
Marine Licence Application for Construction Projects

Havfrue Cable System

Attachment B: Project Description and Construction Method Statement

The Havfrue Cable System is a proposed subsea cable system linking the United States, Denmark, Ireland, and Norway. This Marine Licence application applies to the sections of the cable system passing through the Scottish Territorial Sea (TS) and areas of rock installation within the UK Exclusive Economic Zone (EEZ).

This document includes additional information in response to the following questions in the application form:

- Question 5 (h): Method Statement Including Schedule of Work

A detailed discussion of cable burial, including burial charts and a risk assessment is provided separately in Attachment H: Burial Risk Assessment Plan.

2.1 PROJECT OVERVIEW

The Project is a planned subsea cable system in the Atlantic and North Sea linking the countries of the US, Denmark, Ireland and Norway. The Havfrue cable will be owned and operated by Optibulk Havfrue As, America Europe Connect 2 Limited (AEC), Edge Network Services Limited and Google Infrastructure Bermuda Limited. Tyco Electronics SubSea Communications LLC (TE SubCom) has been contracted to supply and install the system. AEC is the Applicant for this Marine License.

The Project involves laying a subsea fibre-optic cable (approximately 4 centimetres [cm] in diameter) across the seafloor. The cable will be buried, where conditions allow, out to the 1,500-metre (m) depth contour. This EA addresses the cable segment transiting between Fair Isle and the Shetland Islands (Segment 5: see *Figure 2.1*). Approximately 38 kilometres (km) of cable will cross the Scottish TS, with an additional 939 km crossing the UK EEZ, as shown on *Error! Reference source not found.*. The cable will cross existing pipelines and cables in the UK EEZ but will not cross any in-service cables or pipelines within the Scottish TS. Rock protection will be installed at nine pipeline and cable crossings in the UK EEZ where this has been required by the asset owners.

The Project described in this report incorporates siting and technical considerations undertaken by the Project, as well as industry best practice.

2.1.1 Project Objective

The objective of the Project is to install a subsea fibre-optic system providing connectivity across the Atlantic and North Sea. The new system will increase telecommunication reliability and diversity between the regions and increase data transmission capacity and speeds, helping to satisfy the growing demand for transmission capacity in Europe and the US.

2.2 PROJECT LOCATION

Table 2.1 provides the coordinates of the cable entry and exit locations in the Scottish TS. There is no landing site in the UK.

Table 2.1 *Havefrue Cable Entry and Exit Locations through the Scottish TS*

| Enter Latitude | Enter Longitude | Exit Latitude | Exit Longitude |
|-------------------|--------------------|------------------|-------------------|
| 59.715428 | -1.869257 | 59.612778 | -1.228547 |

Datum: WGS 1984

As a result of crossing agreement negotiations with asset-owners, a total of nine in-service cables and pipelines crossed by the proposed cable route within the UK EEZ will require rock installations to protect the asset. *Table 2.2* provides the coordinates of the rock installations.

Table 2.2 *Rock Installation Locations*

| Pipeline/ Cable Name | Latitude | Longitude | Water Depth (m) |
|---|-----------|-----------|-----------------|
| Shetland Island Gas Export System (SIRGE) | 59.485690 | -0.559967 | 111 |
| Brent A - St Fergus (FLAGS) | 59.448415 | -0.361665 | 138 |
| Vesterled Trunkline | 59.267422 | 0.590110 | 140 |
| Frigg - St Fergus 1 (FUKA) | 59.266655 | 0.592665 | 142 |
| Scottish Area Gas Evacuation (SAGE) | 59.157095 | 1.237747 | 120 |
| Devenick - East Brae Umbilical | 59.132643 | 1.566043 | 116 |
| Devenick - East Brae Trunkline | 59.132558 | 1.566588 | 116 |
| Edvard Grieg - SAGE (Utsira High) | 59.132190 | 1.574452 | 116 |
| Bruce - Forties Trunkline | 59.119417 | 1.663125 | 116 |

Datum: WGS 1984

The sections of rock installation are clustered in a 169 km section of the cable route northeast of Scotland. *Error! Reference source not found.* presents the rock placement locations within the UK EEZ and the underlying seabed conditions. There are no crossings or need for rock installations within the Scottish TS.

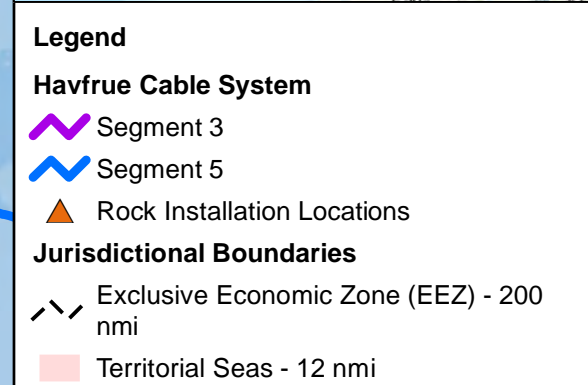
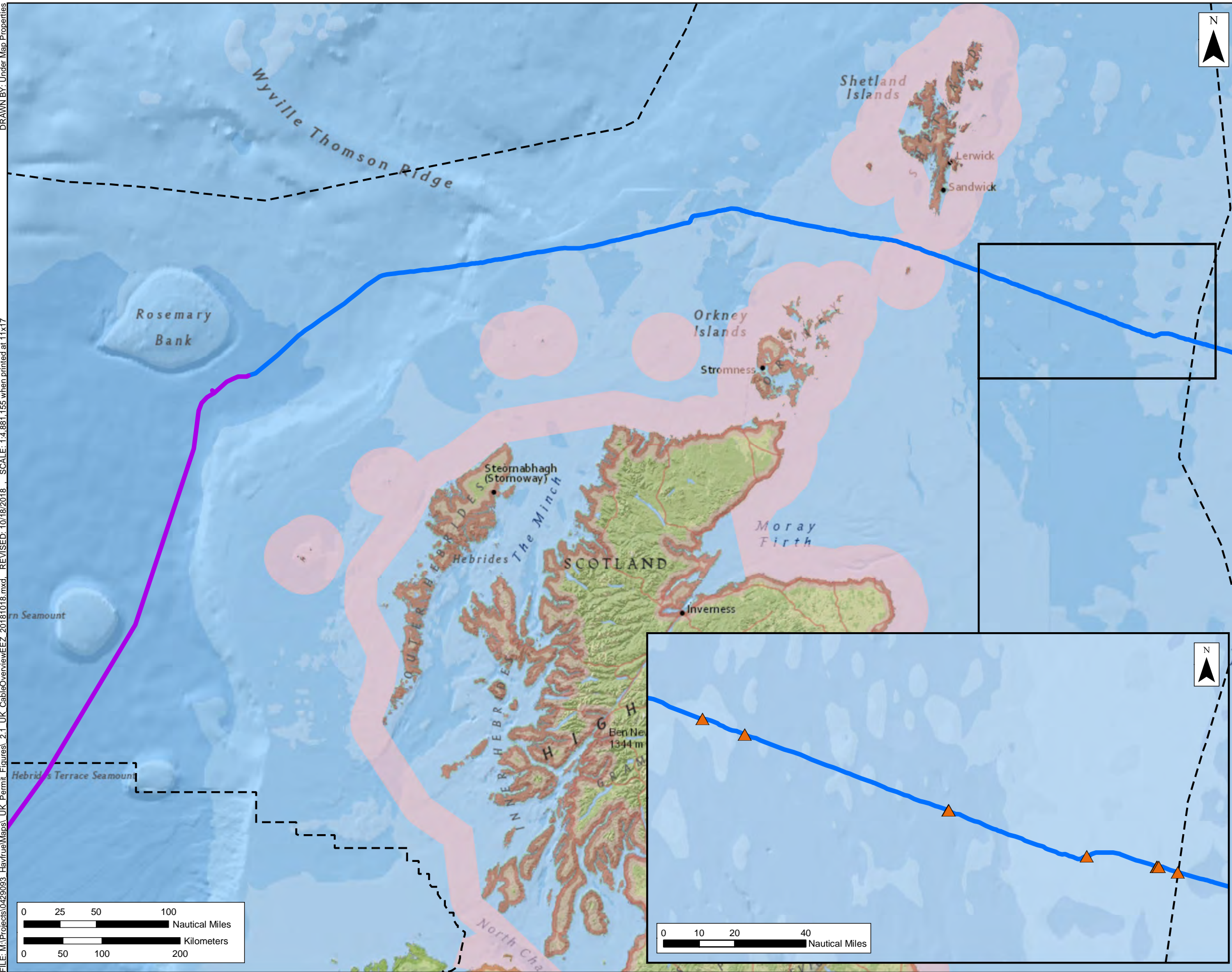
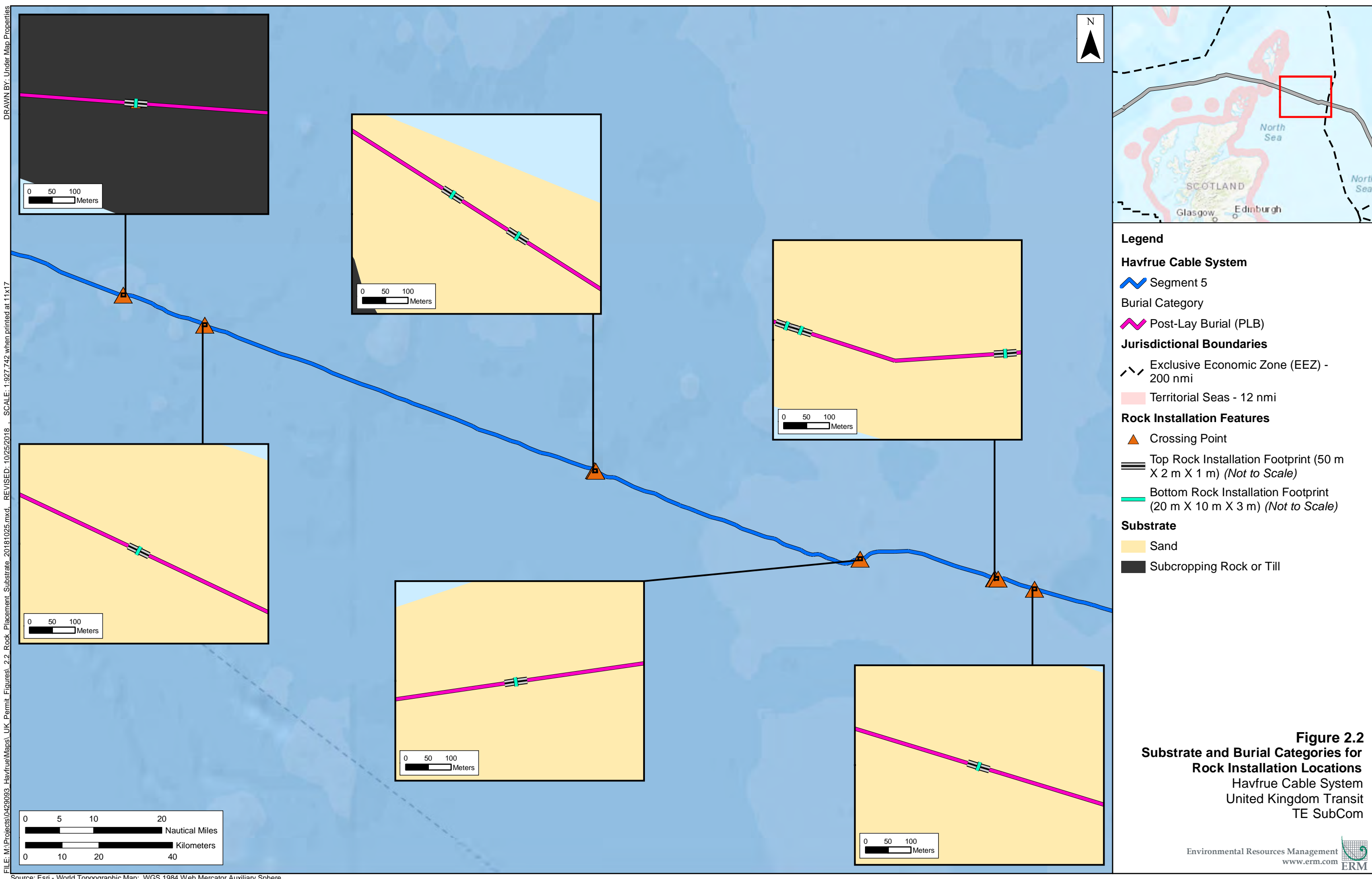


Figure 2.1
Cable Overview in the UK EEZ
Havfrue Cable System
United Kingdom Transit
TE SubCom



FILE: M:\Projects\0429093_Havfrue\Maps\UK_Permit_Figures\2.2_Rock_Placement_Substrate_20181025.mxd, REVISED: 10/25/2018, SCALE: 1:927,742 when printed at 11x17

Source: Esri - World Topographic Map; WGS 1984 Web Mercator Auxiliary Sphere

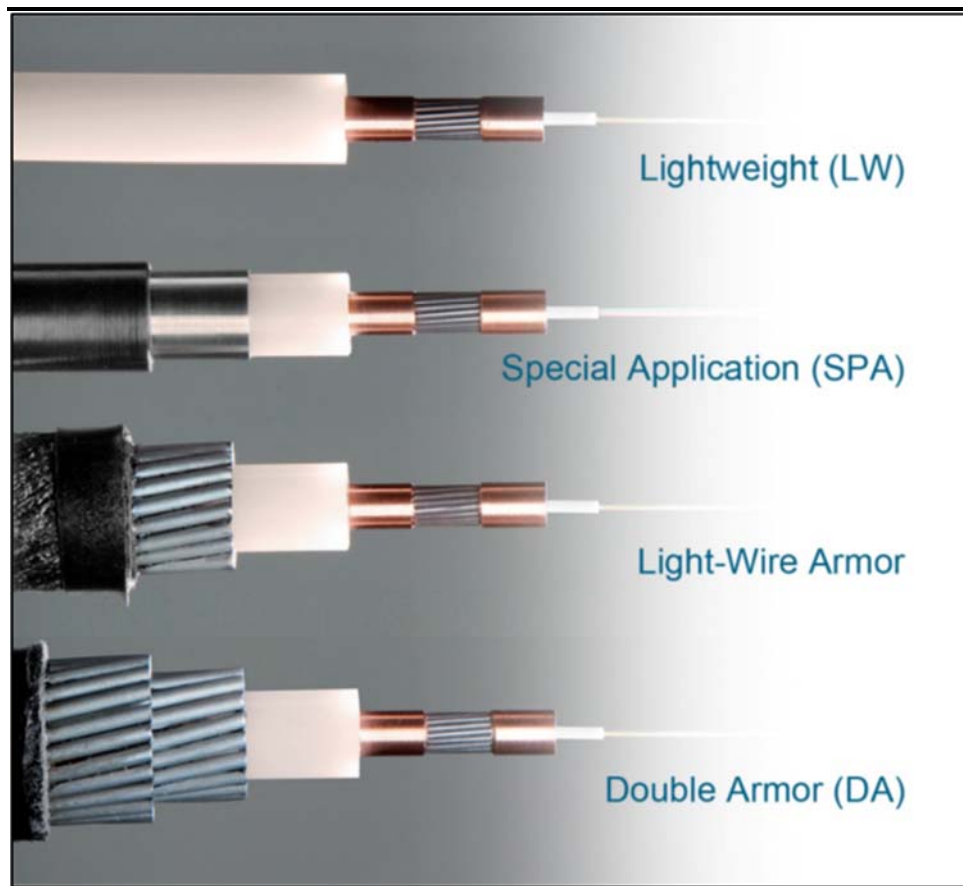
2.3 PROJECT COMPONENTS

2.3.1 Subsea Cable

The basic design of subsea cables includes steel wire and copper sheathing, and polyethylene insulation surrounding a core of optical fibres (see *Figure 2.3 Subsea Cable Design*)

Additional layers of protection may be added to the basic lightweight cable. The degree of protection, *ie* double-armoured (DA) versus light-wire-armoured (LWA), will depend on the seabed substrate and the potential for damage (*eg* fishing interaction). The Havfrue Cable System will use DA cable (diameter of approximately 3.59 cm) through the Scottish TS.

Figure 2.3 *Subsea Cable Design*



(Source: TE SubCom)

2.3.2 Rock Installations

As noted earlier, the owner/operators of nine cables and pipelines crossed by the cable route in the UK EEZ are requiring rock protection at the location where the cable crosses their asset. The details of the rock installations are negotiated and documented in crossing agreements, some of which were not yet finalized at the time of writing.

Each crossing will include a bottom rock installation (pre-cable installation) and a top rock installation to protect the cable once installed. The bottom rock installations will extend 20 m along the pipeline centred at the crossing location, and have a width of 10 m and a berm depth of 0.2 to 0.6 m, depending on the crossing (*Figure 2.4 Bottom Rock Installation Diagram*).

The final dimensions of the top rock installation will be determined following post-lay inspection (see *Section 2.4.7*). The top rock installations will be approximately 2 m wide by 30 to 60 m long and 1 m high (*Figure 2.5*).

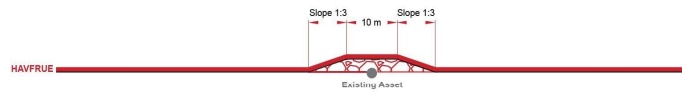
The operation will use freshly crushed rock (granite/gneiss) between 12 and 20 cm, as recommended by the Scottish Fisherman's Federation (SFF). The slope ratio was also designed in consultation with SFF. *Table 2.3 Dimensions and Volumes for Rock Installations* presents the proposed rock installation dimensions and volumes.

Table 2.3 *Dimensions and Volumes for Rock Installations*

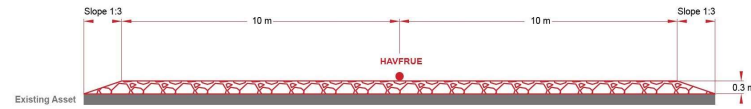
| Rock Installation | Length (m) | Width (m) | Height (m) |
|-------------------|------------|-----------|------------|
| Bottom Rock | 20 | 10 | 0.2 to 0.6 |
| Top Rock | 30 - 60 | 2 | 1 |

There are eight crossings where top and bottom rock installation will be necessary within the EEZ, with a footprint of 260 m² to 300 m² at each site. At least one location will require a top rock installation only (60 m² footprint). The total footprint on the seabed is estimated as approximately 2,300 m². The total volume of the rock installations in the UK EEZ is estimated as 6,765 cubic metres.

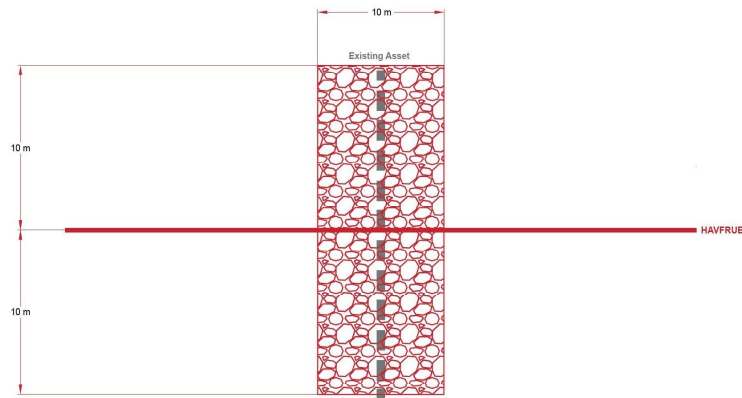
Elevation



Cross-Section



Plan

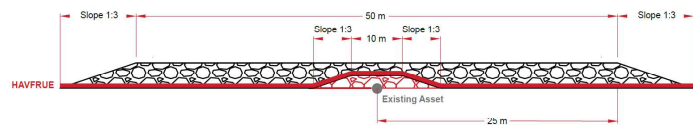


Notes:
Not to Scale.
Side slopes are not included in plan view.

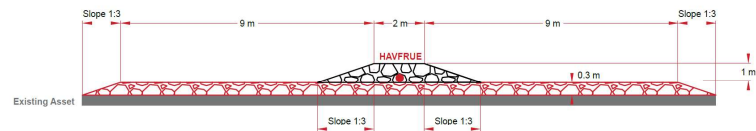
Notes:
Represents the standard dimensions for rock installations along the cable in UK waters. Some variation expected per specific asset owner requests.

Figure 2.4
Typical Bottom Rock
Installation Diagram
Havfrue Cable System
United Kingdom Transit
TE SubCom

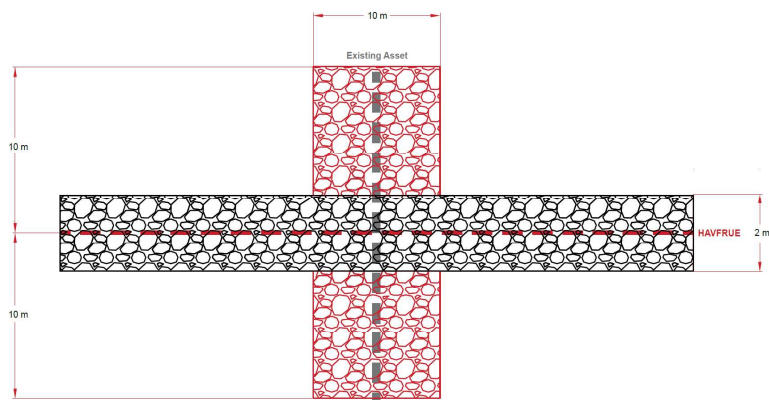
Elevation



Cross-Section



Plan



Notes:

Not to Scale.
Side slopes are not included in plan view.

Notes:
Represents the standard dimensions for rock installations along the cable in UK waters. Some variation expected per specific asset owner requests

Figure 2.5
Typical Top Rock Installation Diagram
Havfrue Cable System
United Kingdom Transit
TE SubCom

The subsea cable installation, operation and decommissioning include the following activities:

1. Cable Route Survey and Design
2. Pre-Lay Inspection and Owner Review
3. Pre-Installation (“Bottom”) Rock Placement
4. Cable Installation
 - a. Route Clearance of Out-of-Service (OOS) Cables
 - b. Pre-Lay Grapple Run (PLGR)
 - c. Main Lay
5. Post-Lay Inspection and Burial (PLIB)
6. Post-Installation (“Top”) Rock Placement
7. Operation, Maintenance and Repair
8. Retirement, Abandonment or Decommissioning

These activities are discussed in more detail below.

2.4.1 Cable Route Survey and Design

Figure 2.1 shows the proposed cable alignment for the Havfrue Cable System within the Scottish TS. The cable route is designed to avoid hard seabed and other marine hazards and features (eg shipwrecks, anchorage areas, fishing and protected areas, and other restricted areas) to the extent possible. The route was engineered in two stages: first through a desktop review and stakeholder consultation, and then refined through a marine survey using geotechnical and geophysical survey techniques, including side scan sonar, backscatter data and core samples to characterise seabed and potential hazards along the route.

2.4.2 UXO Strategy

Certain sections of the route with a high density of sonar or magnetic contacts will be designated for an Unexploded Ordnance (UXO) survey, which occurs after the main marine geophysical/geotechnical survey. It is anticipated that the survey will be undertaken by towed gradiometer array or remotely operated vehicle (ROV)-mounted gradiometer, at line spacing sufficient to identify the minimum estimated ferrous signature. All operations will adhere to the Construction Industry Research and Information Association (CIRIA) 2015 guidelines, *Assessment and management of unexploded ordnance (UXO) risk in the marine environment*.

The outcome of the UXO survey is not yet complete. As such, no mitigation measures have been determined. However, options of avoidance and removal are the two preferred methods. The UXO survey results may result in further refinements to the route.

2.4.3 *Pre-Lay Crossing Inspection and Owner Review*

The Project will perform a pre-lay inspection at the proposed location of each pipeline and cable crossing. The principal inspection tools will be a video system and a cable/pipe-tracking system. Upon completion of the inspection, the recorded video and data will be forwarded to the asset owners for review. The timeline for the review period is typically 2 to 3 weeks, after which the results will be used to finalize the bottom rock installation requirements.

2.4.4 *Pre-Installation ("Bottom") Rock Placement*

Bottom rock placement will be undertaken at designated pipeline and cable crossings in advance of cable installation. A pre-rock placement video is typically undertaken to document the condition of the pipeline or cable and record the horizontal and vertical positioning of the asset. A Dynamically Positioned Fall Pipe Vessel (DPFPV) is then moved into position. Rocks are fed into a flexible fall pipe from the deck and placed on the sea floor. The ROV at the end of the fall pipe is used to manoeuvre the pipe and carries all the survey and positioning equipment necessary to allow the crew to accurately place the rock at the pre-determined location.

Upon completion, the ROV will perform a video inspection to document the installation. The rock placement operation will require two to three vessels: a rock placement vessel and an ROV support vessel, where required (see *Annex A* for vessel specifications).

2.4.5 *Cable Installation*

Route Clearance of Out-of-Service Cables

To allow the cable ship to maximize burial depth along the cable route, a clear cable corridor centred on the cable route should be established at any OOS cable crossings. Before any OOS cable can be cut, the Project will receive permission from the various cable owners to cut and clear the existing cables.

Route clearance operations will involve the following steps:

- Cutting the existing OOS cable at the cable route intersection;
- Recovering the OOS cable that was cut out to the ship for disposal;
- Weighting the OOS cable ends outside the pre-determined corridor with clump weights (small, disk-shaped weight; 0.5 m by 0.2 m thick);
- Lowering the weighted end to the seabed;
- Laying each end back on the original OOS cable route.

This procedure for clearing the OOS cable is intended to ensure a clear passage for the burial operation and to minimize the chances of the OOS cable being fouled or hooked by other seabed users. At this time, three OOS cables have been identified for removal in the EEZ and one in the Scottish TS (*Table*

2.4). Therefore, a maximum of eight clump weights (two per crossing) will be used across the UK cable installation, at the following crossing points:

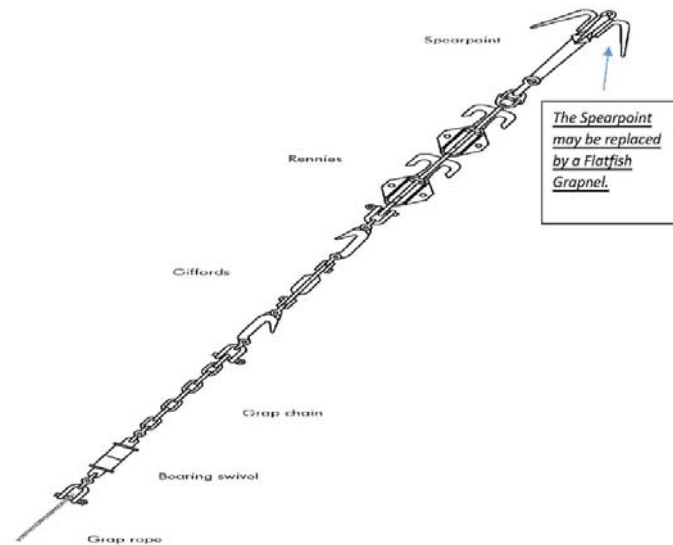
Table 2.4 *Location of OOS Cables in the UK EEZ*

| Latitude | Longitude | OOS Cable |
|-------------|--------------|--|
| 59 33.7364N | 006 49.1855W | OOS SCOTICE South |
| 59 53.0940N | 003 45.4829W | OOS TAT-10 Seg B, As-End: MAG |
| 59 36.9020N | 001 14.5238W | OOS Telegraph, Sandwich Bay-Sinclair Bay |
| 59 20.0756N | 000 14.0729E | OOS Telegraph, Peterhead-Alexandrovsk |

Pre-Lay Grapnel Run

Immediately prior to installation of the subsea cable, a PLGR will be carried out along the proposed cable route at each location where burial is planned. The intention of the PLGR is to clear seabed surface debris (eg wires or hawsers, discarded fishing gear) that may have been deposited on the seabed along the route. The grapnel array will resemble the configuration provided in *Figure 2.6*, using a flatfish or spearpoint grapnel, depending on seabed conditions.

Figure 2.6 *Proposed Grapnel Configuration*



(Source: TE SubCom)

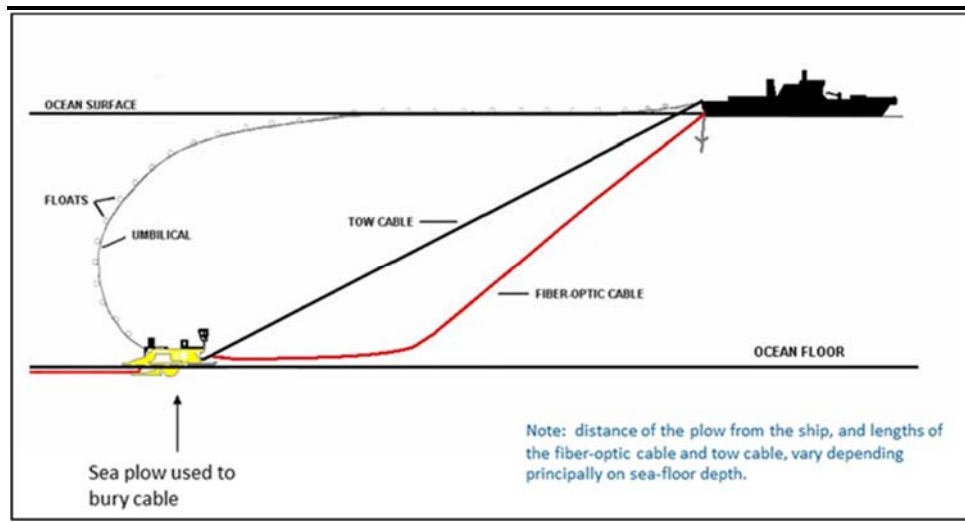
The cable ship will lower a suitable grapnel to the seabed and proceed to tow the grapnel across the seabed along the cable route. Should the first pass encounter any type of debris, two additional parallel passes, on either side of the centre line, will be made. The impact area of each pass will be approximately 0.75 m, with spacing up to 150 m apart. As the grapnel is

pulled across the seabed, typical blade seabed penetration of up to 40 cm is achieved, depending on seabed composition. The grapnel activity will not be conducted in hard bottom areas and will avoid existing buried cables. Debris recovered to the cable ship during these operations will be disposed of appropriately onshore upon completion of the operation.

Main Lay

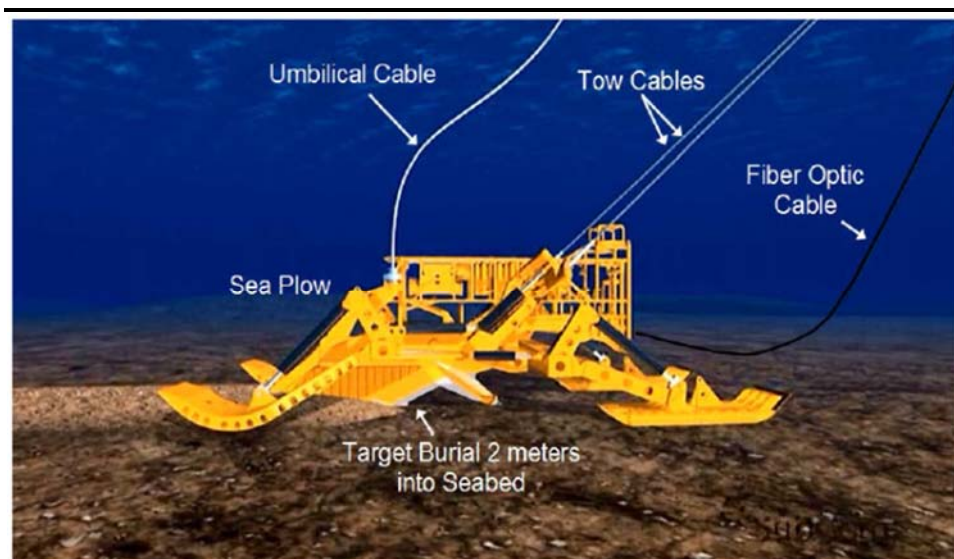
Through soft-bottom areas, including the cable route through the Scottish TS, the cable ship will install and bury the cable simultaneously using a sea plough (*Figure 2.7*). The sea plough is a burial tool resembling a large sled, approximately 5 m wide, attached to the cable ship with a tow wire (*Figure 2.8*, full specification in *Annex A*). It allows for mechanical burial of the cable to a desired depth by creating a furrow approximately 0.75 m wide and feeding the cable to the bottom of the furrow. As the plough moves forward, the cable lies in the bottom of the furrow and is backfilled via the movement of sediment on the seafloor as the plough is towed across the bed. Typical operational plough speeds are less than 1 knot, depending on the stiffness of the seabed and other factors such as sea state, weather, current speed *etc.* In hard bottom areas and areas below 1,500 m depth, the cable will be surface-laid on the ocean floor.

Figure 2.7 **Towed Sea Plough**



(Source: TE SubCom)

Figure 2.8 *Sea Plough*



(Source: TE SubCom)

Computerised modelling and tracking from the cable ship are used to control position and tension of the cable during laying activities, as well as correct for external factors such as wind and ocean currents. Information such as the planned cable route, bathymetry, the ship heading, position and speed, cable characteristics and layout speed are integrated into the software to optimise real-time monitoring of the cable installation. Use of the cable lay software during installation reduces the likelihood of unwanted cable suspensions and assists in accurately placing the cable along the planned route. Once the cable is laid and buried, it maintains position on the seabed due to burial methods (avoiding cable slack), the weight of the cable and the burial depth.

2.4.6 *Cable and Pipeline Crossings*

Where the cable route crosses existing infrastructure, the approach for each crossing will be negotiated with the owners of the existing infrastructure. During installation, the plough will be secured to the deck and the cable will be surface laid across infrastructure crossings, typically 500 m either side. The cable is subsequently buried in this area during the PLIB. Instead of or in addition to rock protection, the cable may be fitted with a URADUCT® sleeve to provide separation between the subsea cable and the pipeline or cable, minimising the risk of abrasion damage. URADUCT protection is not planned for crossings in the UK at this time.

2.4.7 *Post-Lay Inspection and Burial*

Following the completion of the main lay, an ROV will be piloted along the route to inspect the buried cable as part of the main lay cable installation. Where plough burial is not possible as part of the main lay cable installation (eg crossings of other in-service cables) or where the cable plough could not

achieve the target depth due to bottom conditions or technical issues, the subsea cable may be surface-laid by the cable ship and subsequently buried during the PLIB.

If required, the PLIB will be undertaken by an ROV, deployed and operated from the cable ship or support vessel via a control umbilical. The ROV uses a seawater jetting tool directed into the seabed to agitate the seabed. The weight of the cable allows it to be buried to the required depth. The ROV jetting system slowly moves along the seabed on the required cable track forming a trench into which the cable is buried. No seabed materials will be introduced or removed from the area.

The PLIB can take place any time after the initial marine installation is completed.

2.4.8 *Post-Installation ("Top") Rock Placement*

The purpose of the top layer rock installation is to protect the cable from external damage due to activities such as fishing. Top rock placement will take place after PLIB. The basic installation method will be the same as that described for bottom rock installation (*Section 2.3.2*). The top rock placement is designed to protect the cable passing over a feature, such as a pipeline, and as such is thinner and longer than the bottom rock placement (discussed in *Section 2.4.4*).

As detailed in *Section 2.4.4*, two to three separate vessels will be used during the rock placement operations.

2.4.9 *Operation, Maintenance and Repair*

No routine maintenance is required or planned for the marine elements of the Project due to the stability of the seabed environment. Should the cable be damaged by anchors or fishing gear, the location of the interruption can be pinpointed electronically by the onshore cable terminal station and on site by the repair vessel through the use of low-frequency electroding. Methods for repairing any damage would be determined based on the depth of water and depth of burial at that location.

2.4.10 *Retirement, Abandonment or Decommissioning*

The Project's life expectancy is approximately 25 years. In accordance with the Initial Decommissioning Plan (to be submitted to Crown Estate Scotland [CES]), the Applicant will advise Marine Scotland and the CES of the status and disposal of the inactive cable.

The method of abandonment and/or removal and final disposal option will be evaluated by Marine Scotland and the CES at the end of the Project's life expectancy.

2.5 *PROPOSED INSTALLATION SCHEDULE*

The anticipated construction schedule for the proposed work is shown in **Table 2.5 Proposed Installation Schedule, Scottish TS** *Table 2.5* and *Table 2.6*. Combined activities associated with the cable installation operation within the Scottish TS are expected to require approximately 6 days, operating 24 hours per day, 7 days per week.

Table 2.5 *Proposed Installation Schedule, Scottish TS*

| Segment | Activity | Target Start Date | Duration (Scottish TS) |
|-----------|---------------------------|-------------------|------------------------|
| Segment 5 | OOS cable route clearance | April 2019 | 2 days |
| | Pre-lay grapnel run | May 2019 | 2-3 days |
| | Marine cable lay | May 2019 | 2 days |
| | PLIB | July 2019 | Not planned |

Table 2.6 *Proposed Schedule, Rock Placement in UK EEZ*

| Segment | Activity | Target Start Date | Duration |
|-----------|--|-------------------|--------------|
| Segment 5 | Pre-lay crossing inspections | March 2019 | 2-3 days |
| | Bottom rock installation | May 2019 | 3-5 days |
| | Marine cable lay across section of EEZ w/rock installations (169 km) | May 2019 | 12 - 18 days |
| | PLIB | August 2019 | 4-6 days |
| | Top rock installation | August 2019 | 3-5 days |

ANNEX A: VESSEL AND EQUIPMENT SPECIFICATIONS

Detailed specification sheets are attached for the following vessels and equipment to be used in the cable installation:ⁱ

- Main Lay Cable Installation: Reliance Class Vessel
- ROV Vessel for PLIB & Rock Placement Support: Ocean Investigator
- Rock Placement: DPS Fall-Pipe Vessel – *Vessel not yet selected*
- Cable Burial during main lay cable installation: Sea Stallion sea plough
- Post-lay inspection and burial operations; pre-lay crossing inspections:
UTV400 ROV

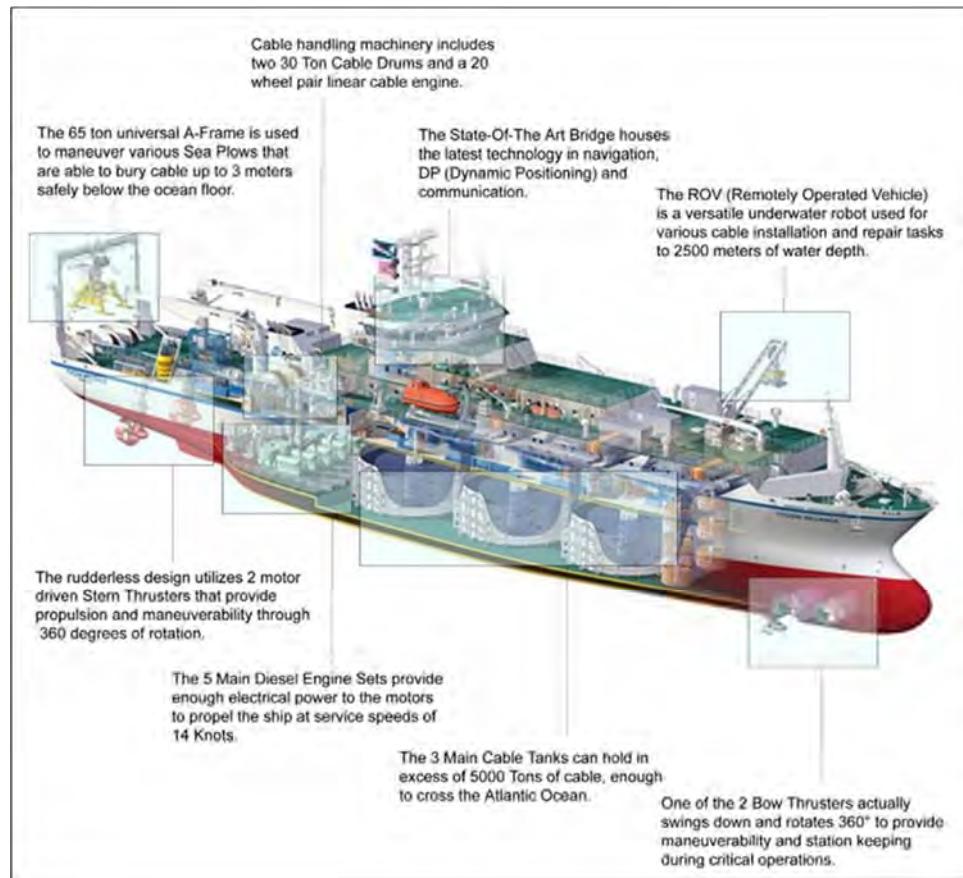
ⁱ Expected equipment type / models at the time of writing. The Project may utilize different but roughly equivalent equipment depending on availability and constraints at the time of installation.

MAIN LAY VESSEL SPECIFICATIONS AND OVERALL INSTALLATION INFORMATION

MAIN LAY VESSEL

TE SubCom will be using a “Reliance Class” vessel for the installation of the cable. *Figure 0.1* provides a generic overview of a “Reliance Class” cable ship.

Figure 0.1 *Three-dimensional Schematic of a Typical Main-Lay Vessel and Supporting Equipment.*



Source: TE SubCom

These powerful, dynamically positioned vessels are capable of sustained cable operations in harsh weather conditions. Each vessel is outfitted with a cable trenching ROV and sea plough system capable of targeting a burial depth of 2 m. Cable handling machinery includes two 30 ton cable drums and 20 wheel pair linear cable engines allowing for precise handling and monitoring of all aspects of the cable installation.

MAIN LAY NAVIGATION

The main lay vessel will use state of the art navigational systems and cable installation software (MakaiLay or equivalent) that allow precise surface positioning and prediction of the installed cable position on the seabed. As discussed in *Section Error! Reference source not found.*, information such as the planned cable route, bathymetry, ship heading, position, speed, cable

characteristics and layout speed are integrated into the software to optimise the real-time monitoring of the cable installation. This software will use an advanced 2D force-based cable model to predict touchdown. The ship route will then be adjusted by the predicted offset distance calculated by the model to ensure the cable touchdown point will be closely positioned along the planned route. Current vector data may also be used to improve prediction of as-laid accuracy within certain depth ranges.

Surface lay accuracy will be limited to the accuracy of the dual frequency GPS receivers, the motion of the vessel and the force-based software touchdown calculations based on cable type. Therefore, accuracy figures for the cable position relative to the planned route are to be given in relation to water depth, except in shallow water areas where the ship surface positioning is more critical.

Main Lay Vessel Speed



Cable laying activities will be closely monitored and the onboard engineer will be utilising the latest advancement in the subsea cable installation industry in order to ensure the cable is laid according to the as-engineered design.

Table 0.1 provides an overview of vessel speed during cable installation.



Table 0.1 ***Vessel Speed Relative to Cable Laying Activities***

| Activity | Speed |
|-----------------|---------------------------------------|
| Burial | 0.1 to 1.0 kt (185.2 m to 1,852 m/hr) |
| Surface Lay | 0.1 to 5.0 kt (185.2 m to 9,260 m/hr) |
| Transit | 0.1 to 10 kt (185.2 m to 1,852 m/hr) |

Throughout the majority of cable installation activities, the main-lay vessel will be travelling at 1-5 knots in open ocean waters, however, speed will vary depending on weather, seabed, and location.

| | | | |
|---|---|---------------------|--|
|  ENGINEERING & MARINE PROJECT SERVICES | BID: 18R0139 | |  |
| | TDM / PLIB / PLGR-RC OFFSHORE SERVICES | | |
| | DOCUMENT TITLE: | | |
| | Commercial Proposal | | |
| REV | DOCUMENT NO: | CLIENT REF: | SHEET NO: |
| 3.0 | 18R139-COM-PROP-002 | Tender Documents | Page 5 of [11] |

VESSEL GENERAL DESCRIPTION

| | | | |
|--|---|---------------------|--|
|  MARITECH ENGINEERING & MARINE PROJECT SERVICES | BID: 18R0139 | |  |
| | TDM / PLIB / PLGR-RC OFFSHORE SERVICES | | |
| | DOCUMENT TITLE: | | |
| | Commercial Proposal | | |
| REV | DOCUMENT NO: | CLIENT REF: | SHEET NO: |
| 3.0 | 18R139-COM-PROP-002 | Tender Documents | Page 6 of [11] |

Ocean Investigator Multipurpose Offshore Support Vessel



The Ocean Investigator is a dynamically positioned offshore support and WROV vessel. The high power availability, DP-2 system and large moon-pool make her perfect for working close to platforms and in adverse conditions. The Vessel has proven capability in providing ploughing support, offshore operations, intervention support as well as support for construction work scopes. The proven and reliable design allows rapid deployment worldwide. Ocean Investigator has an advanced fuel efficient diesel electric propulsion system, providing excellent sea keeping capabilities. The vessel is also prepared for installation of any large work ROV on the on-board Mezzanine deck. Maritech Plans to upgrade the ROV on-board to a 400kW Trenching & WROV during Q2, 2017.

FEATURES

- Class 2 Dynamic Positioning
- Fully Rebuilt & Modernized in 2014



SERVICES

- Cable Lay & PLIB
- Inspections
- PLGR & RC Work
- Construction support
- Surveys

MARITECH USA
4520 Hudson Drive
Stow, Ohio, 44224
T: 1 (234) 334 7700
E: info@maritechus.com



www.maritechus.com

| | | | |
|--|---|------------------|--|
|  MARITECH ENGINEERING & MARINE PROJECT SERVICES | BID: 18R0139 | |  |
| | TDM / PLIB / PLGR-RC OFFSHORE SERVICES | | |
| | DOCUMENT TITLE: | | |
| | Commercial Proposal | | |
| REV | DOCUMENT NO: | CLIENT REF: | SHEET NO: |
| 3.0 | 18R139-COM-PROP-002 | Tender Documents | Page 7 of [11] |

Ocean Investigator

Multipurpose Offshore Support Vessel



General

| | |
|------------------|---|
| Call Sign | H3MV |
| Classification | DnV, 1A1 Supply Vessel Fire Fighter I and II SF E0 DYNPOS-AUTR dk(+) pwdk, Tug / Supply Vessel, SF, EO, FiFi 1+2, Dyn Pos AutR |
| Design | UT 716 |
| Port Of Registry | Panama |

Propulsion / Positioning

| | |
|--------------|---|
| Main Engines | 2 x 4000 BHP, Bergen Diesel KVMB-16/2 x 2940kW 2 x 2600 BHP, Bergen Diesel KVM-12/2 x 1910kW |
| Fuel Type | Gas Oil |
| Propellers | 2 x controllable pitch propellers dia 3,600mm in nozzles |
| Thrusters | 1 x 1,200 BHP, forward (in tunnel) 1 x 1,000 BHP, VROS Retractable, forward, 2 x 1,000 BHP, aft (in tunnel) |
| Rudders | 2 x Ulstein Highlift Rudders |
| Joy Stick | 1 x Ulstein Manoeuvring System - Poscon |



Tonnage

| | |
|--------------|--------------|
| Gross | 3.327 tonnes |
| Net | 999 tonnes |
| Deadweight | 2.254 tonnes |
| Displacement | 5.230 tonnes |
| Light Ship | 2.976 tonnes |

Dimensions



| | |
|-------------------|--------------|
| Lenght OA | 79.70 metres |
| Lenght BP | 68.60 metres |
| Breadth, moulded | 18.00 metres |
| Depth, moulded | 8.50 metres |
| Draft, summer | 5.95 metres |
| Freeboard, summer | 2.55 metres |

Bollard Pull

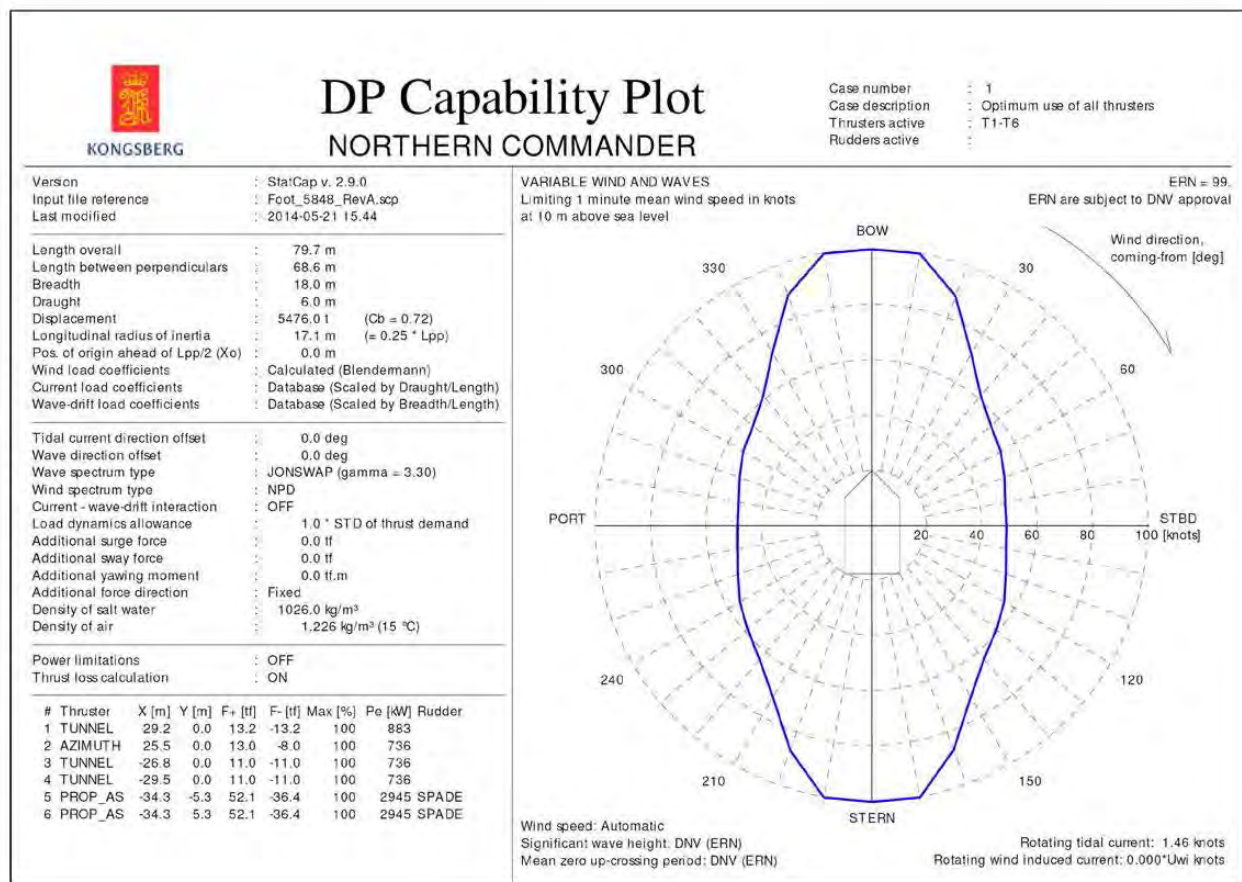
| | |
|------------|---------------------------|
| Continuous | 155 tonnes (DnV-approved) |
|------------|---------------------------|

Speed / Consumption

| | |
|---------------------|---|
| Idling/Stand by | Abt. 2 tn / 24hrs. |
| @ 8 Knots | Abt. 7 tn / 24hrs. |
| @ 10 Knots | Abt. 14 tn / 24hrs. |
| @ 12 Knots | Abt. 21 tn / 24hrs. on direct drive with 2 engines |
| @ 16 Knots (or max) | Abt. 48 tn / 24hrs. on direct drive with 4 engines |
| DP Mode | 8,5-13 tn/24hrs |

| | | | |
|---|---|---------------------|--|
|  MARITECH ENGINEERING & MARINE PROJECT SERVICES | BID: 18R0139 | |  |
| | TDM / PLIB / PLGR-RC OFFSHORE SERVICES | | |
| | DOCUMENT TITLE: | | |
| | Commercial Proposal | | |
| REV | DOCUMENT NO: | CLIENT REF: | SHEET NO: |
| 3.0 | 18R139-COM-PROP-002 | Tender Documents | Page 8 of [11] |

DP Capability Plot





SEA STALLION 3

PLOW SPECIFICATIONS



SSP1 / SSP2 / SSP3

The cable plow system Sea Stallion is an EB SS3 Plow uniquely designed and capable of a 100 Ton bollard pull. It can trench and bury submarine cable to a depth of 3.0 meters, in up to 1,500 meters of water depth, and operate in a wide variety of seabed environments, ranging from sand to firm clays.



EVERY CONNECTION COUNTS



SUBCOM

| | | | |
|--|---|---------------------|---|
|  ENGINEERING & MARINE PROJECT SERVICES | BID: 18R0139 | |  |
| | TDM / PLIB / PLGR-RC OFFSHORE SERVICES | | |
| | DOCUMENT TITLE: | | |
| | Commercial Proposal | | |
| REV | DOCUMENT NO: | CLIENT REF: | SHEET NO: |
| 1.0 | 0-COM-PROP-001 | Tender Documents | Page 10 of [44] |

W-ROV GENERAL DESCRIPTION (PHAROS OFFSHORE)



| | | | |
|--|---|---------------------|--|
|  | BID: 18R0139 | |  |
| | TDM / PLIB / PLGR-RC OFFSHORE SERVICES | | |
| | DOCUMENT TITLE: | | |
| | Commercial Proposal | | |
| REV | DOCUMENT NO: | CLIENT REF: | SHEET NO: |
| 3.0 | 18R139-COM-PROP-002 | Tender Documents | Page 11 of [11] |



UTV400 Trenching ROV



The UTV400 is capable of undertaking all aspects of cable maintenance, seabed survey and cable burial work of long duration, at depths down to 2,500 metres.

| | | | |
|---|---|---------------------|--|
|  ENGINEERING & MARINE PROJECT SERVICES | BID: 18R0139 | |  |
| | TDM / PLIB / PLGR-RC OFFSHORE SERVICES | | |
| | DOCUMENT TITLE: | | |
| | Commercial Proposal | | |
| REV | DOCUMENT NO: | CLIENT REF: | SHEET NO: |
| 3.0 | 18R139-COM-PROP-002 | Tender Documents | Page 12 of [11] |

UTV400 DETAILS:

Operating Depth:
5 - 2500m

Dimensions:
L 3.8m x W 3.7m (with tracks attached) Hx 2.7m

Weight in Air:
8000kg (skids attached)
9200kg (tracks attached)

Weight Aubmerged:
50kg buoyant (skids attached)
750kg heavy (tracks attached)

Max Bollard Pull:
1000kg

Vehicle Power:
1 x 280kW electro-hydraulic power pack
3.3kV 4 pole 1760 rpm

Cameras:
1 x Kongsberg 1358-0702 Camera
3 x Kongsberg 14-110-0845 Camera
1 x Kongsberg 14-366-0120 Camera
1 x Kongsberg 1366-0509 Camera
Optional:
1 x Imenco (Tiger) Shark Range SDS1410
Duplex Digital Stills Camera
1 x Mini Zeus High Definition Camera

Lighting:
2 x Sealite Lights 110v (Deepsea Power & Light)
5 x Subeng LED Light

Pan & Tilts:
2 x Sub Atlantic 0058-MAF Pan & Tilt
1 x Sub Atlantic 0245-MAF Tilt Rotator

Transponders/Responders:
To suit owner supplied beacons.

Cable Cutter:
1 x Webtool WCD 75D
1 x Webtool WCO 38
1 x Stanley GR29 Grinder

Cable clamp:
1 x Slingsby TA17 complete with set of jaws

Search & OA Sonar:
Kongsberg 1071 Sonar

Cable Tracking System:
TSS deployment frame
To suit owner supplied TSS440/ 350 system

Depth Sensor:
Digi Quartz Depth sensor 8CB 2000-I

Manipulators:
2 x 7 function Conan Manipulators

Gyro:
Watson Industries solid state gyro

Altitude:
Teledyne Altimeter PSA-916 (007601)

Pressure Transducers:
Pump 1 System pressure
Pump 1 Boost pressure
Pump 2 System pressure
Pump 2 Boost pressure
Water depth
Water Manifold Pressure

Linear Transducers:
Oil reservoir volume
1 x Jetter depth
1 x Depressor Height
2 x Jet leg seperation

Water Tngress:
Oil reservoir
Valve tanks x 7
Electrical termination
Electronics Pod

Cable Detection:
2 proximity sensors depressor

Configuration:
Twin jet legs with multiple low pressure water jets.
Positive cable depressor
Fwd mounted tool

Water Pump:
3 x Variable speed hydraulically driven single stage water pumps.

Maximum Jet Pressure:
5 bar

Maximum Water Flow:
6,000LPM/ pump

Water Power Consumption:
100 - 210kW

Burial Tool Control:
Depressor 0 - 1.0m
Tool width 0.1 - 0.4m
Tool depth 0 – full depth (tool dependent)
1.0/ 1.5 & 2.0m tools available

