of impact that a sensitive receptor may be subjected to. Finally, a simple propagation loss model was used to estimate the range from source where impacts on sensitive receptors may be experienced.

The predicted underwater noise emissions from the installation and operation of the NorthConnect marine HVDC cables do not pose any risk of injury to marine mammals or fish, however, they do have the potential to cause disturbance to both. The greatest disturbance ranges result from the use if sub-bottom profilers, which could disturb fish to a range of 2.2km, and marine mammals to 0.5km.

The next largest disturbance ranges result from large vessel thruster noise, which could disturb fish to a range of 1.4km, and marine mammals to 0.3km. It should be highlighted that the large vessel thruster noise resulting from the NorthConnect project is set against the of the background of the North Sea oil and gas activities. Similar vessels to those likely to be employed to install the HVDC cables are utilised regularly by the oil and gas industry to support the offshore infrastructure in the North Sea. The consenting corridor passes through an area with numerous oil and gas assets, so large vessels will regularly operate in the vicinity of the corridor, and hence this noise source is unlikely to be considered a significant change from baseline conditions.

The disturbance ranges resulting from the cable installation works, and the smaller vessel noise are all below 0.2km and hence, are unlikely to result in any significant impact to marine mammals or fish. This information was then used inform the detailed impact assessments on marine mammals and fish, outlined in Sections 15 and 16.

24 Resource Usage and Waste

During construction, various types and volumes of material will be required for the installation of the HVDC cables, both onshore and in the marine environment. The majority of materials utilised are within the cables themselves, followed by the rock associated with cable protection and temporary construction measures. There will be two, 2km long onshore HVDC cables and two marine HVDC cables, each 230km long, to the edge of the UK EEZ. This is equivalent to 24,154 tonnes of cabling, a large proportion of which are finite resources such as metals. Hence, at the point of decommissioning, the cables will be recovered, stripped and recycled. The intrinsic carbon cost of the cables was considered as part of the air quality assessment (see Section 9). In the region of 170,000 tonnes of rock will be required to protect the cables in the marine environment.

In addition to the larger volumes of materials above, there will be multiple different materials utilised in much smaller volumes, including fuels, oils and chemicals. Appropriate storage and safe handling of these materials will be ensured at all times to prevent unintentional release to the environment.

The onshore cable installation design requires concrete to be utilised. The majority of this will be pre-cast off site and brought to site for installation. Where concrete needs to be poured onsite, it will be delivered as ready mix and appropriate shuttering will be utilised to ensure it is contained. Any cement contaminated equipment requiring cleaning after use will be washed out in a dedicated area. Washing arisings will be collected for onsite treatment. This will include settlement and, if required, pH correction. The liquids will be reused on site as grey water, if suitable, or disposed of via a consented waste route. The solids will be disposed of as solid waste, potentially to be recycled as aggregate.

Waste arisings during construction and operations are relatively small volumes, but the waste hierarchy will, however, be employed. Wastes will be sorted and segregated to allow them to be reused or recycled wherever possible.

The close proximity of the onshore cable site to the marine environment makes it likely that any litter present could enter the marine environment. Similarly, loose materials or littering on the vessels could lead to litter entering the marine environment.

All personnel working on the project will need to undertake site induction. This will include a section on waste management and the use of the waste receptacles provided. It will be made clear that littering will not be tolerated. The use of single use plastics will be discouraged, and reusable crockery and cutlery will be provided in the welfare units to facilitate this.

The use of materials shall be minimised where possible. Materials will be safely stored and used to prevent environmental effects arising and, as such, no significant environmental effects are predicted.

25 Schedule of Mitigation

All the mitigation identified within the various EIAR chapters is compiled into the Schedule of Mitigation. NorthConnect will produce an Overarching Construction Environmental Management Plan (CEMP). The lead contractors will be required to produce CEMP's for their specific elements of the work. The CEMP's will provide the policy and plans of how the construction and cable installation works are to be managed from an environmental perspective in alignment with the Schedule of Mitigation.

Task specific Risk Assessments & Method Statements will be utilised to implement elements of the environmental plans. Risk Assessments & Method Statements will also be provided for all construction tasks, identifying task specific risks, including those to the environment, and detail the mitigation measures in place to prevent or reduce them.

In addition to the CEMP, the Fisheries Liaison and Mitigation Action Plan and UK Marine Communication Strategy will be implemented to minimise effects on marine users.

26 Conclusions

Seventeen significant environmental effects were identified, fourteen adverse and three beneficial. All adverse impacts could be reduced by applying secondary mitigation measures to reduce their effect levels sufficiently to render them non-significant in EIA terms.

The NorthConnect project will provide significant benefits in terms of Carbon savings by facilitating an increase in renewable power sources to the energy mix. In addition, it will aid in security of power supply, grid stabilisation services and stabilisation of energy prices to consumers, which all have an associated socio-economic benefit.

NorthConnect are committed to ensuring that adverse environmental effects associated with the development are minimised and beneficial effects are maximised. As the project moves forward, NorthConnect will continue to ensure that the design, construction and installation techniques utilised take account of environmental factors. It is recognised that ongoing communication with stakeholders is key to the project's successful implementation.

27 References

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