MORAY OFFSHORE WINDFARM (WEST) LIMITED

Export Cable Plan

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Document Approval				
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Plan Overview

Purpose and Objectives of the Plan

This Export Cable Plan (ECP) has been prepared to address the specific requirements of the relevant conditions attached to the Offshore Transmission Infrastructure (OfTI) Marine Licence issued to Moray Offshore Windfarm (West) Limited. The overall objective of the ECP is to ensure all environmental and navigational issues are considered for the location and construction of the Offshore Export Cables (OEC).

The ECP confirms the location of the OEC and methods of installation, burial and protection. It explains how cable routing has been, and will be, informed by survey work that has identified constraints within the Development. The ECP also confirms the anticipated technical specification of the OEC.

All Moray West personnel and Contractors involved in the Development must comply with this ECP.

Scope of the Plan

In line with the requirements of the consents condition (Condition 3.2.2.15), along with industry standards and good practice, the ECP covers the following:

- the location and layout of the OEC route;
- the duration and timings of the licenced activities;
- the results of monitoring or data collection work (including geophysical, geotechnical and benthic surveys) which will help inform cable routing;
- technical specification of cables, including a desk-based assessment of attenuation of electro-magnetic field strengths and shielding;
- cable installation methods including vessel requirements, preparatory works, and cable installation techniques;
- a cable burial risk assessment, to ascertain burial depths and where necessary alternative protection measures, and a mechanism for risk-based approach to protection measures where target burial has not been achieved;
- cable burial techniques, including measures to bury and protect cables where target burial has not been initially achieved;
- measures to ensure the remediation, where practicable, of any seabed obstacles created during construction;
- survey methodologies and planning (e.g., inspection, over trawl, post-lay) for the cables through their operational life; and
- measures to address and report to the Licensing Authority any exposure of cables or risk to users of the sea from cables.

Plan Audience

The ECP is intended to be referred to by personnel involved in the construction and operation of the Development, including Moray West personnel and Contractors. All method statements produced in relation to the Development must comply with this ECP.

Compliance with this ECP will be monitored by the Moray West Development Team, Moray West's Environmental Clerk of Works (ECoW), and Marine Scotland Licensing Operations Team (MS-LOT).

Plan Locations

The latest version of this ECP can be obtained from Moray West's document management system, Viewpoint For Projects and from Marine Scotland website[1]. Copies of this ECP are to be held in the following locations:

- Moray West's main project office in Edinburgh;
- Premises of the installation contractors in Norway;
- the Moray West Marine Coordination Centre (MCC); and
- with the ECoW(s).

[1] https://marine.gov.scot/ml/moray-west-offshore-windfarm

Table of Contents

Abbreviations and Acronyms

Acronym / Abbreviation	Description
AC	Alternating Current
ALARP	As Low As Reasonably Practicable
CLV	Cable Lay Vessel
CMS	Construction Method Statement
CoP	Construction Programme
CPT	Cone Penetration Tests
CPS	Cable Protection System
CTV	Crew Transfer Vessel
DTS	Distributed Temperature Sensing
DoC	Depth of Cover (Vertical distance between top of cable and top of cover above the cable)
DoL	Depth of Lowering (Vertical distance between top of cable and MSBL)
DDV	Drop Down Video
DP	Decommissioning Programme or Dynamic Positioning
DSLP	Design Specification and Layout Plan
DSV	Dive Support Vessel
ECoW	Ecological Clerk of Works
ECP	Export Cable Plan
EIA	Environmental Impact Assessment
EMF	Electromagnetic Field
EMP	Environmental Management Plan
ERP	Emergency Response Plan
ES	Environmental Statement
FPV	Fall Pipe Vessel
HDD	Horizontal Directional Drilling or Horizontally Drilled Duct
HDPE	High Density Polyethylene
HVAC	High Voltage Alternating Current
JUV	Jack-Up Vessel
KP	Kilometre Point
LAT	Lowest Astronomical Tide
MBES	Multibeam Echosounder
MCA	Maritime and Coastguard Agency
MHWS	Mean High Water Spring
MPA	Marine Protected Area
MS-LOT	Marine Licensing Operations Team
NLB	Northern Lighthouse Board
NSP	Navigational Safety Plan

Acronym / Abbreviation	Description
NtM	Notice to Mariners
O&M	Operations and Maintenance
OD	Outer Diameter
OEC	Offshore Export Cable
OfTI	Offshore Transmission Infrastructure
OFTO	Offshore Transmission Owner
OMP	Operation and Maintenance Programme
OSP	Offshore Substation Platform
OSV	Offshore Support Vessel
PAD	Protocol for Archaeological Discoveries
PLGR	Pre-Lay Grapnel Run
PMF	Priority Marine Feature
PSA	Particle Size Analysis
ROV	Remotely Operated Vehicle
SAC	Special Area of Conservation
SBI	Sub Bottom Imager
SBP	Sub Bottom Profiler
SFF	Scottish Fishermen's Federation
TDP	Touch Down Point
TI	Transmission Infrastructure
TJB	Transition Joint Bay
TSV	Trenching Support Vessel
UXO	Unexploded Ordinance
VMP	Vessel Management Plan
WTG	Wind Turbine Generators
XLPE	Cross Linked Polyethene

1 Introduction

1.1 Background

The Moray West Offshore Wind Farm and associated Offshore Transmission Infrastructure (OfTI) (referred to as 'the Development') is being developed by Moray Offshore Windfarm (West) Limited (known as 'Moray West'; see Appendix A for defined terms). Consent for the Development was granted on 14 June 2019 under Section 36 (S36) of the Electricity Act 1989 (as amended), Part 4 of the Marine (Scotland) Act 2010 and the Marine and Coastal Access Act 2009 from Scottish Ministers One S36 consent was granted by Scottish Ministers for the wind farm (012/OW/MORLW – 8) and two Marine Licences were granted by Scottish Ministers, one for the Wind Farm and another for the OfTI.

Variation of the S36 consent and Wind Farm Marine Licence (licence number: MS-00009774) were granted by the Scottish Ministers on 7 March 2022, and further variations of the Wind Farm Marine Licence (licence number: MS-00009774) and OfTI Marine Licence (licence number: MS-00009813) were granted on 11 April 2022. The revised S36 consent and associated Marine Licences are referred to collectively as 'offshore consents'.

Further details of Moray West and the Development can be found in Appendix B.

1.2 Objectives of the Plan

Marine Licence MS-00009813 contains a variety of conditions that must be discharged through approval by the Scottish Ministers prior to the commencement of offshore construction. One such requirement is the approval of an Export Cable Plan (Condition 3.2.2.15), referred in this document as the ECP.

The objective of the ECP is to provide:

- supporting descriptions, data, and evidence that the planning for the installation and operation of the Offshore Export Cables (OECs) within the Moray West Site and export cable corridor (referred to as 'OfTI Corridor') are in accordance with the required consent conditions

The relevant conditions setting out the requirement for an ECP for approval, and which are to be discharged by this ECP, are presented in full in Appendix B.

1.3 Linkages with other Consent Plans

The consent condition that requires the development of an ECP does not explicitly identify linkages between this and other consent plans; however, other conditions require consistency with this ECP, and these plans are identified in Table 1-1.

Table 1.1: ECP linkage with other Consent Plans	
Other Consent Plans	**Linkage with ECP**
Construction Programme and Construction Method Statement (CoP & CMS)	Specifies the Development's construction programme and construction methods, setting out good practice construction measures and how agreed mitigation measures from the Environmental Impact Assessment (EIA) report, associated documents, consents and those stated within this ECP are implemented during construction. The Marine Licence MS-00009813 states the CMS must, so far as is reasonably practicable, be consistent with the ECP.
Decommissioning Programme (DP)	Gives details of all aspects of the Development, from the associated effects the infrastructure will have on the surrounding environment to the current known methods to undertake the decommissioning.
Design Specification and Layout Plan (DSLP)	Details provided on the design, layout and specifications of the offshore export cables.
Environmental Management Plan (EMP)	Contains details on environmental sensitivities and design considerations to mitigate, as far as possible, the effects of cable laying and associated protection during installation and operation of the Development.
OfTI Operation and Maintenance Programme (OMP)	Sets out the procedures and good working practices for the operation and maintenance (O&M) phase of the Development. The Marine Licence MS-00009813 states the OMP must, so far as is reasonably practicable, be consistent with the ECP.
Protocol for Archaeological Discoveries (PAD)	Provides procedures for reporting and investigation of unexpected archaeological discoveries found during site investigations and construction.
Vessel Management and Navigational Safety Plan (VMNSP)	Provides the management and coordination of vessels to mitigate the impact of vessels.

1.4 Document Structure and Control

1.4.1 Document Structure

The structure of this ECP is provided in Table 1-2.

Table 1.2: ECP document structure		
Section	**Title**	**Summary of Content**
1	Introduction	An overview of the Development and its associated consent requirements.
2	Location and Layout of Offshore Export Cables	Provides information on the site investigation surveys, cable routing and relevant key constraints considered.
3	Timing of Construction Works	Sets out the key construction milestones.

Table 1.2: ECP document structure		
Section	**Title**	**Summary of Content**
4	Technical Specification of the Cables	Provides details of the cable specifications.
5	Cable Installation Method	Sets out the manner of preparatory works prior to cable installation, cable installation methods management, and coordination, including type and use of vessels.
6	Cable Burial and Protection	Provides a summary of the cable burial risk assessment, cable burial techniques, and information on cable protection methods.
7	Operation and Maintenance	Survey methodologies and planning (inspection, over trawl, post-lay) for the cables through their operational life.
8	Reporting Measures	Measures to address and report to the Licensing Authority any exposure of cables or risk to users of the sea from cables, as well as regular reporting requirements throughout the construction phase of the Development
Appendix A	Defined Terms	Defines the terms to be used throughout this document.
Appendix B	Project Background Information	Detailed information of the Development. Including the construction programme, key stakeholders and legal context associated with the Development.

1.4.2 Document Control and Management of Change

This ECP is a 'live document' and will be revised as relevant to ensure the information is kept up to date. Linkages exist between a number of offshore consent plans as highlighted in in Table 1-1. As plans are updated, there will be a review of inter-linkages with other consent plans to ensure these are also updated as relevant. The document is controlled via Viewpoint For Projects, an electronic document management system.

Should there be a reason to modify methodologies brought about during the engineering stages of the project, such changes will be made to this document and resubmitted for approval through the review process. As required by the Marine Licence conditions, any updates or amendments made by the Licensee, will be submitted, in writing, by the Licensee to the Licensing Authority for their written approval.

No later than three months prior to final commissioning, this ECP will be updated to cover O&M activities for the Moray West Offshore Wind Farm and OfTI to the Scottish Ministers for their written approval. The operational ECP will reflect the working practices and potential environmental management issues set out in the approved OfTI Operation and Maintenance Plan (OMP). The updated ECP will focus on the activities associated with the O&M of the Development and incorporate any findings or lessons learned during the construction phase.

2 Location and Layout of Offshore Export Cables

Figure 2-1 shows the layout of the Development, with further information on the layout of the Wind Turbine Generators (WTGs) and Offshore Substation Platforms (OSPs), including the specifications of the WTGs and OSPs and the location coordinates of each structure, is provided in the DSLP.

The OfTI will comprise two OSPs ("OSP1" and "OSP2") and two OECs ("OEC1" and "OEC2") running broadly parallel to each other, and will converge in the nearshore area at the landfall location approximately 50 km from the OSPs (Figure2-1). The cables will make landfall at Broad Craig near Sandend Bay on the Aberdeenshire coast.

This section describes the layout and location of the OECs and the information that has been used to inform cable routing.

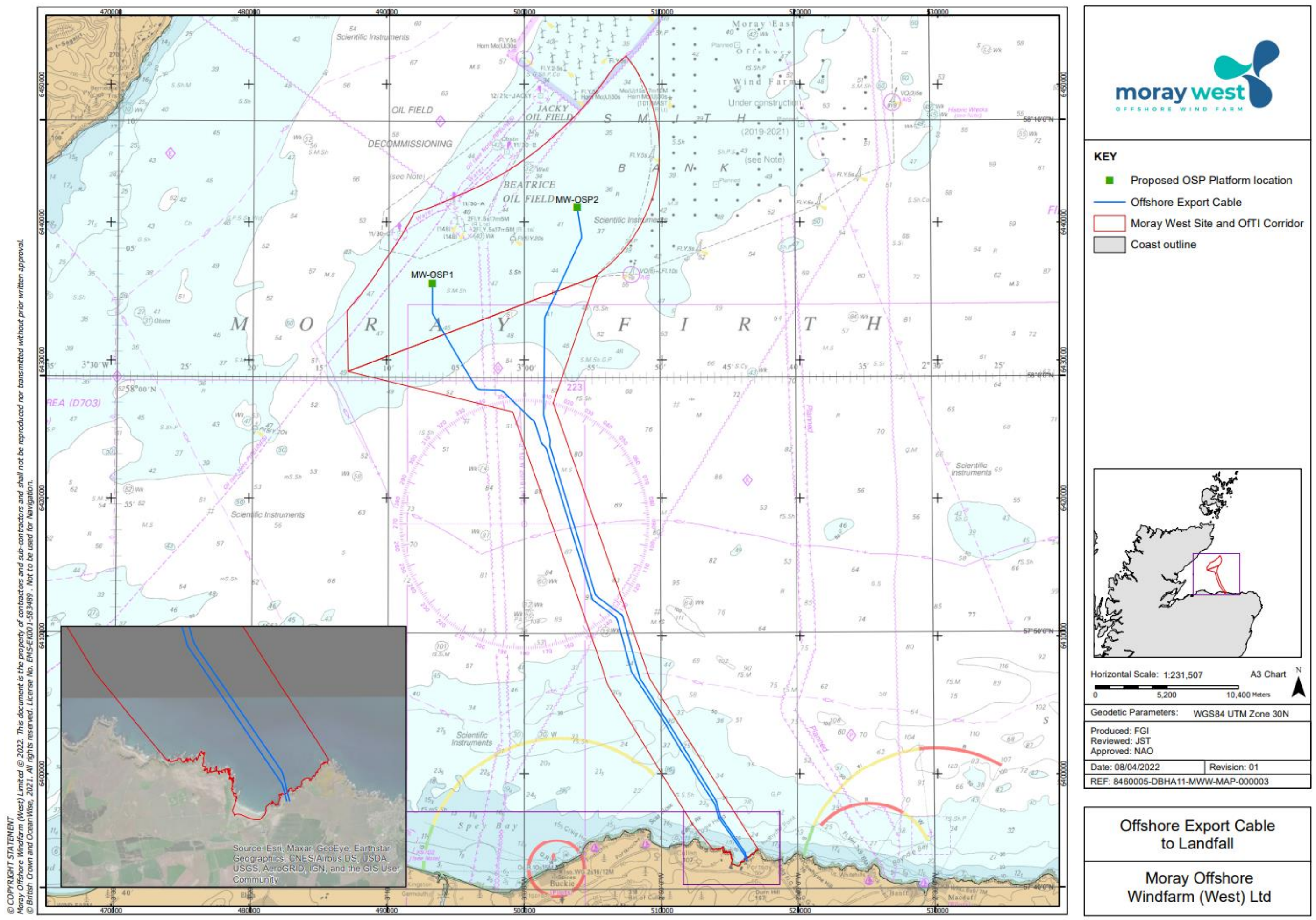


Figure 2.1: Moray West Site, OfTI Corridor and proposed OEC arrangements

2.1 Site Investigations and Survey Results

2.1.1 Site Investigations

A series of site investigation surveys (geophysical, geotechnical, and benthic) have been commissioned by Moray West to establish the seabed conditions along the OEC route and Moray West Site in order to initially define, and then refine, the OEC routes and hence determine the most appropriate installation methods. A summary of the surveys that have already been performed, as well as planned future surveys are provided in Table 2-1.

Table 2.1: Site investigation surveys (completed surveys and anticipated surveys)

Survey type	Description	Date
Geophysical	High-resolution swath bathymetric survey, side scan sonar survey, and sub-bottom seismic profiling survey used to inform site development and EIA.	2010
Benthic	Baseline information on the benthic communities within the Moray Firth Zone has been collected using grab samples and drop down video (DDV). Grab samples were used for particle size analysis (PSA). This was used to inform the Moray West site development and EIA.	2010 - 2017
Geophysical	Geophysical site investigation, comprised of an MBES coverage of Moray West Site with line spacing of 100m and 6 cross lines.	2019
Geophysical	Seismic coverage with Sub-Bottom Profiler (SBP) and Sparker of the grid used to determine WTG locations with spacing of 1400 m (E-W) x 1100 m (N-S) and 4 diagonal lines across the Moray West Site.	2019
Geotechnical	Moray West Site geotechnical investigation comprised of 42 composite boreholes to a depth of 40 m, 6 composite boreholes to a depth of 60 m and 52 Seismic CPTs with target depth of 25 m	2019
Geophysical	Moray West Site geophysical investigation with high-resolution swath bathymetric survey, side scan sonar survey, magnetometry, vibrocore, and sub-bottom seismic profiling	2021

Table 2.1: Site investigation surveys (completed surveys and anticipated surveys)		
Survey type	**Description**	**Date**
Geotechnical	32 Drilling seismic CPTs to a depth of 40 m carried out in Moray West Site positions not previously investigated or in positions where the soil profile was originally interpreted with difficulty.	2021
An unexploded ordinance (UXO) Investigation	Planned UXO specified survey at boxes (300 m x 300 m) centred on each WTG/OSP and safe haven location and a +/- 25 m coverage either side of the inter-array, interconnector and export cable routes. Survey area shall also include Horizontal Directional Drilling (HDD) area and export route wet store areas.	Q3 to Q4 2022
Pre-lay	Bathymetry (multibeam echosounder (MBES)), side scan sonar and magnetometer investigations of the engineered centreline of each OEC route, plus detailed surveys of the crossing point to confirm their status (position and burial). Remotely operated vehicle (ROV) visual survey will also be carried out around the OSP foundation.	Q4 2022 to Q2 2023
Touch Down Monitoring	ROV video survey during cable lay to confirm touch down position	Q3 to Q4 2023
Post Trench Survey	Cable tracking and MBES to confirm as-trenched status	Q3 to Q4 2023
PanGeo Survey (OEC; to be confirmed)	Optional PanGeo SBI survey (to be confirmed)	Q4 2023 to Q1 2024
Pre-Rock Placement Survey (OEC)	Pre-lay rock placement MBES, crossing and remedial trenching areas	Q3 2023 to Q1 2024
Post -Rock Placement Survey (OEC)	Post Lay rock placement MBES, crossing and remedial trenching areas	Q3 2023 to Q1 2024

2.1.2 Survey Results

2.1.2.1 Geophysical and Geotechnical Surveys

Bathymetry across the OfTI Corridor ranges from approximately 10 m to 90 m below Lowest Astronomical Tide (LAT). The cable route reaches a maximum water depth of approximately 90 m below LAT before shallowing to approximately 45 m below LAT for OSP1 and up onto Smith Bank to 30 m below LAT for OSP2. The shallowest water depths are associated with the cable landfall.

The OfTI corridor is relatively benign in terms of slope, with one exception where the OEC1 route goes over a localised mound which has a maximum slope of 5.4°. Slope angles within the Moray West Site are low with an average gradient of 1% and up to 5% on the slopes of the seabed coming up out of the channel in the middle of the route. Side scan sonar images highlight boulders, debris, outcrops, seabed scars, megaripples and all other seabed features which have influenced the OEC route. The sediment scar and wave features are understood to be a reflection of conditions in deeper sediment or bedrock and not due to mobile sediments. However, surface boulders and larger gravel sized materials may be prone to rolling under storm conditions.

Near to the Moray West Site, in intermediate water depths, the OfTI Corridor transit areas of mixed sands and gravels, with a small proportion of fines (<5 to 10%) present. Seabed sediments become progressively finer in deeper water along the OEC route, becoming relatively muddy (30 to 65% fines) in the deepest parts. The sediment character and distribution in these offshore sections of the OEC route is the result of the relatively benign tidal regime and the spatially variable effect of wave action at the seabed, depending upon the local water depth.

2.1.2.2 Benthic Surveys

Across the OfTI Corridor, PSA characterised sediment types as (slightly gravelly) sand, gravelly sand, gravel, sandy mud and (slightly gravelly) muddy sand. The inshore stations included clean sand or (slightly gravelly) sand with negligible mud content and coarser sediments (gravelly sand, sandy gravel and gravel respectively) with sediment at these stations generally including stones and pebbles. At the middle section of the OfTI Corridor (in deeper water) sediments were sandy mud or (slightly gravelly) muddy sand with a quite high mud content (31% to 63% mud) recorded at the stations in the deepest water depths. Outer OfTI Corridor sediments tended to be (slightly gravelly) sand with a modest mud content (<10%) and very low quantities of gravel.

The DDV sampling campaign corroborate the PSA findings presented above, with the inshore areas representing areas of relatively clean Sublittoral sands (SS.SSA) and patchy or heterogeneous forms a mosaic of Circalittoral coarse sediments (SS.SCS.CCS) or SS.SMx.CMx (Circalittoral mixed sediment). This showed some correlation to a number of biotopes and more diverse areas resembling somewhat sheltered inshore variants of rocky biotopes such as CR.HCR.XFa.SpNemAdia (Sparse sponges, *Nemertesia* spp. and *Alcyonidium diaphanum* on circalittoral mixed substrata) or uncertain variants of SS.SMx.CMx.FluHyd (*Flustra foliacea* and *Hydrallmania falcata* on tide-swept circalittoral mixed sediment) albeit lacking *Flustra foliacea*. Occasional patches of cobbles/boulders in some areas also resembled an inshore variant of CR.MCR.EcCr.FaAlCr.Pom (Faunal and algal crusts with *Pomatoceros triqueter* and sparse *Alcyonium digitatum* on exposed to moderately wave-exposed circalittoral rock) or in very barren areas a more stable variant of SS.SCS.CCS.PomB (*Pomatoceros triqueter* with barnacles and bryozoan crusts on unstable circalittoral cobbles and pebbles). Some areas had small patches of more consolidated cobble/boulder which could be considered clast supported albeit rather small scale.

One sampling station at the inshore end of the OfTI Corridor was characterised by sand/gravelly sand (SS.SCS.CCS) with patchy areas cobbles/pebbles. This habitat was rather heterogenous/patchy but generally characterised by areas of brittlestar beds which included variable densities of *Ophiocomina nigra* and *Ophiothrix fragilis* often reaching Abundant or Super Abundant densities.

Along the middle section of the OfTI Corridor, deep water was characterised by areas of sandy mud or very muddy sand (SS.SMu). The seabed also had numerous pits, holes within the mud which may include megafauna burrows. Visibility was generally poor in this area due to the continued presence of *Nephrops* trawlers, but other taxa included *Virgularia mirabilis*, sparse hydroid/bryozoa (presumably on occasional shell/stone within the mud), curled octopus (*Eledone cirrhosa*) and plaice (*Pleuronectes platessa*). These habitats fall under the biotope SS.SMu.CFiMu.SpnMeg (Seapens and burrowing megafauna in circalittoral fine mud) which is a Priority Marine Feature (PMF).

Stations with rippled (slightly muddy) sand often with shell debris/grit or occasional small stones SS.SSa (Sublittoral sands and muddy sands) were present at the offshore end of the OfTI Corridor adjacent to the Moray West Site. The habitat in this area had a fairly sparse epifauna characterised by small clumps of hydroid/bryozoa (on shell or stones) patchy *Ophiura* sp. and occasional or rare *Pennatula phosphorea*, *Antalis entalis*, *Asterias rubens*, *Callionymus lyra* and *Astropecten irregularis*. Densities of sea pens were not high enough to qualify as a sea pen biotope although may be an intermediate variant with SS.SSa (Sublittoral sands and muddy sands).

2.2 Key Constraints

Having identified a stretch of coastline within which the landfall will be located, a desk-based assessment was undertaken to identify the boundary of the OfTI Corridor presented in the Moray West EIA Report. The following criteria, defined by the Moray West engineering team, were also applied in identifying the OfTI Corridor:

- Point of exit from the Moray West Site – given that the location of OSP1 within the Moray West site was still to be determined at the time of the desk-based assessment, the precise exit points for OEC1 were also unknown. Therefore, in order to retain flexibility for positioning the OSPs, the potential exit area for the OEC circuits extended along the entire southernmost boundary of the Moray West Site.

- OfTI Corridor – the following criteria were agreed:
    - the OfTI Corridor (shown in Figure 2-1) is 3 km wide, to allow for detailed routing and micro-siting of the two cable circuits to avoid features of known and potential archaeological interest;
    - the cable route should be as direct as possible whilst avoiding known constraints; and
    - cable crossings should be minimised, if they are required then the route should be altered where possible to ensure that the cables can cross close to 90 degrees.

Within the OfTI Corridor, the cables will, where possible and practicable, be routed to avoid engineering and environmental constraints, such as areas of high steep gradients, areas with significant seabed features that could affect the installation through life integrity, and areas of challenging seabed conditions. Environmental constraints include Marine Protected Area[2] (MPA) features such as burrowed mud (Seapens and burrowing megafauna in circalittoral fine mud) which is a Scottish Priority Marine Feature (PMF).

In addition, the cables will be routed in such a way as to minimise the anticipated amount of remedial rock protection required. Analysis of the pre-construction site investigation data will provide the required information to be able to microsite the OEC route. The routes will be further refined using data collected during the pre-lay surveys.

The main objectives during the engineering of the OEC routes can be identified as follows:

- consideration of all the constraints within the consented OfTI Corridor that bound the cable route such as anomalies identified by geophysical surveys, or existing infrastructure on the seabed;
- minimising likelihood of interactions with fishing activities and shipping exclusion zones etc., if applicable;
- the shortest or most efficient route to the relevant OSP;
- reduction in the number of alter courses (curve in route) to simplify installation;
- mitigation of identified hazards by avoidance or sympathetic routing;
- mitigation of identified known undesignated cultural heritage assets such as wrecks by micro-siting and re-routing in order to avoid them;
- consideration of all constraints regarding operational limitations (slope, offset distance, turning radius); and
- additional consideration for the radius of routes to allow for the post lay trenching activities.

3 Timing of Construction Works

Offshore construction is expected to commence in December 2022 and is scheduled to take approximately two years to complete. Details of the construction programme are provided in the CoP and CMS.

Construction works for the OECs will be undertaken as detailed in Table 3-1 (up to date at time writing). Full details of the construction programme are provided in the CoP.

[2] Southern Trench MPA

Table 3.1: Summary of key milestone dates of the OEC construction works		
Operation	**Time period**	**Description**
Offshore Export Cable		
Landfall Preparation and HDD Works	December 2022 to April 2023	Drilling of 2No. HDDs at Broad Craig and installation of HDD liners
PLGR	Between January and July 2023	Removal of linear debris, ropes, chains wires which may be over the route and not generally detectable by other means.
Pre-Lay Survey	December 2022 to March 2023	MBES and visual survey of the engineered RPL, and confirmation of depth of existing assets at crossing points etc.
Boulder / Debris Clearance	March to August 2023	Relocation of boulders and debris from the cable corridors to allow cable lay and trenching activities
Crossing Installation	Q2 to Q4 2023	Installation of any pre-lay constructions required to make the crossings
Cable Pull-in at Landfall	Q2 to Q4 2023	1st Cable
Cable Lay and Trenching	Q2 to Q4 2023	Post lay trenching of cable includes potential wet storage of OEC at OSP end
Cable Pull-in at Landfall	Q3 to Q4 2023	2nd Cable
Cable Lay and Trenching	Q3 to Q4 2023	Post lay trenching of cable includes potential wet storage of OEC at OSP end.
Diving Works at HDD	Q3 2023 to Q1 2024	Ancillary works associated with cable pull-in and protection of the HDD e.g., sealing
Rock Placement	Q4 2023 to Q2 2024	Post installation rock placement of the crossings
Cable Pull-in to OSP1 / OSP2	Q4 2023 to Q2 2024	Second End Pull-in of OECs to OSPs
Post Installation Testing (OSP to Onshore Substation)	Q1 to Q3 2024	Testing to commission the circuits Note testing is planned for Q1/Q2 but delays to other parts of the project may affect these operations.

4 Technical Specification of the Cables

4.1 Key Cable Data

Two high voltage alternating current (HVAC) OECs will transmit electricity from the OSPs to shore. The typical operating voltages used for these cables will be 220 kV. The cables will be initially laid on the seabed before being subsequently trenched in separate trenches, buried to a target Depth of Lowering (DoL) of 1.0 m below the seabed, with a minimum DoL of 0.7 m (exact value to be confirmed). Where the cables cannot be buried due to seabed conditions or other constraints, they will be physically protected. Spacing between the cables has yet to be finalised but will likely be in the region of four times water depth. The Design Envelope for OECs is presented in Table 4-1.

The OECs comprise three conductor cores assembled together with one fibre optic cable bundle to allow control and communications between the offshore assets and onshore control centres. It is envisaged that two different cable types will form part of the OEC circuits to improve electrical losses whilst optimising cable cross section and size.

For the main part of the submarine route between the nearshore area and termination point at each OSP, the OEC will be formed of three aluminium conductor cores of 2,000 mm^2, which have an overall outer diameter (OD) approximately 265-270 mm. The length of these cables are approximately 50 km (OEC1) and 52 km (OEC2) respectively.

When the submarine cables reach the HDD pop-out location (i.e., landfall), the cable design will change to having three copper conductor cores of 1600 mm^2, with an overall OD of approximately 255 mm. The length of this section of cable on each circuit is approximately 500 m in length spanning from the TJB located onshore to a short distance after the HDD pop-out offshore. This will be confirmed during the detailed engineering phase in 2022.

The three conductor cores and the fibre optic cable will be bundled together and protected by an armour wire layer that will include an outer coating as the outer part to complete the OEC.

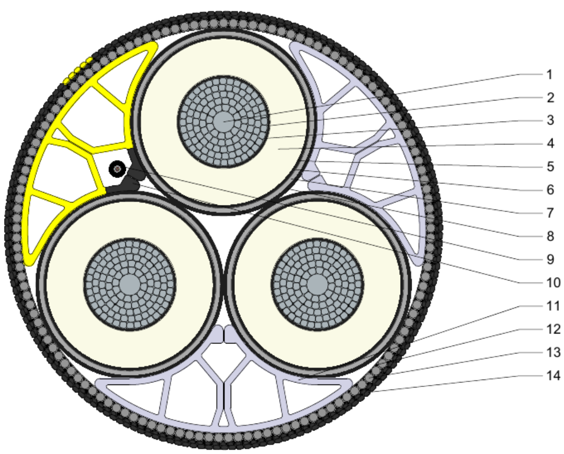
Table 4.1: OEC design parameters (Common to both cable types)

Parameter	Design Basis
System operating voltage	220 kV
Maximum system voltage	245 kV
Rated lightning impulse withstand voltage	1050 kV
Operational frequency	50 Hz
Power transmission capacity	2 x 430 MW at OSP
Lifetime expectancy (minimum)	25 years

Table 4.1: OEC design parameters (Common to both cable types)	
Max. conductor temperature at normal operation	90°C
Design load factor	Static and dynamic
System fault current – 3-phase to ground / Duration	9.0 kA / 1 s
Cable circuit specification	3-core cable, most likely with integrated fibre optics
Number of export cable circuits	2
Number of trenches	2
Offshore Export Cable length	Export cable no. 1 – approximately 50 km Export cable no. 2 – approximately 52 km
Distance between cables	4 x water depth, with minimum separation of 50 m (to be confirmed), except at landfall.
Target Depth of Lowering	1.0 m
Minimum Depth of Lowering	0.7 m (to be confirmed)*

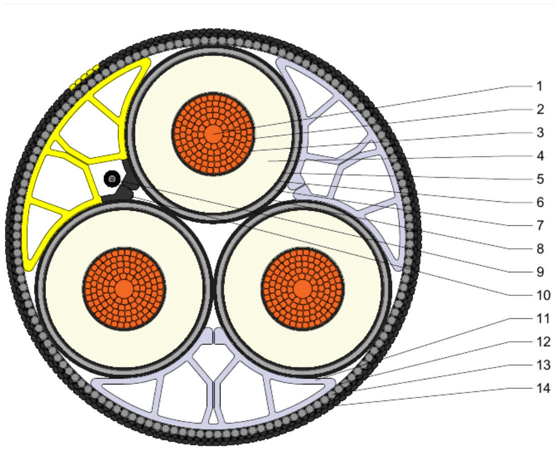
*TBC once cable tracking system accuracy is confirmed by Contractor, note this can be DoL / cable specific. The minimum generally acceptable in the North Sea is 0.6 m.

A cross section of the OEC (the submarine component of the cable) can be seen in Figure 4-1. The cross section of the part of the cable at landfall can be seen in Figure 4-2.



Item	Description
1	Aluminium round-wire conductor with filling compound
2	Semi-conductive swellable tape
3	Conductor screen, semi-conductive XLPE
4	Insulation, XLPE
5	Insulation screen, semi-conductive XLPE
6	Semi-conductive swellable tapes
7	Lead sheath
8	Semi-conductive polyethylene sheath
9	Fibre optic cable, 48 fibres
10	Filler element with semi-conductive lip
11	Filler element
12	Semi-conductive binder tapes
13	Galvanized carbon steel wires
14	Outer serving, two layers of polypropylene yarn

Figure 4.1: SUBMARINE CABLE - Cross section drawing of the OEC (Product Name: TKRA 245 kV 3x1x2000 mm^2 AQ + FO).



Item	Description
1	Copper round-wire conductor with filling compound
2	Semi-conductive swellable tape
3	Conductor screen, semi-conductive XLPE
4	Insulation, XLPE
5	Insulation screen, semi-conductive XLPE
6	Semi-conductive swellable tapes
7	Lead sheath
8	Semi-conductive polyethylene sheath
9	Fibre optic cable, 48 fibres
10	Filler element with semi-conductive lip
11	Filler element
12	Semi-conductive binder tapes
13	Non-magnetic, galvanized stainless steel wires
14	Outer serving, two layers of polypropylene yarn

Figure 4.2: LANDFALL CABLE - Cross section of the part of the OEC at landfall (Product Name: TKRA 245 kV 3x1x1600 mm^2 KQ + FO)

Table 4-2 provides key data for the two different types of cables discussed above.

Table 4.2: Key cable data (per cable type)		
Parameter	**TKRA 245 kV 3x1x2000 (submarine)**	**TKRA 245 kV 3x1x1600 (landfall)**
Current rating in seabed	1065 A	1059 A
Conductor material	Aluminium	Copper
Approx. weight (in air)	100 kg/m	123 kg/m
Approx. weight (submerged)	53 kg/m	80 kg/m

4.2 Cable Components

4.2.1 Power Cores

The submarine cable has three conductor cores made of profiled or rounded aluminium wires filled with a longitudinal water-blocking material. The cable to be used at landfall has three conductor cores made of profiled or rounded copper wire, also filled with a longitudinal water-blocking material. The water-blocking material for these two types of conductors is used to prevent penetration of seawater into the conductor in case of damage to the cable.

The cores will be insulated with cross-linked polyethylene (XLPE), which has high dielectric strength, low dielectric constant, high insulation resistance and low water absorption.

4.2.2 Fibre Optic Data Cable

Both the submarine and landfall cable will be bundled with a fibre optic cable which will provide the necessary communications, control and cable temperature monitoring capabilities. The fibre optic cable consists of a minimum of 48 single mode fibres.

4.2.3 Cable Armouring and Outer Sheathing

The cable armouring consists of layers of nylon tape and one layer of galvanized steel. For the landfall section, the armour consists of one layer with round galvanized stainless steel wires. The armour wires are embedded in bitumen and serve as mechanical protection during laying and installation. Although the wires are galvanized to avoid corrosion, the main corrosion protection is the bitumen layer.

The outer sheathing consists of asphaltic compound (bitumen) with polypropylene reinforcement. The outer sheathing also includes contrasting stripes as identification markers.

4.3 Electromagnetic Fields

This section summarises the results of an electromagnetic field (EMF) desk-based assessment carried out in 2022 by Cable Consulting International Ltd on behalf of Moray West on the attenuation of electromagnetic fields associated with the OEC.

The calculations were based on the worst-case scenario and do not include the negating impact of circulating sheath currents and association of the armour wires. The study calculated the magnetic field at a given distance from the OEC and at a range of burial depths including surface laid, to illustrate the effect of DoL on the EMF value and to encompass a credible range of burial depths achievable on the project.

The following inputs into the calculations were used, in addition to the cable design provided by Moray West:

- a current of 1,065 amps (A) taken as the steady state, root mean square current and assumed to be balanced;
- currents at a frequency of 50 Hz with no harmonic currents or transients; and
- no consideration of external influences such as other cables or nearby metallic structures or pipes.

At the Moray West Development Site, the geomagnetic total field is estimated as 50.67±0.145 microtesla (µT). Table 4-3 and Table 4-4 provide the maximum EMF strength using a profiled aluminium conductor and a round aluminium conductor, respectively.

Table 4.3: Maximum EMF strength for the OEC cable a profiled aluminium conductor				
Measurement height above seabed (m)	Cable depth of lowering (m)			
	Surface laid	0.5	1.0	2.0
	EMF (µT)	EMF (µT)	EMF (µT)	EMF (µT)
0	2,553*	78.6	23.88	6.64
5	1.18	1.16	1.12	1.00
10	0.3	0.3	0.29	0.28

* this value is calculated for the EMF on the outer surface of the cable

Table 4.4: Maximum EMF strength for the OEC with a round aluminium conductor				
Measurement height above seabed (m)	Cable depth of lowering (m)			
	Surface laid	0.5	1.0	2.0
	EMF (µT)	EMF (µT)	EMF (µT)	EMF (µT)
0	2,553	79.09	24.08	6.7
5	1.19	1.17	1.13	1.01
10	0.3	0.3	0.3	0.29

As is shown in the table above, the modelling outputs predict that the EMF generated by the OEC will reduce to almost zero µT within 5 m of the cables and down to zero µT within 10 m of the cable when it is carrying the maximum current of 1,065 A. The maximum generated EMF identified at the shallowest DoL of 0.5 m is 79.9 µT; predicted maximum magnetic field strength of the OEC is close to earth's magnetic field (50.67±0.145 µT). With a DoL of 1.0, the generated EMF will fall below that of natural geomagnetic total field.

5 Cable Installation Method

5.1 Vessel-Related Requirements

Table 5.1 presents the main construction vessel types and their role in the OEC installation campaign. All vessels to be used during all OEC installation activities will adhere to the VMNSP and, at least five days prior to vessel engagement, the details of the vessel are provided to MS-LOT within the Vessel Report. Further details on this procedure can be found within the VMNSP.

Table 5.1 Main OEC installation vessels	
Vessel Type	**Role**
Anchor handling tug / offshore installation vessel	Pre-lay grapnel run (PLGR) and general construction support.
Crew Transfer Vessels (CTVs)	Transfer of personnel to and from the OSPs and the DSV, to assist with site preparations, cable pull-in, cable termination and testing.
Dive Support Vessel (DSV)	Required to assist with cable pull-in and preparation of exit pit at the landfall location.
Dynamic Positioning (DP) 2 Cable Lay Vessel (CLV)	Cable delivery from cable factory to site. Pre- and post-lay surveys. Cable laying. Cable trenching and burial.
Trenching Support Vessel (TSV)	May be used if the CLV does not perform the trenching support vessel role.
Dynamically Positioned Fall Pipe Vessel (FPV)	Crossing installation and remedial cable protection.
Guard vessels	Guard vessels will be required for the two crossings between the start of cable lay and the completion of remedial rock. placement/protection. Guard vessels will also be required to protect the cable at approximately 10 km intervals or as otherwise agreed.
Walk to work (WTW) vessels	Transfer of personnel to the OSPs for site preparations, pull-in operations as well as termination and testing. May be used as an alternative to the JUV at the OSP or in addition to CTVs.
Jack-Up Vessel (JUV)	Accommodation facilities for OSP operations (Jacktel).
Offshore Survey Vessel (OSV)	Pre- and post-lay surveys.

Figure 5.1 provides an example CLV (C/S Nexans Skagerrak) that is proposed to be used for the OEC installation and trenching.

Figure 5.1: C/S Nexans Skagerrak

5.2 Pre-Installation Preparatory Works

Prior to the installation of the OECs, a series of works will be carried out in preparation to facilitate successful cable installation, these are described in the sections below.

5.2.1 Landfall Preparation and HDD Works

The 'landfall' is the location where the OECs are brought ashore and connected to the onshore export cable within transition joint bays (TJBs). The TJBs comprise buried underground chambers, cofferdams or similar that are installed at a location above mean high water springs (MHWS) to allow the jointing of the onshore and offshore cables.

A total of two HDDs will be established at the landfall location at Broad Craig, between Portsoy and Red Haven Cliff. The HDDs will be circa 600 m in length and installed one at a time. The HDD pop-out location is expected to extend offshore from the MHWS mark by approximately 400 m.

At landfall, the OEC circuits will be installed using the following technique:

- HDD – involves drilling holes from the landward side of the landfall to a point where marine installation equipment can operate. A small diameter pilot hole will be drilled from the onshore entry pit to approximately 50 m from the HDD pop-out, for the purpose of defining the path of the channel into which the ducts and later the cable is to be installed. The pilot hole will then be enlarged several times to produce a bore hole for the preferred duct size of approx. 2.5 times the cable diameter. Following enlargement, the final approx. 50 m of hole will be drilled through to the HDD pop-out location into the seabed.

- During HDD operations, drilling fluid will be pumped from shore along the hole to prevent water ingress, improve hole stability, and to carry the cuttings out of the hole back to shore into the recycling unit. Drilling fluid is formed from a natural montmorillonite clay known in the industry as bentonite. It is estimated that approx. 7.3 tonnes of bentonite per HDD will likely be discharged during drilling works. It is expected that the drilling fluid will quickly disperse and to have no adverse impact on the environment. A contingency plan will be in place during drilling operations to reduce risk of fluid discharges into sea e.g., punch out operation to be delayed as much as possible to reduce the amount of bentonite discharged into the sea (As Low As Reasonable Practicable levels) and drilling fluid will be controlled when used to ensure discharges are monitored and controlled to suit ground conditions encountered.
- Once the drilling is completed, a high-density polyethylene (HDPE) or steel duct will be pushed in from the land side to offshore exit point, using pipe thruster and assisted by divers. This will be installed using the push-in method to reduce any delays caused by adverse weather conditions.

The HDD works will be undertaken in such a way as to cause minimum disruption to the members of the public, although it should be noted that HDD works will be carried out using 24hr working shifts (subject to appropriate onshore planning consent). The site will be contained by fencing and access will be restricted for health and safety reasons. HDD drilling activities will be undertaken from shore with an offshore DSV assisting the punch out of the drill.

Once installation of HDD ducts is complete, and before the cable-pull in operations commence, each HDD duct end will be sealed off to avoid intrusion of debris or sediments and temporarily buried and, or stabilised with concrete mattress, rock bags or similar. A diving campaign will also be undertaken from a DSV to install bellmouths and messenger wires in preparation for OEC pull-in activities.

The DSV will likely be moored with a 4-point mooring system which allows the DSV to remain on station throughout each shift. The DSV will typically return to a nearby port on a daily basis. A CTV may be employed for crew change, for example, where 24hr operations are required. The mooring spread will be marked by buoys.

5.2.2 OSP Preparation

Prior to cable installation, the OSPs are prepared for cable pull-in in such a manner so as not to delay the vessel upon its arrival. Messenger lines will be passed through the installed J-tubes, winches fitted and tested, and all pull in equipment loaded and set up both in the fabrication yard and offshore. The J-tube ends will be covered until shortly before cable pull-in.

5.2.3 Pre-Lay Grapnel Run

A PLGR will be conducted to remove linear seabed surface debris along the OEC routes. Seabed surface debris can include items such as fishing gear, wires and ropes located along the routes. A PLGR will be carried out along the centreline of each route prior to cable installation procedures. PLGR will be performed approximately along the entire route from landfall to the OSPs; practical limitations apply with respect to approach to existing (e.g., crossings) and planned structures, and landfall approaches, for example no PLGR is typically allowable within 500 m of an existing structure.

The PLGR will be carried out by towing a grapnel train similar to that shown in Figure 5.2 using a suitable vessel such as an anchor handling tug or offshore installation vessel. During the tow, the tension in the wire holding the grapnels will be monitored at all times. A steady rise in tension is normally an indication that the grapnel has engaged with debris. The grapnels will then be recovered, and debris removed. Recovered debris will be stored onboard and disposed in a suitable manner at the next port of call. The penetration of the grapnel will be approx. 0.5 m in the seabed. If debris is located deeper than this, the debris will not be recovered.

As the grapnel interacts with the top approx. 0.5 m of the seabed, it is proposed to perform the PLGR before the pre-lay route inspection to ensure the pre-lay route inspection captures the position of any boulders or debris dislodged from the seabed.

Figure 5.2: Example of a typical PLGR train

5.2.4 Cable Route Pre-Lay Inspection

Pre-lay inspection surveys of the OEC routes and cable crossings will be carried out to ensure that the cable lay area is free from any debris or hazards that can damage the cables. The surveys will be carried out using an MBES, and, where required, SBP, a visual inspection using an ROV and cable tacking techniques to positively locate the crossings. The MBES survey will be carried out approximately six months in advance of cable installation; this will allow time to acquire high resolution data and to give sufficient time required to review the survey data and evaluate the need for any route adjustment. The

ROV visual inspection surveys of the J-tube and bellmouth will be carried out just prior to cable installation by the CLV or another suitable vessel.

The pre-lay surveys will also identify if there are any boulders and, or, debris present along the OEC routes that will require to be relocated ahead of cable lay operations.

5.2.5 Boulder and Debris Clearance

Where boulders and debris are present, they may need to be relocated by grab and, or, plough methods where they will be relocated outside the OEC route.

Following completion of the OEC route pre-lay inspection described above, a finalised listing of boulder and debris targets to be relocated from the route will be developed. Either the OEC Contractor or Moray West directly will undertake boulder and debris clearance works. Depending on the setting and the density of boulders this may take place via the following methods (Figure 5.3):

- boulder / debris grab for isolated / individual boulders and, or boulder fields; or
- boulder ploughing for boulder fields.

Boulder clearance works will be covered under a separate Marine Licence.

Figure 5.3: Example of a boulder grab system (left) and typical boulder clearance plough (right).

5.2.6 Third-Party Crossing Preparation

A total of four third-party crossings have been identified; one crossing on OEC2 and three crossings identified on OEC1. OEC1 will cross the Beatrice Offshore Wind Farm Offshore Export Cables (2No.) to reach OSP1, and both Moray West OECs will cross the existing Caithness Moray HVDC cable bundle. The position of the third-party cables will be confirmed during the pre-lay survey; this survey will also establish the status of the as-installed protection in terms of DoL and Depth of Cover (DoC) at the proposed crossing locations.

Depending on the as-found condition of the seabed at the proposed crossing locations, it may be required to install measures to guarantee the physical separation between the third-party asset and the Moray

West OEC. Typically, these pre-lay works comprise installation of rock bags, sandbags or concrete mattresses (Figure 5.4). If the seabed is specifically challenging, then it may be required to install pre-lay rock placement.

Following completion of the installation, a suitable survey e.g., visual inspection, MBES and, or cable tracking survey will be performed to confirm the specifics of the installation comply with the various requirements required to make the specific crossing.

Figure 5.4: Example of a concrete mattress

5.2.7 Unexploded Ordnance

A UXO geophysical survey is expected to be performed between June and September 2022. Prior to start of construction activities, a UXO clearance programme will be undertaken between January and March 2023 following a UXO inspection in October 2022. Therefore, the risk of discovering previously unidentified UXO will be reduced to as low as reasonably practicable (ALARP). However, in the event of a UXO discovery, the Contractor(s) shall inform the Moray West Marine Coordinator immediately, who will in turn contact the Moray West QHSE Manager and Moray West Development Team.

Moray West will consult with, and engage, a recognised, competent UXO disposal company for the safe handling and disposal of any UXO.

The requirements for UXO clearance will fall under a separate Marine Licence.

5.3 Cable Installation

During the OEC cable installation operations, notifications to other mariners will be provided by way of Notice to Mariners (NtM), information to Sea Users Bulletins (Kingfisher Bulletin), publication on the Moray West webpage[3] and communications with the local port authorities. Guard vessels will also be

[3] https://www.moraywest.com/current-works

present from the start of cable lay to the satisfactory completion of cable protection works to warn other mariners about the installation operations in progress and to protect the installed cables and other users for the sea. Further details on this can be found within the VMNSP.

5.3.1 Mobilisation

Load-out of the cables onto the CLV is expected to be performed at Nexans factories located in Charleston, USA and Halden, Norway. The load out will follow project specific procedures to carefully monitor the cable and to ensure that the mechanical limits of the cable is not exceeded. Once the cable is loaded, the CLV will transit to the Development.

5.3.2 Cable Pull-In Operations at HDD

At an appropriate time ahead of the CLV arrival, the ends of the HDDs will be unsealed, they are then pigged and gauged to confirm the ducts are clear of debris and ready to accept the cable. A messenger wire is then used to pull out the winch wire which gets connected to the pull-head which is attached to the cable onboard the CLV. The cables are then pulled into the HDDs using a suitably sized winch located onshore.

At the HDD pop-out, a dive team will be mobilized to do the necessary preparations of the pipe exit. If required, a bellmouth will be installed on each HDD exit. Seabed preparations may be carried out to ensure the proper as-laid configuration of the cables. The type and extent of preparations will be dependent on the exit of the pipe at the seabed and subject to detailed engineering in 2023 after the HDD is in place, as the exact exit geometry of the HDD and hence the cable will be known. The dive team will also perform necessary route clearance of rock debris which could potentially damage the cables in the vicinity of the HDD.

Once all preparations are complete and suitable weather conditions exist for the pull-in and the lay, the pull-in operations will start. The water depth at the HDD pop-out, approx. 10 m LAT, means a direct pull-in from the CLV vessel may be possible. If not, a short float-in may be required between the vessel and the HDD.

The first end of the cable will be launched over the laying wheel of the CLV. The pull-in winch wire will be attached to the pull head and the cable will be directly pulled in through the HDD until reaching its end termination point at the TJB. A camera may be installed to monitor the entry of the cable into the duct; alternatively, an ROV can be positioned outside the HDD and monitor the pull-in. Once the cable is pulled in through the HDD and the pull head has reached its final planned position, cable lay can commence.

5.3.3 Cable Laying

The cable laying operation will proceed by laying the OEC directly onto the seabed from the CLV, using a navigation system set up in such a way that the vessel will travel along a pre-defined route and lay the cable on the RPL accordingly (within the agreed tolerance, typically +/-2m). The cable-lay operations will be monitored using an ROV at the Touch Down Point (TDP) to ensure that the OECs are laid accurately e.g. across any pre-installed constructions at the third-party crossings and to avoid laying the cable on areas of the seabed that could damage or lead to damage of the cable, e.g., avoiding creation of free-spans, sharp protrusions.

5.3.4 Cable Pull-In at OSP

When the CLV approaches the OSP during the cable lay operations, the required cable length is calculated, and the cable is cut. Depending on the situation at the time of operation, there are three possible methods for preparation of cable pull-in at the OSP:

- The cable is laid around the pull-in bow, prepared with appropriate rigging, and then laid onto the seabed just outside the J-tube. The cable will remain in wet storage until pull-in operations are carried out. The J-tubes will be capped until OSP pull-in operations are planned to begin.
- The cable is laid around outside the 500 m zone of the OSP, prepared with abandonment and recovery rigging, and then laid in the designated laid storage area. The cable will remain in wet storage until pull-in operations are carried out. Note: the cable may be temporarily stabilised and protected by means of concrete mattresses or jetted into the seabed.
- The cable is directly pulled into the OSP from the CLV.

The preferred method for pull is by using a quadrant from the deck of the CLV, whereby a “bight” of cable will be supported from deck to seabed during the pull-in. The cable end will be pulled into the OSP using a platform-mounted winch, and cable protection will be attached to the OEC on board the cable laying vessel prior to the pulling operation. Upon completion of the pull-in operation, the OEC will be secured with the temporary hang-off clamps above the J-tube flange.

For the pull-in operations, it is likely that a turn point anchor is required to be placed on the seabed. The turn point anchor is used during the pull-in operation and then recovered when completed.

5.3.5 Post-Installation Survey

The position of the cable is determined by touchdown monitoring during cable lay from CLV. The final position of the cable (after trenching) will be determined by means of a post-installation survey, carried out by using an ROV, moving along the cable route and recording the horizontal and vertical position of the cable relative to the seabed. This shall be performed from the cable burial vessel using an ROV fitted with an Orion cable tracker system, TSS-440, PanGeo Sub Bottom Imager (SBI), or similar system and where remedial rock placement works are required, it will be performed from the FPV using MBES coupled with the as-trenched data.

6 Cable Burial and Protection

This section provides a summary of the Cable Burial Risk Assessment (CBRA) undertaken to identify potential threats to the OECs and proposes burial depths to minimise risk from these threats and to protect the integrity of the installed cables. This section then sets out the proposed cable burial techniques and protection, informed by the CBRA.

6.1 Cable Burial Risk Assessment

The CBRA is a risk assessment undertaken to consider all potential hazards that are presented to the OECs and the level of protection afforded by the seabed soil strength. This helps determine an optimized DoL for the cables such that threats to the cables and other marine users (e.g., interactions with fishing gear) can be avoided.

This CBRA was performed prior to the latest site investigation survey results collected during late 2021 being available. Therefore, the CBRA will be updated using the latest survey results and other updated datasets, where possible (e.g., updated Automatic identification system (AIS) data). Depending on the outcome of the trenching, the CBRA may also be updated once the OECs have been trenched to further minimise and optimise the requirement of any remedial rock protection.

DoL is defined as the minimum depth recommended for protection from external threats (see Figure 6.1)

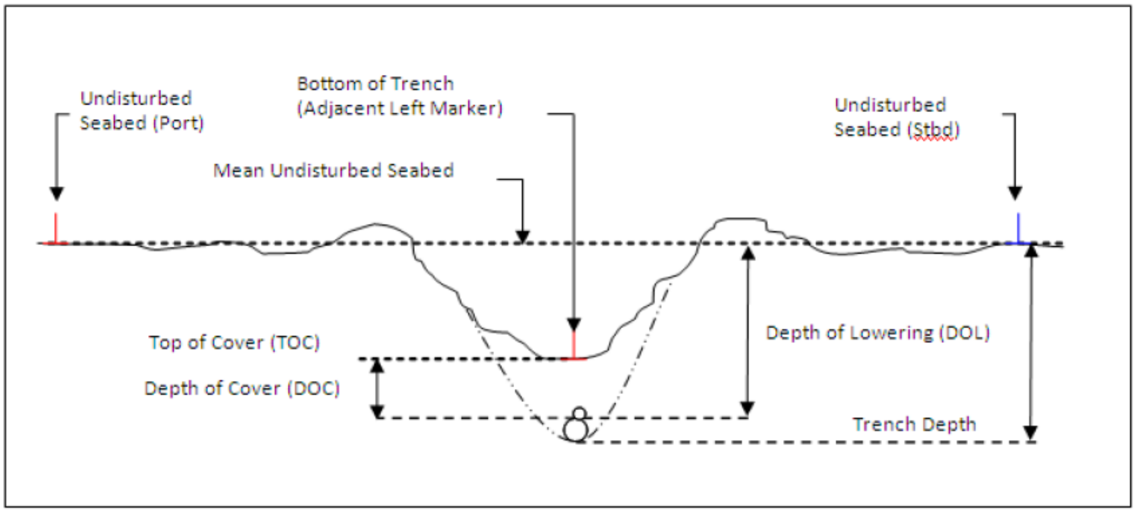


Figure 6.1: Trenching specification terminology including DoL and DoC.

6.1.1 Method

The basis of the risk assessment for OECs relies on identifying the potential hazards, associated risks, and evaluating the level of protection that may be afforded to the cable by its armouring (internal or external), cable burial beneath the seabed, and any other means such as rock placement or concrete mattresses.

The CBRA assesses the soil conditions along the OEC routes, identifying seabed hazards risks areas such as existing cable crossings, boulders, sandwaves, sediment mobility and any other adverse seabed conditions, and provides recommendations on how these risks can be mitigated. The CBRA method is adopted in accordance with the following guidance:

- Carbon Trust (Feb 2015). Cable Burial Risk Assessment Methodology, Guidance for the Preparation of Cable Burial Depth of Lowering Specification. (www.carbontrust.com/resources/cable-burial-risk-assessment-cbra-guidance-and-application-guide; accessed January 2022)
- Carbon Trust (Dec 2015). Application Guide for the Specification of the Depth of Lowering using the Cable Burial Risk Assessment (CBRA) Methodology. (www.carbontrust.com/resources/cable-burial-risk-assessment-cbra-guidance-and-application-guide; accessed January 2022)
- DNV (2021). Subsea Power Cables in Shallow Water, Recommended Practice, DNVGL-RP-0360 (www.dnv.com/energy/standards-guidelines/dnv-rp-0360-subsea-power-cables-in-shallow-water.html; accessed January 2022).

Following the identification of the initial cable route, the following steps are taken for the CBRA:

1. Seabed conditions are assessed. Consideration is given to seabed strata, seabed gradients, water depth for trenching operations, seabed features that may impact trenching operations, and cable crossings including gradual seafloor change and scour development.
2. An integrated ground model in GIS is prepared, including detailed analysis and soil categorisation in support of routing and the CBRA.
3. Threats and hazards are identified and assessed. Review of the natural hazards to the cable, such as sediment mobility, and anthropogenic hazards, principally commercial fishing and shipping, to assess the potential risk to the cable. The approach uses the available shipping/fishing data to identify vessel movements across the proposed OfTI corridor.
4. Identified risks to the cable are assessed in more detail, either through a probabilistic approach, where applicable and/or data quality permits, or through a more qualitative approach.
5. Minimum DoL are recommended to mitigate the risks identified to an appropriate level. The DoL is assessed by determining the anchor penetration for the maximum expected vessel size for which the cumulative probability of strike is within the acceptable probability (or acceptable return period).
6. Recommendations for additional cable protection.

Hazards are categorised into primary and secondary hazards that must be considered when undertaking a burial risk assessment. A primary hazard is defined as a hazard (i.e., an activity or seabed condition which has the potential to cause harm) that presents a direct risk to the cable. A secondary hazard is one which, although not able to directly damage a cable, results in an increased risk of damage from primary hazards. Table 6-1 provides a list of primary and secondary hazards that have been identified as a risk along the OfTI Corridor.

Table 6.1: Primary and secondary hazards		
Hazard type	**Hazard description**	**Design purpose & risk**
Primary Hazards		
Fishing	Damage from snagging or hooking of the cable.	Fishing activity over proposed cable. This is considered to be a primary risk.
Shipping / vessel anchoring	Damage from dragged or dropped anchors.	Vessel anchoring in an emergency, unintentional, or anchorage proximity. This is considered to be a primary risk.
Secondary Hazards		
Sediment mobility	Leads to cable exposure, freespans, and exposure to primary hazards.	Suitable sediment, energetic wave / current regime. This is a risk in particular areas but is generally very low

6.1.2 Sediment Mobility

Evidence of sediment mobility, indicated by the presence of megaripples (defined as small scale features with wavelengths between 2 and 8 m) has been identified in small sections of each export cable route at the following approximate kilometre points (KPs):

- OEC1: KP 0.2-2.2 (nearshore)
- OEC2: KP 0.3-2.1 (nearshore) and KP 41.6-45

The risk associated with sediment mobility is considered low for OEC routes. However, within the nearshore area, the thickness of the sand and shallow water depths suggests that these mobile bedforms may migrate over time possibly resulting in an increase in the likelihood of impact. A maximum potential mobile bedform height of 0.2 m has been applied to each of the CBRA DoL assessment where sediment mobility is identified as a risk.

A seabed mobility study was completed in 2022 which confirmed that the seabed mobility over the route was very limited. Hence the approach adopted in the CBRA was robust.

6.1.3 Fishing Gear Interaction

Due to the prevalence of fishing activity in the Moray Firth, as confirmed by the CBRA undertaken, fishing gear interaction presents the greatest risk of damage to the cables compared to the relatively low risk of anchor strike. When trawl equipment is towed over or along a cable which is laid on the seabed, the interaction between the trawl equipment and cable can be considered in three phases, as described below:

- Impact: this is the initial phase when the trawl board, beam shoe, or clump weight hits the cable. This impact occurs over a short time frame and mainly results in localised damage to the shell and protective coating of the cable. This stage has the potential to damage the cable but rarely damages the trawl gear; therefore, there is negligible risk to the fishermen on board the vessel.
- Pull over: this occurs when a trawl board, beam trawl, or clump weight is pulled over the cable. The duration of this phase is longer than that of the initial impact and forces can be significantly greater. Again, the risks to fishermen during this phase of the interaction are limited.
- Hooking: hooking occurs when the trawl equipment becomes “stuck” under the cable. This tends to be a low probability event; however, it represents the greatest risk to fishermen.

Fishing activity has been identified along the full length of the OEC routes and presents a hazard to the cables because fishing gear interacts with the seafloor and could snag the cables, if not appropriately protected. The Moray Firth is a known area of commercial fishing with a wide range of species commonly fished.

The predominant fishing methods within the Moray Firth are scallop dredging, demersal trawl nets, pelagic trawls, beam trawls, and pots and traps activities. Evidence of trawl scars is observed on the seabed between KP 23.31 and KP 29.09 on OEC2, and occasional trawl scars are observed on the seabed between KP 44.8 to KP 45.9 on OEC1 and KP 41.5 to KP 43.9 on OEC2 suggesting that fishing occurs in these areas.

The possible physical impact of trawl gear on the seabed has been the subject of various research studies over the past 40 years. Relatively recent investigation by the Irish Fisheries[4] reviewed past research and more current research studies (investigating larger gear types) to determine the likely penetration depth of various types of fishing gear. The study described direct observations from divers and submersible equipment such as underwater cameras and side scan sonar. The findings of this paper indicate that a maximum penetration of 300 mm was observed for beam trawls and otter trawl doors penetrating a very soft clay seabed. No penetration exceeding 200 mm was observed in sandy seabeds.

6.1.4 Shipping Anchor Interaction

Anchoring has the potential to damage a subsea cable if a vessel drops anchor or drags an anchor over the cable. The damage caused depends on the penetration depth of the anchor (which depends on vessel

[4] Irish Fisheries Investigations (2000). “A review of Potential Techniques to Reduce the Environmental Impact of Demersal Trawls”. New series, No.7 – 2000.

size and type of anchor), the type of seabed, and depth to which the cable is buried. It is considered that anchor interaction with a subsea cable will be similar to that of fishing gear interaction (see section 6.1.3), based on impact, pull over, and potential snagging phases. Anchoring can take place for a number of reasons, including: adverse weather, machinery failure, and waiting on approach to port. It is worth noting that, as so far as is reasonably possible, cables are normally routed to avoid charted vessel anchorages, such that the risk to the cable is normally from anchors deployed accidentally or in an emergency. The probability, therefore, of anchor damage to a cable is very low as compared to fishing activity.

No designated anchoring sites have been identified within 10 km of the OfTI Corridor; however, the Moray Firth is frequently transited by several vessels on passage to the various ports, and seeking shelter, in the Inner Moray Firth. Therefore, shipping anchors may still present a significant but rare hazard to subsea cables because of deployment of anchors in emergency situations such as mechanical failure or the need to prevent a collision.

Defining the risk to a cable from shipping is a function of the intensity and frequency of vessel traffic, type of vessel, size of the deployed anchor, bathymetric profile and the seabed material in which it penetrates. The main data sources for the assessment are as follows: shipping density data from EMODnet, Marine Management Organisation (MMO) data from the DEFRA Data services platform, Maritime Transport (Ports & Shipping) information from Marine Scotland, and 3rd party reports from other wind farm and cable projects in the Moray Firth.

The majority of OEC1 lies within a moderate to high density (i.e., 30 to 300 routes per square km) shipping zone. Two high density zones (i.e., 120+ routes per square km) occur between KP 7.4 to KP 11.6 and KP 40.5 to KP 45.9. The rest of the route lies within a moderate density zone (i.e., 40 to 120 routes per square km) except between KP 37.0 to KP 39.6 and KP 45.9 to KP 47.3 where low density zones (i.e., <40 routes per square km) are noted.

Similarly, OEC2 lies within a moderate to high density (i.e., 30 to 300 routes per square km) shipping zone. A high density zone (i.e., 120+ routes per square km) occurs between KP 7.3 to KP 11.6 and the remaining the route until KP 46 lies within a moderate density zone (i.e., 40 to 120 routes per square km). From KP46 to KP51.9, a low density zone (i.e., <40 routes per square km) is noted.

6.1.5 CBRA Findings

The primary hazards to the cables are from fishing and shipping activity which require sufficient cable burial. Burial depths have been determined based on a probabilistic assessment (See Figure 6.2 showing potential areas where remedial protection may be required when the target or minimum DoL is not achieved based on preliminary assessment carried out at this point and subject to detail engineering).

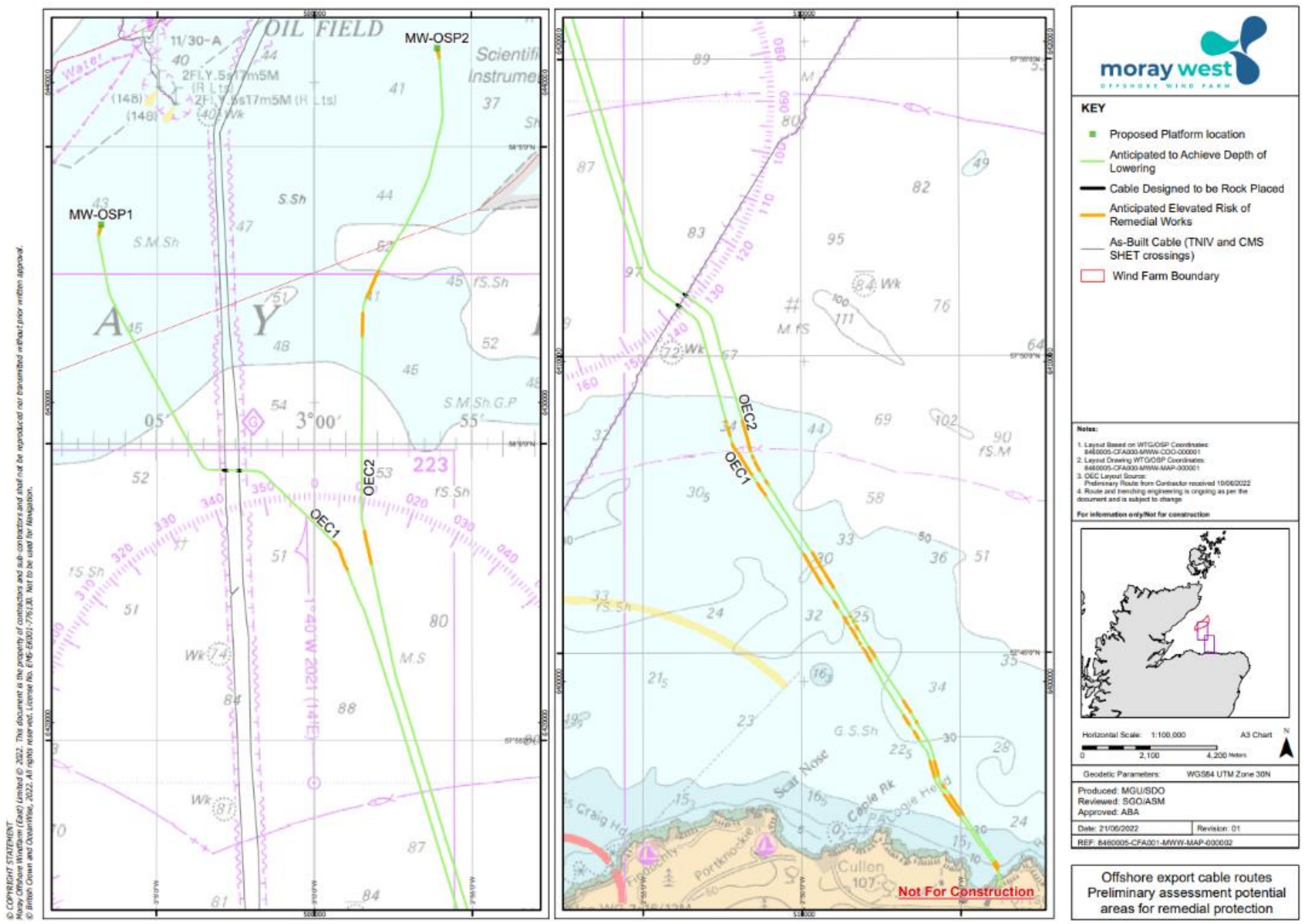


Figure 6-2: Offshore Export Cable Route – Preliminary assessment potential areas for remedial protection

Secondary hazards, in the form of limited seabed sediment mobility, have also been accounted for in the CBRA. In areas of seabed mobility, a 0.2 m sediment mobility allowance is included. Table 6-2 summarises the findings of the CBRA for the OEC routes.

Table 6.2: Depth of Lowering required for various event return periods (m)					
Probability of Cable Interaction (years)	**KP 0-5**	**KP 5-14**	**KP 14-18**	**KP 18-36**	**KP 36-OSP1/2**
1 in 40,000	0.6	0.6	0.6	0.6	0.6
1 in 100,000	1.0	1.3	0.6	0.6	0.6

Moray West have taken the results of the CBRA together with practical survey limitations and Moray West's view on acceptable risk for cables together with the expected trenchability of the seabed and have elected to target DoL = 1.0m of across the OEC routes with a minimum DoL = 0.7 m (exact value to be confirmed) considered acceptable at this time, in line with other cables installed within the vicinity of the Development.

Following completion of trenching, the CBRA may be updated to account for the achieved DoL over the OEC route and compute the actual risk level of the cable (based on the methodology adopted) and use this assessment to inform and optimise where remedial rock placement is required to ensure the cable is adequality protected.

To further protect the OECs a DoC of 0.6 m within 500 m of the OSP and a nominal 0.2 m DoC will be targeted in addition to the DoL.

Note: the minimum DoL typically acceptable is 0.6m but in specifying the minimum DoL, the accuracy of the cable tracker system used to define the as-trenched DoL must be considered hence the reason Moray West consider this as TBC at present. This will be confirmed during detailed design.

6.2 Cable Burial Techniques

The OEC routes feature a variety of soils along the routes, representative of the various geological and bathymetric conditions. The most appropriate tool will be selected at the time to achieve the best possible cable burial and sediment cover above the cable. In some areas, it will not be possible to achieve the target or the minimum DoL, in such cases, remedial protection methods will be required.

Trenching will be performed in sections with the as-trenched survey performed such that the requirements for remedial trenching and remedial protection can be established.

6.2.1 Jet Trenching

Jetting tools may be mounted on towed sleds or on tracked cable burial vehicles operated and controlled from a host vessel via an umbilical cable. A jetting system works by using water jets to fluidise the seabed and hence create a trench.

Whilst the type of equipment used for jet trenching is to be fully confirmed, it is expected that Nexans' CAPJET trenching system will be used (Figure 6.3).

During burial operations, the trenching tool is manoeuvred into position above the OEC, moving along the route using two 'jetting swords' (Figure 6.4) to fluidise the seabed material beneath the cable, thus creating the trench. The cable then falls into the trench by its own weight and a proportion of the fluidised material settles back into the trench as back fill after the jetting tool has passed.

The aim of the burial plan is to achieve the burial requirements (DoL and DoC) based on a single pass operation; however, if DoL is not achieved then a second pass will be carried out (where feasible) before considering alternative methods of achieving protection.

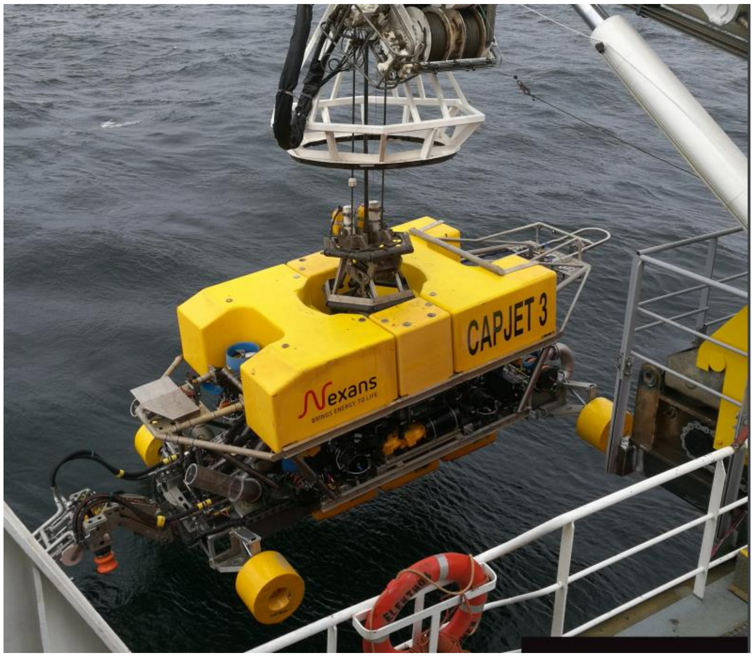


Figure 6.3: One of Nexans' CAPJET trenchers

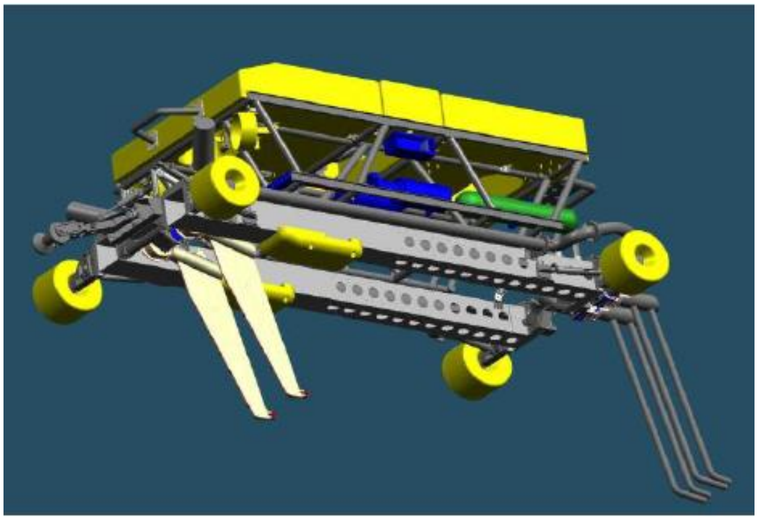


Figure 6.4: Schematic showing the CAPJET trenching swords.

6.2.2 Mechanical Cutting

In areas where water jet trenching is not suitable to achieve the protection specification, mechanical cutting techniques may be used instead. Mechanical cutting methods are used in areas of harder seabed, and they typically deploy chain, wheel or scoop type slot cutters to mechanically remove spoil and create a trench. Mechanical trenching systems include tools such as QTrencher 1400, AssoTrencher IV Mk9 , Travocean EN-TM05-D or similar which are mobilised to a dedicated trenching support vessel such as Havila Phoenix or similar.

Once the OEC route engineering is completed (Q3 2022), a cable burial assessment study will be developed with aim to define the anticipated soil conditions along the design cable routes and expected performances of their primary trenching solution for the project (CAPJET – jetting trencher) in meeting the target DoL specification. Subsequently the sections identified along OEC routes where the primary trenching solution may not be able to meet the target DoL specification, an operational and cost evaluation will be carried out to determine benefits of utilising the mechanical trencher against remedial protection (e.g rock placement, mattresses etc).

A typical mechanical trenching machine, such as those mentioned above, feature a high performance heavy soil cutter capable of 2.0 m trench depth and is suitable for localised high strength clays. Mechanical trenchers are typically launched from a Trenching Support Vessel and lowered onto the cable. Normally, the cable is loaded into the trencher which then progresses along the cable route cutting a trench into which the cable is lowered. In some cases, the cable can be pushed into the cut trench by means of the depressor assembly.

The requirement for a mechanical cutter will be established during detailed engineering in 2022 and introduced if it is deemed necessary.

6.3 Cable Protection

The CBRA has identified the DoL at which threats to the cable are mitigated to an acceptable risk level. The results of the CBRA will also be used to inform likely locations that will require remedial protection, and type of protection.

If the cable protection being used reduces the navigable depth to more than 5% (referenced to chart datum), then agreement will be sought, in writing, by the Licensing Authority in consultation with the Maritime and Coastguard Agency (MCA) and Northern Lighthouse Board (NLB).

6.3.1 Remedial Protection

Where DoL cannot be achieved during installation, remedial protection such as the use of rock berms and, or, concrete mattresses will be employed. The final achieved (i.e., as-built) burial profile for the OECs will be provided by the cable installation contractor once cable installation and post-lay survey have been completed.

The final route and trenching engineering for the OEC routes is currently ongoing. Outside crossing areas, the final approach to the OSP, and trench transition areas, the primary method of cable protection will be trenching. However, the latest route survey data indicates that for some sections of the proposed OEC routes, there is a potential requirement for alternative cable protection e.g., rock placement to supplement partial protection by trenching.

These areas of challenging trenching conditions are characterised by large numbers of surface boulders, likely subsurface boulders, and the localised occurrences of non-trenchable soil conditions. The areas of challenging trenching conditions are expected to be predominantly within the following sections of the route:

- Approx. KP 2.5 to KP 17.0; and
- Approx. KP 33.25 to KP 35.5.
- Approx. KP42

The requirement for rock placement, out with the above areas, is less likely, but could occur in a small number of locations if localised boulders or unfavourable soils conditions are encountered.

In areas where very soft clay is present (i.e., KP 20 to KP 34.5), a bearing capacity assessment will need to be performed to assess the effects of sinkage and to ensure the soils will provide adequate bearing capacity for each installation method. The locations of potential sinkage and any remedial action is still to be confirmed through detailed engineering.

Whilst detailed engineering is to be completed during 2022 and 2023, it is anticipated that, where required, the rock placement will comprise a typical North Sea rock berm design with nominally 1 to 3 in slopes, 1 m crest width and a height which varies depending on the achieved DoL up to 1.0 m excluding tolerances. Where the cable is partially buried, the berm height can be reduced to provide the equivalent mechanical protection over the design life with berm designs varying in height between 0.4 m and 0.6 m being typical. Figure 6.5 provides an example schematic of a typical offshore rock berm.

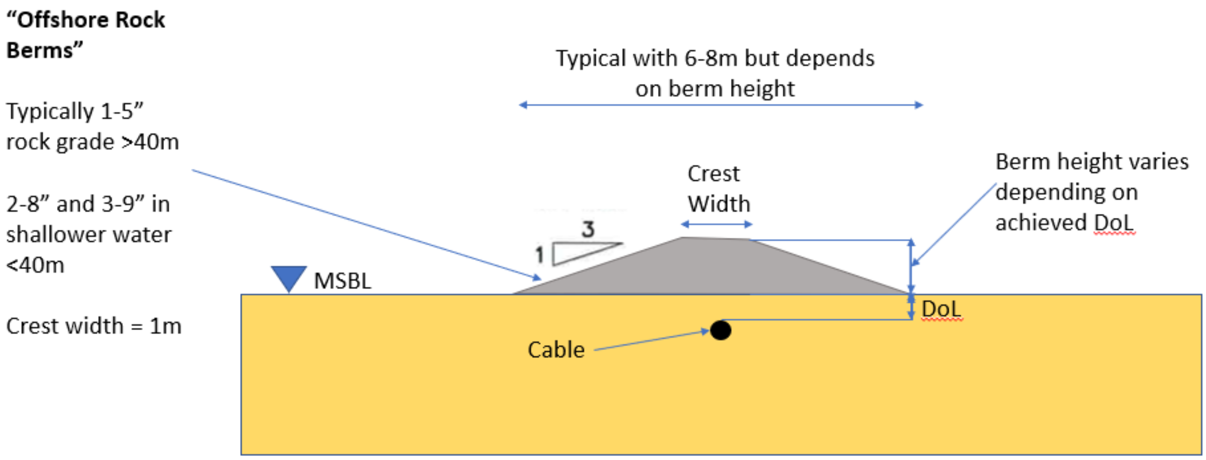


Figure 6.5: Example schematic of a typical offshore rock berm

In the shallower parts of the route where the water depth is <20 m LAT, alternative berm designs may be required with slide slopes varying between 1 in 3 and 1 in 6 in order to provide berm stability over the design life from hydrodynamic forces. In these areas, it can be necessary to install both filter and armour layers (two layer rock berms) in order to meet the design requirements. Figure 6.6 provides an example schematic of a nearshore rock berm showing the multiple layers.

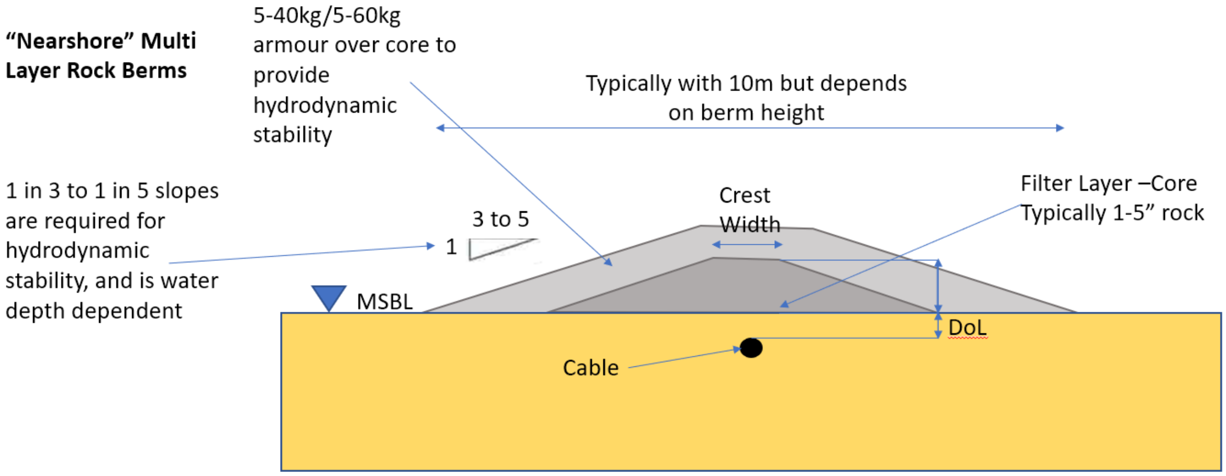


Figure 6.6: Example schematic of a nearshore multi-layer rock berm.

In order to reduce the amount of rock placement, Moray West may perform a post-installation CBRA as has been performed on adjacent developments. Where the cable is installed deeper than the target depth, then it is possible to use this benefit to recompute the probability of a 3rd party interaction event using the CBRA method as long as a minimum DoL is achieved, typically around 0.6 m to 0.7 m (exact value to be confirmed).

6.3.2 Planned Protection (Non-Trenched Sections)

There are a number of planned locations requiring rock, concrete mattress and, or, other alternative protection methods. These are as follows:

- At the four third-party crossings it may be required to install measures to guarantee separation between the two assets. Measures include the use of rock bags, sandbags or concrete mattresses and would be placed over the third-party asset with the Moray West OEC laid on top (see Section 5.2.6). The Moray West OEC will then need to be further protected using rock protection and, or concrete mattresses. The extent of each cable crossing is approx. 125 m, subject to detailed engineering.
- It is expected that at least 25 m but up to 50 m of each OEC from the OSP will require a cable protection system (CPS) where the cable approaches the OSP bellmouth. CPSs, which may be used alone or in combination with other protection methods, are effectively protective polymer or steel sleeves (cast-iron half shells) which are installed around the cable to provide mechanical protection. CPS will interact with the trenching at one end and will be inside the j-tube at the other. The CPS will run over the OSP scour protection, at the bellmouth it may be necessary to stabilise the CPS via the use of rock placement, rock bags or similar.
- At the HDD pop-out, it is likely that the cable, bellmouth and HDD will be buried using soil displacement techniques e.g. air-lift, localised controlled flow excavation for a support vessel. If these options are not used, then rock protection and, or, concrete kennels may need to be used for protection and stabilisation of the HDD. CPSs may also need to be used to protect the cable entering the HDD; this will be confirmed during the detailed engineering design in 2022 / 2023. Where the cable enters the HDD, the duct forms the protection.

If an alternative cable protection solution is required to be used that is not covered by the licensed deposits on the OfTI Marine Licence, these will be subject to approval of an additional Marine Licence or variation to the existing Marine Licence.

6.3.3 Temporary Stability – Ancillary Items and Operations

During detailed engineering it may be necessary to install temporary items on the cable for the purposes of stabilisation and protection for example, it can be common to install concrete mattresses or rock bags to protect the HDD until the construction is completed. Similarly, it can be common to install the same on the wet stored cable at various points which will be later removed. In some circumstances it may be necessary to bury the cable temporarily on the wet stored section at the OSP. In all instances, this will be confirmed via detailed design and, as above, any techniques / deposits that are not covered by the OfTI Marine Licence, would be subject to approval of an additional Marine Licence or variation to the existing Marine Licence.

7 Operation and Maintenance

Once the Development is fully operational, a programme of cable and, or, seabed surveys will be undertaken to confirm that cables remain buried.

7.1 Ongoing Cable Inspections

Prior to completion of installation, a full set of as-built documentation will have been obtained as the baseline for the as-built condition of the OECs. Post-construction surveys will be undertaken shortly after installation, to determine the as-built conditions. These as-builts will consist of survey data for all aspects of the lay and burial and include updated charts, acceptance tests etc. In addition, ROV footage of the seabed will be collected during the laying and specific other aspects of the installation of the cables.

The OEC will also be subject to periodic inspections. An initial survey for specific sections will be undertaken approximately 1-year post-installation to confirm the cables remain buried. The Sediment mobility study undertaken for the OEC routes shows very little movement (see section 6.1.2 Sediment mobility study) and experience gained from other projects in the vicinity (e.g. Moray East) is that there is limited seabed mobility in the area. The frequency and scope of further monitoring will be proportionate to the risk of future cable exposure and determined based on comparisons with the initial post-installation survey results. The proportionate risk will be based upon the as-installed cable protection (trenching, rock placement), the risk of seabed mobility, any change in depth of lowering, depth of cover and any wider changes in the seabed observed between various surveys e.g., is the seabed situation stable or not. The following surveys or inspections may be considered as part of ongoing operation and maintenance activities:

- geophysical surveys along the entire OEC route, or sections of the OEC route which are considered at risk of exposure based on initial post-installation survey findings; and
- Distributed Temperature Sensing (DTS) monitoring fibres are installed within the cables to remotely monitor cable conductor temperature and may, in future, be possible to calibrate to monitor the burial depth.

7.2 Overtrawl Surveys

For areas where the minimum DoL is not achieved (and remedial protection has been installed), where high density fishing activity occurs and where substantial lengths of the OEC has required mechanical protection, Moray West will be required to provide methodologies to undertake targeted overtrawl surveys. The appropriate methodologies will be discussed with the local fishing industry and agreed with the Licencing Authority. Moray West will liaise with the Scottish Fishermen’s Federation (SFF) and are committed to discuss the methodologies for overtrawl surveys with stakeholders. Once as-built information is available, this can be provided for review. Following the review of the as-built information, Moray West will discuss the scope and timings of overtrawl trials, should they be required.

7.3 Further Remedial Actions

Should the OECs become locally exposed, or in the event of cable failure, cable sections will be inspected to determine the full extent of the exposure or failure.

An assessment will be undertaken to determine the risk posed by the exposed cables to other sea users and to the Development. Where the risk is unacceptable, remedial action will be undertaken to ensure the cable is adequately protected. The following measures may be considered:

- cable reburial, placement of rock bags, rock armour or suitable alternatives, at the relevant locations to mitigate cable movement / migration; and
- placement of rock armouring along the length of exposed cable.

If a fault occurs on the subsea portion of the route, the following actions will be taken:

1. First notification of cable damage – the cable repair contractor and relevant third parties and authorities will be notified.
2. Initial fault location – if any damage is identified, it is essential to be able to locate the relevant area (rough position) early, to be able to determine what kind of repair spread will be required. Fault location equipment is assumed to be readily available.

All remedial work will be undertaken immediately after mobilisation and on a continuous 24/7 basis until operations are fully completed. Following the repair, the cable will be tested prior to demobilisation. Following reinstatement of the OEC, it may be required to install remedial protection as described above upon issue of a Marine Licence from MS-LOT for the deposits required.

7.3.1.1 Replacement of a Section of Cable

In the event that the cable is found to be damaged and requires a repair, the repair is performed by cutting out the damaged section of cable and splicing in a new section of cable. Typically, in the water depths over the Development it is expected that around 1,000 m of cable would be required to be repaired. This estimate is dependent on several factors, the specifics of which would need to be determined at the time of the repair.

An overview of the procedure to cut out a section of cable and insert a new piece using two cable joints is presented below:

1. The CLV or similar vessel will expose the cable at the suspected damage location e.g. via a jetting tool and/or mass flow excavation.

2. The cable will be cut at the suspected damage location.

3. The CLV will then recover the first (good) end of the cable and test back to either the Onshore Substation or the OSP to confirm the fault is clear. If the fault is clear then the cable can be laid down in the selected repair configuration.

4. The CLV will then recover the second (bad) end of the cable and test to the opposite station, to confirm the fault is in this section, the cable will then be cut back and the test repeated until the

fault is located, and then cut out. The second end, now without fault will also be laid down in the repair configuration.

5. Assuming a "hair pin" or "paper clip" repair configuration would be used, then the CLV will recover the first cable end again and join to it the splice in section via an in-line joint, once the joint is complete the vessel lays the splice in section toward the second end and the second end is recovered.
6. The two ends can now be connected using a second submarine cable repair joint but this time in an omega configuration.
7. The repaired cable and second joint will then be lowered to the seabed using the CLV crane, stepping the vessel ahead. The cable repair section will result in a bight (loop) at the repair location.
8. The CLV would then demobilise whilst testing was performed to confirm that the repair was good between the OSP and the onshore substation.
9. Depending on the site conditions and the specifics of the repair the exposed sections of the cable would likely be protected by jet trenching, Controlled Flow Excavation and, or rock placement to reinstate the required protection.

8 Reporting Measures

Table 8-1 below provides the opportunities for sharing and communicating information to MS-LOT on matters relating the OEC, including reporting any exposure of cables or risk to other users of the sea from the cables.

Table 8.1: Reporting opportunities

Reporting Pathway	Summary of Content
As-built report	Moray West will provide the proposed, and as-built locations of the areas where remedial rock placement is required to the fisheries stakeholders, MS-LOT, and NatureScot in the form of maps and coordinates, as soon as these become available.
Environmental Clerk of Works (ECoW) monthly and quarterly reports	The ECoW will be reporting on a monthly and quarterly basis, the progression of construction to MS-LOT. This will include construction activities relating to the installation of the OEC, including any issues that may arise.
Survey results	Moray West will submit the results of any geophysical, geotechnical and benthic surveys to MS-LOT.
Overtrawl survey reporting	On completion of the overtrawl survey, a report summarising the results of the survey will be provided to MS-LOT.

Appendix A – Defined Terms

Term	Description
Design Envelope	The range of design parameters used to inform the assessment of impacts.
Marine Licence for the Generating Station	Marine Licence for the Moray West Offshore Wind Farm - Licence Number: MS- MS-00009774 - granted under the Marine and Coastal Access Act 2009, Part 4 Marine Licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the United Kingdom Marine Licensing Area granted to Moray West on 14 June 2019, varied on 7 March 2022 and on 11 April 2022.
Marine Licence for the Transmission Works	Marine Licence for the Offshore Transmission Infrastructure – Licence Number MS-MS-00009813 – granted under the Marine and Coastal Access Act 2009, & Marine (Scotland) Act 2010, Part 4 Marine Licensing for marine renewables construction works and deposits of substances or objects in the Scottish Marine Area and the UK Marine Licensing Area (referred to as the "OfTI Marine Licence") granted to Moray West on 14 June 2019 and varied on 11 April 2022.
Moray Offshore Windfarm (West) Limited	The legal entity submitting this Export Cable Plan (ECP).
Moray West EIA Report	The Environmental Impact Assessment Report for the Moray West Offshore Wind Farm and Associated Transmission Infrastructure submitted July 2018. Additional information was provided in the Moray West Report to Inform an Appropriate Assessment (RIAA) July 2018 and Moray West Application Addendum Document November 2018
Moray West Offshore Wind Farm	The wind farm to be developed in the Moray West site (also referred as the Wind Farm).
Offshore Consents	Collective term for the two Marine Licences and the Section 36 consent
Offshore Consents Conditions	Collective term for the conditions attached to the Section 36 Consent and Marine Licences
Offshore Transmission Infrastructure (OfTI)	The offshore elements of the transmission infrastructure.
OfTI Corridor	The export cable route corridor, i.e., the OfTI area excluding the Moray West site.
Section 36 Consent	Section 36 consent under Section 36 of the Electricity Act 1989 for the construction and operation of the Moray West Offshore Wind Farm assigned to Moray West on 14 June 2019 and varied on 7 March 2022.
The Development	The Moray West Offshore Wind Farm and OfTI.
The Development Site	The area outlined in Figure 1 attached to the Section 36 Consent Annex 1, Figure 1 attached to the two Marine Licences, and Figure B.1 of this ECP.

The Moray West Site	The area in which the Moray West Offshore Wind Farm will be located. Section 36 Consents and associated Marine Licence to construct and operate generating stations on the Moray West site were granted in June 2019 and varied on 7 March 2022.
The Works	The construction activities undertaken for the Development
Transmission Infrastructure (TI)	Includes both offshore and onshore electricity transmission infrastructure for the consented wind farm. Includes connection to the national electricity transmission system near Broad Craig in Aberdeenshire encompassing Alternating Current (AC) Offshore Substation Platforms (OSPs), AC export cables offshore to landfall point at Broad Craig, near Sandend in Aberdeenshire continuing onshore to the AC collector station (onshore substation) at Whitehillock and the additional regional Transmission Operator substation at Blackhillock near Keith. A Marine Licence for the OfTI was granted in June 2019 and varied on 11 April 2022.

Appendix B – Development Background Information

B.1 Development Description

Moray West Offshore Wind Farm is being developed by Moray Offshore Windfarm (West) Limited (Moray West; Company Number 10515140) which is registered at Octagon Point, 5 Cheapside, London, England, EC2V 6AA. Moray Offshore Windfarm (West) Limited is a wholly owned subsidiary of Moray West Holdings Limited which in turn is owned by Moray Offshore Renewable Power Limited, Delphis Holdings Limited, EDP Renewables Europe, S.L.U and UAB Ignitis Renewables.

The Moray West Site covers an area of approximately 225 km^2 on the Smith Bank in the Outer Moray Firth approximately 22 km from the Caithness coastline.

The Moray West Offshore Wind Farm will comprise 60 wind turbine generators (WTGs), associated substructures and seabed foundations, inter-array cables, one OSP inter-connector cable and any scour protection around substructures or cable protection. The OfTI comprises two offshore substation platforms (OSPs) which will be located within the Moray West Site, and two offshore export cable circuits which will be located within the OfTI Corridor and will be used to transmit the electricity generated by the offshore wind farm to shore.

The offshore export cable circuits will come ashore at Sandend Bay, which is located on the Aberdeenshire Coast at Broad Craig, approximately 65 km south of the Moray West Site. There will be two underground circuits from landfall at Sandend Bay to Whitehillock where the onshore substation will be located. There will also be further underground cabling between Whitehillock substation and Blackhillock substation. Moray West will transfer ownership of the transmission asset to an Offshore Transmission Owner (OFTO) who will manage the transmission infrastructure.

Figure B.1 displays a map of the Moray West Site and OfTI Corridor.

The development is aiming to be fully operational in 2024/25 with an operational life of 25 years from the date of final commissioning of the Development.

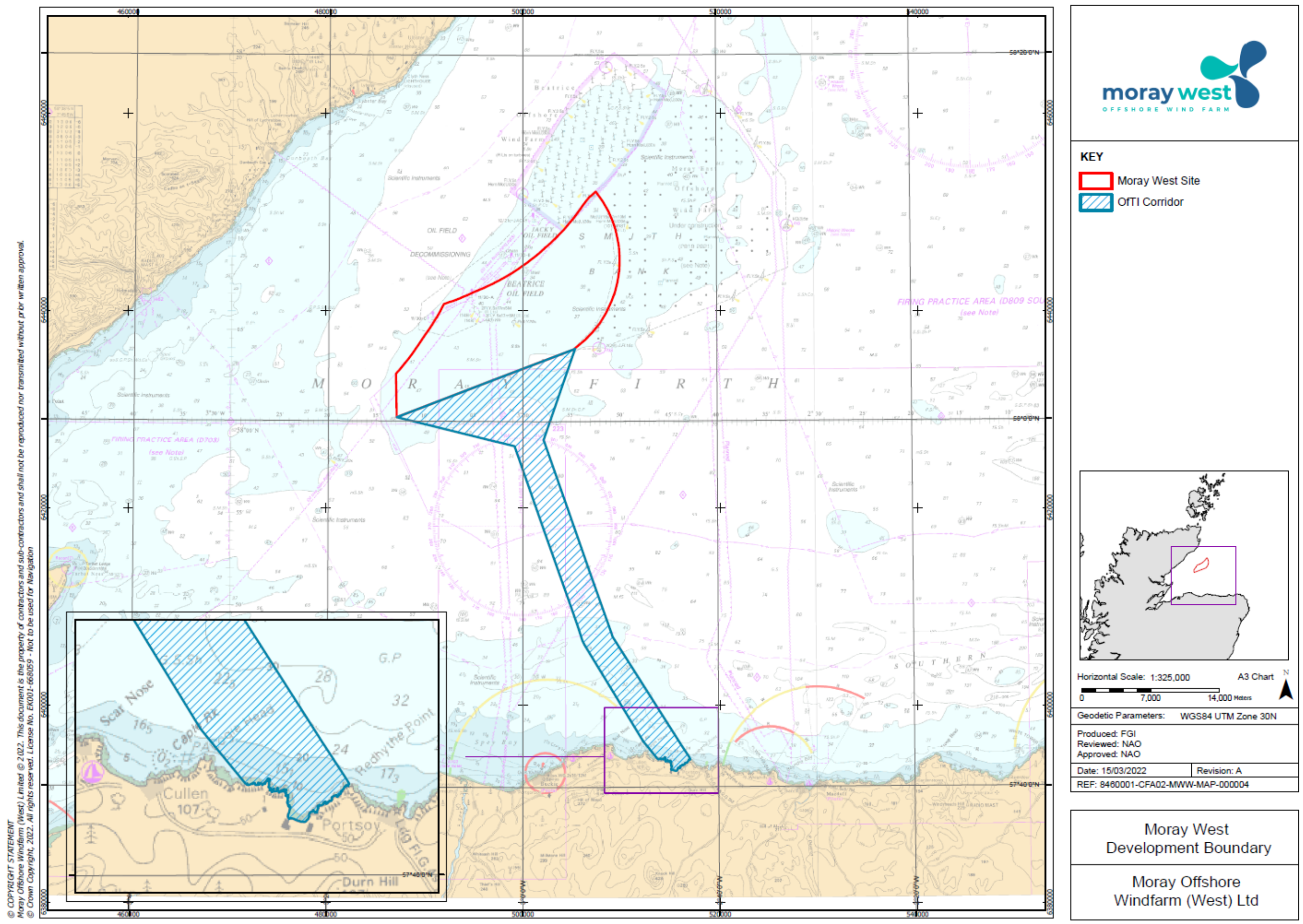


Figure B.1 Geographical location of the Moray West Site and OfTI Corridor.

B.2 Legal Context

Table B.1 provide a list of the marine licence consent conditions relevant to this ECP and how they are addressed within it.

Table B.1. Consent conditions to be discharged by this ECP

Consent Condition Reference	Condition	Addressed
OfTI Marine Licence MS-00009813 Condition 3.2.2.15	The Licensee must, no later than six months prior to the Commencement of the Works, submit a CaP, in writing, to the Licensing Authority for its written approval. Such approval may only be granted following consultation by the Licensing Authority with SNH, MCA, SFF, SEPA, Mountaineering Scotland, FSDCC and any such other advisors or organisations as may be required at the discretion of the Licensing Authority. Commencement of the Works cannot take place until such approval is granted. The CaP must be in accordance with the Application.	This document sets out the Export Cable Plan for approval by the Scottish Ministers. Consultation to be undertaken by the Scottish Ministers.
	The CaP must include, but not be limited to, the following:	
	a) The vessel types used in the licensed activities;	Section 5.1
	b) The finalised location of the export cable route;	Section 2
	c) The duration and timings of the licensed activities;	Section 3
	d) The cable laying techniques, including measures to bury cables where target burial has not initially been achieved;	Sections 5.3 and 6
	e) Measures to ensure the remediation, where practicable, of any seabed obstacles created during construction;	Sections 5.3.5 and 7.1
	f) The results of monitoring or data collection work (including geophysical, geotechnical and benthic surveys) which will help inform cable routing;	Section 2.1
	g) Technical specification of cables, including a desk based assessment of attenuation of electro-magnetic field strengths and shielding;	Section 4
	h) A cable burial risk assessment, to ascertain burial depths and where necessary alternative protection measures, and a mechanism for risk-based approach to protection measures where target burial has not been achieved;	Section 6.1

Table B.1. Consent conditions to be discharged by this ECP		
Consent Condition Reference	**Condition**	**Addressed**
	i) Survey methodologies and planning (inspection, over trawl, post-lay) for the cables through their operational life; and	Sections 7.1 and 7.2
	j) Measures to address and report to the Licensing Authority any exposure of cables or risk to users of the sea from cables.	Section 8
	Any licensed cable protection works must ensure existing and future safe navigation is not compromised. The Licensing Authority will accept a maximum of 5% reduction in surrounding depth referenced to Chart Datum. Any greater reduction in depth must be agreed in writing by the Licensing Authority.	Section 6.3

B.3 Sustainable Construction

The Institute of Environmental Management and Assessment (IEMA) state "Sustainable Construction" as "*application of sustainable development to the construction industry, whereby the construction and management of a development is based on principles of resource efficiency and the protection/enhancement of natural and built heritage. Sustainable construction comprises such matters as site planning and design, material selection, resource and energy use, recycling and waste minimisation". (Institute of Environmental Management and Assessment, Environmental Management Plans Practitioner, Volume 12, December 2008).*

Moray West is fully committed to ensuring that the Development staff and stakeholder needs and expectations are met and exceeded, achieving the ultimate goal of delivering the Development to the highest standard of quality, with a Zero Harm approach to the health and safety of individuals and to the environment as a whole. Moray West have developed an overarching QHSE Policy, which includes the following objectives:

- To reduce our carbon footprint by conserving natural resources and reducing energy use and waste generated by our operations; and
- To support and maintain our commitment to the protection of the environment, including prevention of pollution and other specific commitment(s) relevant to the context of the organisation's undertakings.

The Moray West EMP provides a framework, supported by Moray West's QSHE Policy, the organisational context, the EIA and associated documents, the Consent Plans (including the WMP and MPCP) and the output of hazard identification processes, to aid Moray West in achieving its own environmental objectives:

- Zero spills to sea.
- Zero high potential incidents.
- All personnel working on the Development shall have a risk assessment for every task, which also addresses environmental impact.
- Responsible construction and compliance with all applicable legislation, licences and conditions and best practice guidance.
- Consideration of local supply chain and use of sustainable materials where possible.
- Use of the waste hierarchy of reduce, reuse and recycle wherever possible.
- Incorporation of 'lessons learnt' into ongoing works for continued HSE improvement.