Doc. ID.:	1AA0395404	Classification:	Project report	Prepared date:	2023-10-31
Revision:	M	Project ID:	G19009	Approved date:	2023-10-31
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Cable Burial and Protection Plan

LT000009 - Shetland HVDC Link

Rev.	Purpose	Date	Description	Prepared	Reviewed	Approved
01	IFR	2020-12-14	Issued for Review	Elisabeth Sondenaa	Duncan Kerkhoff	Nigel Walker
02	IFR	2021-02-01	Issued for Review	Elisabeth Sondenaa	Duncan Kerkhoff	Nigel Walker
03	IFR	2021-02-25	Issued for Review	Duncan Kerkhoff		Nigel Walker
04	IFR	2021-03-19	Issued for Review	Elisabeth Sondenaa	Duncan Kerkhoff	Arne Abrahamsson
05	IFR	2021-04-19	Issued for Review	Elisabeth Sondenaa	Duncan Kerkhoff	Nigel Walker
06	IFR	2022-03-11	Issued for Review	Elisabeth Sondenaa	Ian Buchan	Alex Eakin

07	IFR	2022-12-01	Issued for Review	Elisabeth Sondenaa	Ian Buchan	Nigel Walker
08	IFR	2023-02-09	Issued for Review	Elisabeth Sondenaa	Ian Buchan	Nigel Walker
09	IFR	2023-08-29	Issued for Review	Alex Eakin	Elisabeth Sondenaa	Ian Buchan
10	IFR	2023-10-18	Issued for Review	Elisabeth Sondenaa	Ian Buchan	Nigel Walker
11	IFR	2023-10-25	Issued for Review	Elisabeth Sondenaa	Ian Buchan	Nigel Walker
12	IFR	2023-10-31	Issued for Review	Elisabeth Sondenaa	Ian Buchan	Nigel Walker

Cable Burial and Protection Plan

Shetland HVDC Link

Doc. ID.:	1AA0395404	Classification:	Project report	Prepared by:	Elisabeth Sondenaa
Revision:	M	Language:	eng	Prepared date:	2023-10-31
Status:	Approved	Function:	Installation	Approved by:	Nigel Walker
Security level:	Public	Project ID:	G19009	Approval date:	2023-10-31

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List of Terms and Abbreviations

Term	Definition
SHE Transmission	Scottish Hydro Electric Transmissions plc
NKT	NKT HV Cables AB
DOC	Depth of Cover is defined as the depth measured from the top of the backfill material or rock berm to the top level of the cable (reference Figure 0-1).
DOL	Depth of Lowering is the calculated vertical distance between Top of Product to Mean Seabed Level.
DOT	Depth of Trench is defined as the depth measured from mean undisturbed original seabed level to the bottom of the trench (reference Figure 0-1). To achieve the required DOL a certain DOT is defined: DOT = DOL (TOC) + Cable diameter + Margin Where margin is the additional depth setting to the burial tool necessary in order to achieve the required DOL by allowing for some infilling of the trench between the bottom of trench and bottom of cable.
Holocene	The Holocene is the current and most recent Epoch (period) in the geological record. It began at the time of the retreat of the ice sheets at the end of the last glaciation. Various dates are given for this retreat, but many sources place it at around 11,500 years before present (BP).
Subcontractor	NKT's appointed installation contractor for specific work scopes.
TOC	Top of Cable is defined as the top level of the cable (reference Figure 0-1), or in case of bundled cables, the top of the highest cable when those cables are not fully adjacent to each other.

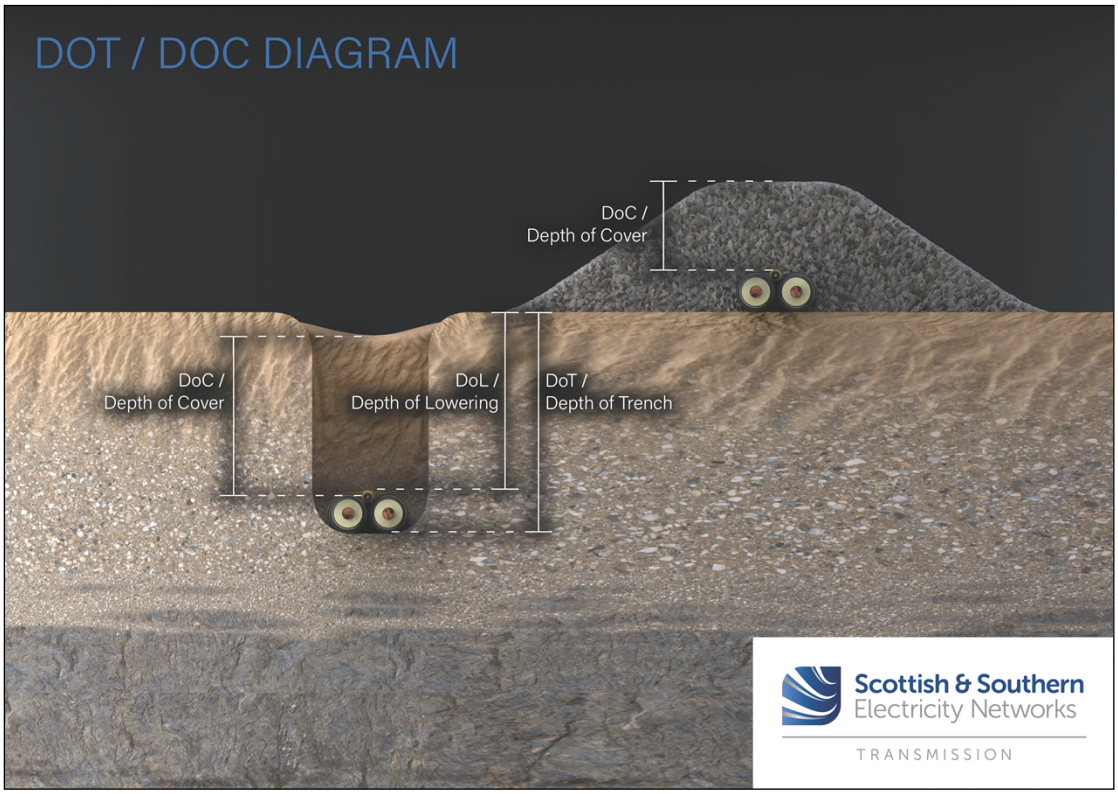

Figure 0-1: Definitions for Cable Burial and Rock Berm Protection (*source:* [02])

Abbreviation	Definition
ALARP	As Low as Reasonably Possible
BAS	Burial Assessment Study
CBPP	Cable Burial and Protection Plan
CIS	Cast-Iron Shell (Cable Protection)
CMS	Contractors Method Statement
CP	(Offshore) Campaign
CPT	Cone Penetration Test
D50	The particle size at the 50th percentile, by weight, of the rock material particle distribution curve

Abbreviation	Definition
FO	Fibre-Optic (Cable)
HDD	Horizontal Directional Drilling
HMB	Horse Mussel Bed
HVDC	High Voltage Direct Current (Cable)
KP	Kilometre Point
LAT	Lowest Astronomical Tide
MHWS	Mean High Water Springs
MNCR	Marine Nature Conservation Review
MPA	Marine Protected Area
MW	Mega Watt
NM	Nautical Mile
OOS	Out-of-Service (Cables)
PLGR	Pre-Lay Grapnel Run
PU	Polyurethane
ROV	Remotely Operated Vehicle
RPL	Route Position List
SROV	Survey Remotely Operated Vehicle
UXO	Un-eXploded Ordnance
VC	Vibro-Core

Abbreviation	Definition
WDV	Weisdale Voe

Table of Reference

Reference	Document Number	Document Title, (Created by)
[01]	A-200396-S00-TECH-001	Burial and Protection Summary Revision A01, (Xodus, 2019)
[02]	A-200409-S00-REPT-003	Shetland HVDC Link Marine Environmental Appraisal, (Xodus, 2019)
[03]	A-200409-S04-TECH-003	LT09 Shetland HVDC Link Communications Plan (Xodus, 2021)
[04]	A-200409-S04-TECH-004	LT09 Shetland HVDC Link Inspection, Repair and Maintenance Plan (Xodus,2021)
[05]	A-200409-S04-TECH	005LT09 Shetland HVDC Link Fisheries Liaison Mitigation Action Plan (Xodus, 20201)
[06]	A-200409-S04-TECH-006	LT09 Shetland HVDC Link Marine Archaeological Written Scheme of Investigation (ORCA, 2020)
[07]	1AA039544	Construction Environmental Management Plan (CEMP), (NKT, 2021)
[08]	1AA0392078	Construction Method Statement (CMS) - (Offshore Permits), (NKT, 2021)
[09]	1AA0500118	Shetlink ALARP Certificate, (NKT, 2021)

Reference	Drawing Number	Drawing Title
[10]	1AA0428474	CBPP Overview Charts, (NKT, 2022)

For survey references, see Table 2.2 in Section 2.

1 Introduction

In line with Part 4 of the Marine (Scotland) Act 2010 and Part 4 of the Marine and Coastal Access Act 2009 and Scottish Hydro Electric Transmission plc's (SHE Transmission) application for a Marine License for the Shetland HVDC Link, this document describes the planning for the burial of the Shetland HVDC Link. Where burial is not feasible due to either obstructions on or in the seabed, geological limitations or environmental restrictions, this plan also describes the alternative protection of the marine cable.

The applicable Marine Licences issued by Marine Scotland and Works Licences from Shetland Island Council are mentioned below:

- Shetland Island Council (SIC) Decision for Works Licence Application Ref. 2020/011/WL: Cable installation from Weisdale Voe out to 12 nautical miles (NM) from the Shetland Islands (referred to hereafter as SIC Marine Works Licence 2020/011/WL);
- Marine Scotland Licence Number 07203/20/0: Licence to Construct, Alter or Improve and works within the Scottish Marine Area (referred to hereafter as ML 07203/20/0);
- Marine Scotland Licence Number 07357/20/0: Licence to Construct, Alter or Improve and works within the Scottish Offshore Region (referred to hereafter as ML 07357/20/0);

This plan is submitted to the Shetland Islands Council and Marine Scotland to discharge:

- Condition 3 of the Shetland Islands Council Marine Works Licence 2020/011/WL;
- Condition 20 of Marine Licence 07203/20/0; and
- Condition 20 of Marine Licence 07357/20/0.

The document is designed to cover all works below MHWS.

1.1 Summary of Changes

Table 1-1: Changes in document from Rev E to Rev J

Section	Change	Reason
1.3	Changes in RPL	Micro-rerouting performed to make sure the cable route minimizes hazards
6.1	Table 6-1: Aligning KPs with latest RPL. Table 6-2: Latest burial assessment	Updated tables to reflect latest changes.
6.2	Table 6-3: No trenching areas prior to trenching activities Table 6-4: No trenching areas after trenching activities	Updated tables to reflect assessment prior to trenching and result after trenching
6.2	Section “Rock Installation Material – Rock Berm and Volume”: Table 6-8; latest revised tonnages Table 6-9; tonnages from Rev E Table 6-11; latest revised lengths	Assessed after receiving final trenching results. Update to tables.
6.2	Section “Rock Berm Design”: Berm heights for remedial rock berms	The remedial berm height is dependent on local soil conditions and assumptions of seabed morphology within that certain region along the route. The berm height design varies between 0.3m to 0.6m top of seabed depending on the location of the berm.
6.3	Design Landfall WDV inclusive tonnages rock	Change of protection strategy.
7	Item 1-3 and 7-11 has been updated according to final design	Settlement not included in the calculations for item 7-11

1.2 Structure of this document

Table 1-2 below sets out the details of these conditions and how they are addressed, with more detail on the structure of the document provided in

Table 1-3:

Table 1-2: Relevant Licence Conditions

Relevant Licence Condition	Relevance to this CBPP
Shetland Islands Council Marine Works Licence 2020/011/WL, Site Specific Condition 3. "Prior to the works commencing a Cable Burial Plan (CBP) will be submitted to the Planning Authority and agreed in writing. Within 28 days of the completion of the development hereby permitted, as-laid coordinates of the cable between the levels of Mean High-Water Springs (MHWS) out to 12 nautical miles from the Shetland Islands shall be submitted to the Planning Authority. Reason: To ensure other marine users and the cable are protected and the completed development can be accurately recorded in the interests of maintaining navigational safety".	Addressed through provision of this document and associated plans
Marine Licence 07203/20/0 "The licensee must submit a Cable Burial and Protection Plan (CBPP) to the licensing authority for their written approval no later than two months prior to the commencement of operations relating to the licence. It is not permissible for operations relation to the licence to commence prior to the granting of such approval. In granting such approval, the licensing authority may consult any such other advisors, organisations or stakeholder as may be required at their discretion. The CBPP must be consistent with the marline licence application and supporting information. All works must proceed in accordance with the approved CBPP. The CBPP must include the following: a) Details of the location of all works relating to the license and cable laying techniques; b) Summaries of the survey work used to inform cable routing. The summaries must include geophysical, geotechnical and benthic surveys, desk top studies and cable route studies where available. A non-technical summary of this information must be provided; c) A burial plan based on survey data to show proposed burial depths throughout the whole cable route. In locations where burial is not proposed it must be demonstrated, to the satisfaction of the licensing authority, that burial is not feasible. In locations where burial is not feasible, cables must be suitably protected	Addressed through provision of this document and associated plans

Relevant Licence Condition	Relevance to this CBPP
through recognised and approved measures where practicable, and as risk assessments direct; d) Micrositing of the cable to avoid any areas where horse mussels are recorded as 'frequent or above' on the SCAFOR abundance scale where feasible; e) Proposals for survey activity and programming to ensure safety of navigation to other legitimate users of the sea, and with particular relevance to fishing activity, in line with industry best practices and guidelines. Such proposals must apply to the entire cable route; f) Proposals for further surveys to be undertaken, determined by the analysis of the data from previous survey activity and subsequent modelling and trending of seabed conditions; g) The cable must be surface laid and protected using articulated Tekduct, Uraduct or Duragaurd half shells between KP 248.9 and KP 250.2; h) The licensee must ensure that no trenching or rock is placed between KP 248.9 and KP 250.2; i) Best method of practice to minimise re-suspension of sediment during the works; and j) Steps to ensure existing and futures safe navigation is not compromised. A maximum of 5% reduction in surrounding depth referenced to Chart Datum must not be exceeded without the approval of the licensing authority"	
Marine Licence 07357/20/0 "The licensee must submit a Cable Burial and Protection Plan (CBPP) to the licensing authority for their written approval no later than two months prior to the commencement of operations relating to the licence. It is not permissible for operations relation to the licence to commence prior to the granting of such approval. In granting such approval, the licensing authority may consult any such other	Addressed through provision of this document and associated plans

Relevant Licence Condition	Relevance to this CBPP
advisors, organisations or stakeholder as may be required at their discretion. The CBPP must be consistent with the marline licence application and supporting information. All works must proceed in accordance with the approved CBPP. The CBPP must include the following: a) Details of the location of all works relating to the licence and cable laying techniques; b) Summaries of the survey work used to inform cable routing. The summaries must include geophysical, geotechnical and benthic surveys, desk top studies and cable route studies where available. A non-technical summary of this information must be provided; c) A burial plan based on survey data to show proposed burial depths throughout the whole cable route. In locations where burial is not proposed it must be demonstrated, to the satisfaction of the licensing authority, that burial is not feasible. In locations where burial is not feasible, cables must be suitably protected through recognised and approved measures where practicable, and as risk assessments direct; d) Proposals for survey activity and programming to ensure safety of navigation to other legitimate users of the sea, and with particular relevance to fishing activity, in line with industry best practices and guidelines. Such proposals must apply to the entire cable route; e) Proposals for further surveys to be undertaken, determined by the analysis of the data from previous survey activity and subsequent modelling and trending of seabed conditions; f) Best method of practice to minimise re-suspension of sediment during the works; and g) Steps to ensure existing and futures safe navigation is not compromised. A maximum of 5% reduction in surrounding depth referenced to Chart Datum must not be exceeded without the approval of the licensing authority."	

Table 1-3: Structure of the Document, highlighting where Specific Requirements of the Conditions are Met

Section of this Document		Contains information on:	Addresses Requirement
Section 1	Introduction	• Purpose of this Plan • Background information on the Project • Location of the Work and reference to the cable route (RPL)	Condition 20 of ML07203, (a) Condition 19 of ML07357, (a)

Section 2	Survey Data	• Reference to survey data used
		• Summaries of the survey work
		  ○ Geotechnical
		  ○ Geophysical
		  ○ Benthic
			Condition 20 of ML07203, (b)
			Condition 19 of ML07357, (b)

Section 3 Section 4 Section 5	Methods of Burial and Protection Proposed	• Route Engineering • Description of trenching equipment and alternative methods for burial • Re-suspension of sediment during the works	Condition 20 of ML07203, (c), (d)(g), (i) Condition 19 of ML07357, (c), (i)
Section 6	Cable Burial and Protection Assessment	• Burial by trenching • Cable protection by means or rock placement • Cable protection by means of cable protection system (CPS) • Cable protection by means of HDD and open trench duct	Condition 20 of ML07203, (c), (d), (g), (h) Condition 19 of ML07357, (c) Site Specific Condition 3 of the SIC Decision
Section 7	Reduction in Water Depth	• Locations with description of reduction in water depth	Condition 20 of ML07203, (i) Condition 19 of ML07357, (i) Site Specific Condition 3 of the SIC Decision
Section 8	Investigations	• Planned survey activities, pre-commencement of the works.	Condition 20 of ML07203, (f) Condition 19 of ML07357, (e) Site Specific Condition 3 of the SIC Decision
Section 9	As-Built Data and Documentation	• As-built reporting	Condition 20 of ML07203, (j) Condition 19 of ML07357, (g)

1.3 The Project

Shetland is not presently connected to the UK mainland electricity Transmission grid and as such is solely reliant on island-based generation, this generation is in the majority derived from fossil fuels with the support of onshore wind.

There is currently approximately 600MW of consented renewable energy generation on the Shetland Isles, which will require connection to the UK mainland transmission network once these projects are constructed. Scottish Hydro Electric Transmission Plc (SHE Transmission) is the licenced Transmission Owner in the north of Scotland, and as such, has a requirement to provide connection to the UK's network when requested by a generator.

To meet the dual requirement of the provision of reliable transmission level supply and export surplus renewable generation, SHE Transmission are planning to install a single circuit 253km long, 600MW High Voltage Direct Current (HVDC) link between Weisdale Voe in Shetland and Noss Head in Caithness ('Shetland HVDC Link' or 'the Project'). The marine cable infrastructure will consist of a single bundle comprising two conductor cables and one fibre optic communications cable, to allow control of the substation and HVDC converter station. Marine cable solution provider, NKT, will be responsible for the manufacture and installation of the subsea cable.

An overview of the marine installation corridor is provided in Figure 1-1.

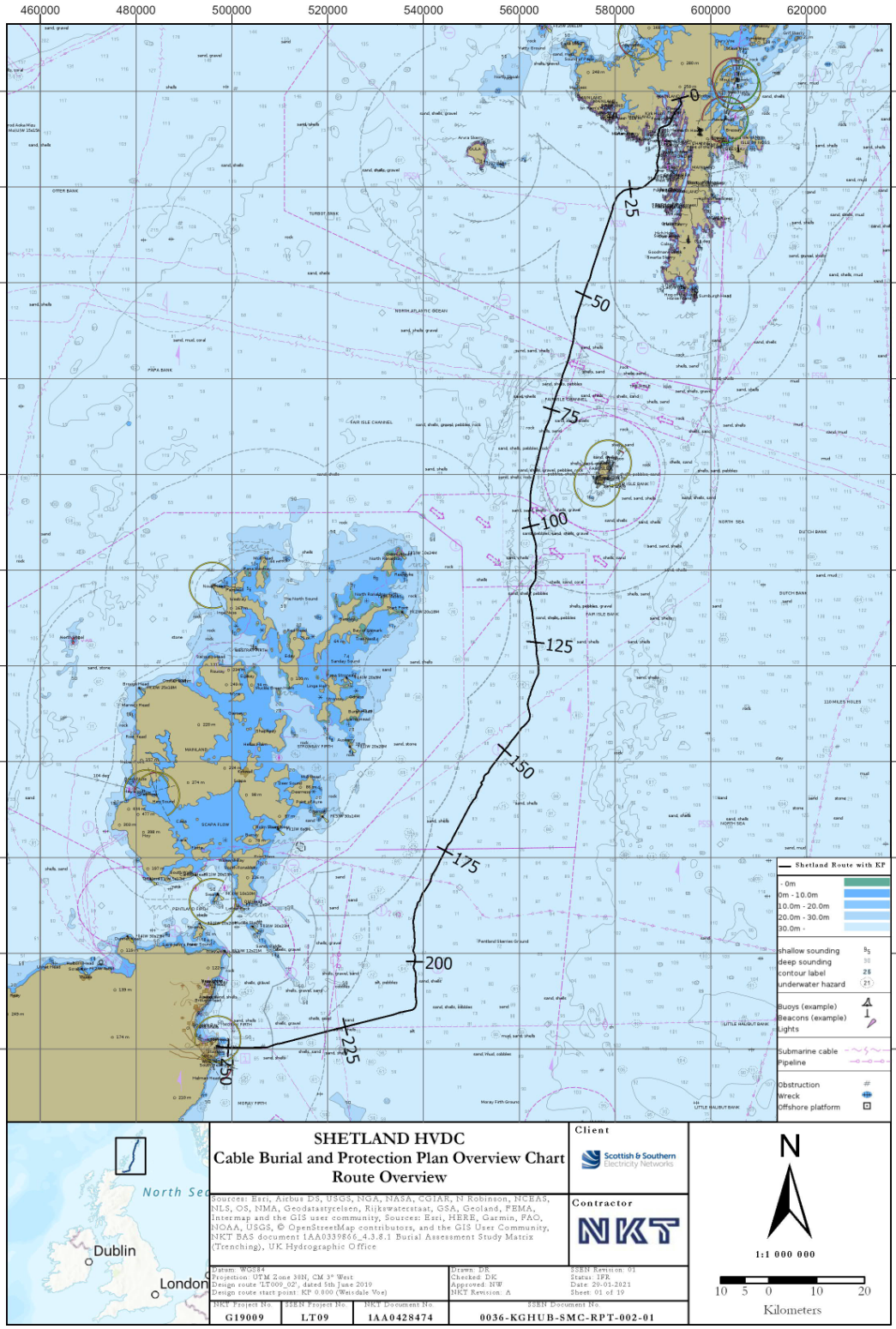

Figure 1-1: Shetland HVDC Link Route Overview

From landfall at Weisdale Voe, Shetland, the cable will briefly exit the Shetland 12NM Zone before again entering the 12NM Zone which surrounds Fair Isle (Shetland).

From KP 59.330 to KP 64.032 and between KP 110.402 and KP 229.494 the cable route is outside any 12NM zone, here in this document named “Offshore”.

The cable will enter the 12NM zone for mainland Scotland East of Noss Head.

Refer to Table 1-7 for 12NM zone limits.

Reference is made to Table 6-10 regarding locations along the route where alternative protection methods are being performed due to partial or no protection provided by trenching.

RPL Reference

The route described within this report and KP references are based on coordinates contained within 1AA0442240 Route Position List (RPL)_D.

Table 1-4: RPL Source Data

Ref.	Route	Name	Version / Date of issue	KP
[11]	Shetland Link Marine HVDC Cable	0036-KGHUB-SED-RPT-021, 1AA0442240 Route Position List (RPL)_D which is based on RPL_LT009_02_20190605	Rev 04 / 2022-05-18	Start KP at Weisdale Voe, Shetland (KP0) End KP at Noss Head, Scotland (KP252.590)

Table 1-5: Datum Parameters

Datum Parameters	
Datum	WGS84
Spheroid	GRS 1980
Prime meridian	Greenwich
Prime meridian	0;00;00.000 E
Conversion factor to metres	1.000000000000000
Semi Major Axis	6378137.000 m
Semi Minor Axis	6356752.314 m
Inverse Flattening	1/298.257222101
Flattening	0.003352810681182
First eccentricity	0.081819191042816
First eccentricity squared	0.006694380022901
Second eccentricity	0.82094438151917
Second eccentricity squared	0.00673949677479

Table 1-6: Projection Parameters

Datum Parameters	
Projection	UTM
Zone	UTM30N
Central Meridian	3°W
Latitude origin	0°
False Northing	0 m
False Easting	500000 m
Central Scale Factor	0.9996
Units	Metres

Table 1-7: Cable Route KPs at 12NM Zone Limits from RPL [11]

UTM Zone	Latitude (N)	Longitude (W)	Easting	Northing	KP (km)	Note
	12NM Zone Shetland					
30N	60.232807°	1.310132°	593587	6678537	0	Start
30N	59.788342°	1.728814°	571353	6628523	59.330	End 12NM
	12NM Zone Shetland					
30N	59.747569°	1.749834°	570259	6623961	64.032	Start 12NM
30N	59.345682°	1.884265°	563455	6579076	110.402	End 12NM
	12NM Zone Scotland					
30N	58.492327°	2.668598°	519318	6483573	229.494	Start 12NM
30N	58.465702°	3.045869°	497324	6480561	251.982	HDD2 Exit Point

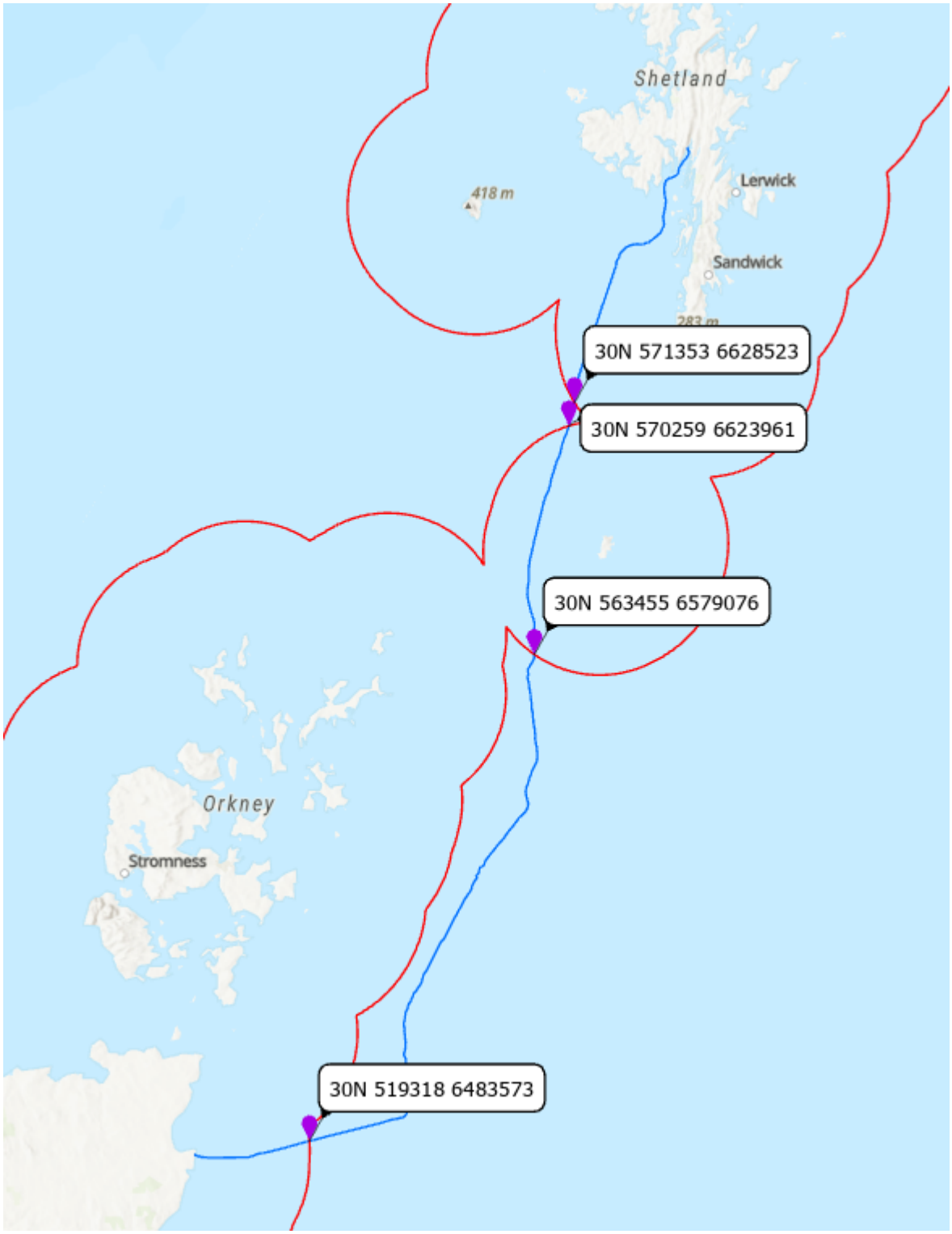

Figure 1-2: Cable (Blue) Eastings and Northings at and 12NM Lines (Red)

2 Survey Data

This section describes the features and conditions found along the route which need to be evaluated regarding the burial and protection of the marine cable. Any further elaboration of the assessment process regarding the cable burial or protection design and activities are detailed in the subsequent sections.

2.1 Summary

The 2013 report [20], [21] summarises the survey data as follows:

The seafloor, from the Weisdale Voe in Shetland to the Scottish coast, comprises several provinces with different seabed morphologies. The depth ranges between 0 to 124 meters, and the seabed gradients, although generally very low, varies between different areas. The seabed is mainly composed of mixed sandy sediments, with different proportions of shells, gravels and silt.

Weisdale Voe is dominated by a highly irregular bedrock surface, with troughs infilled by clay and coarse sediments. These are often overlain by thin layer of gravel to gravelly sand/sandy gravel which at some areas forms ripples on the seabed.

The midsection of the route, mainly located offshore, is generally a flat, sandy area, with occasionally outcropping or sub-cropping flat bedrock surface around the Orkney platform. This is commonly blanketed by a thin layer of marine sediments, with an upper discontinuous recent mobile sediment layer, in places observed as current induced bedforms e.g., sandwaves and mega ripples.

The area towards the Scottish coast is dominated by a slightly irregular seabed, gently sloping towards the northeast. The surface is usually covered with gravelly or sandy sediments with large proportions of shells and gravels of shells as thin mobile layers, on top of coarse sediment and bedrock.

The above is confirmed by data provided in the 2018 survey report [14],[15].

The description of survey methods performed are split under Chapter 2.3 and 2.4, however geotechnical and geophysical surveys are done in conjunction and data should align. Assessment of the available survey data will therefore be an integrated approach when using the information for engineering purposes.

2.2 Survey Data Reference

The seabed conditions for the cable route are based on the following list of reference survey reports:

Table 2-1: Reference List of Survey Reports and Data Provided

Ref. Doc. Title	Survey Contractor	Date of Issue	External Doc. No.	Doc. Rev.
[12] 1AA0485503 -SHETLAND HVDC LINK GEOPHYSICAL AND UXO SURVEYS RESULTS REPORT	N-SEA	2021-12-15	0036-KGHUB-SCI-RPT-041	B
[13] 1AA0399088_LT000009-TN-182 Aspects Noss Head Data Survey Files	Aspect Surveys	2020-11-03	N/A	A
[14] Marine Survey Report	MMT	2019-11-14	102967-SSE-MMT-SUR-REP-SURVEYRE	D
[15] Geotechnical Report	MMT	2019-11-15	1027967-SSE-MMT-SUR-REP-GEOTECH	02
[16] Geodatabase MMT 2018 surveys: SSE-102967-Shetland-Geotech.gdb	MMT	2019-11-15		
[17] Noss Head	Bibby Offshore	2019-08-28	REP-F-015	04
[18] Horse Mussel Bed	MMT	2016-06-02	101594-ABB-MMT-SUR-REP-ENVIRON	02
[19] The structural geology of a coastal zone south of Noss Head, near Wick, Caithness Geology and Landscape Scotland Programme	BGS	2014-01-31	Commercial Report CR/13/129	1.0
[20] Marine Survey Report – Geophysical, Geotechnical and Environmental Survey Volume 1 Western Route	MMT	2013-06-12	101290-SSE-MMT-SUR-REP-SURCMSWE-A	A
[21] Marine Survey Report – Geophysical, Geotechnical and Environmental Survey Volume 2 Eastern Route	MMT	2013-05-20	101290-SSE-MMT-SUR-REP-SURCMSEA-A	A
[22] Survey Shetland Isles to Scottish Mainland Volume 3: Environmental Report February - April 2013	MMT	2013-06-12	101290-SSE-MMT-SUR-REP-ENVIRCMS	A
[23] Geodatabase MMT 2008 – 2013 surveys: SSE-101290-MMT-Survey2013.gdb	MMT	2013	SSE-101290-MMT-Survey2013.gdb	

Ref. Doc. Title	Survey Contractor	Date of Issue	External Doc. No.	Doc. Rev.
[12] 1AA0485503 -SHETLAND HVDC LINK GEOPHYSICAL AND UXO SURVEYS RESULTS REPORT	N-SEA	2021-12-15	0036-KGHUB-SCI-RPT-041	B
[13] 1AA0399088_LT000009-TN-182 Aspects Noss Head Data Survey Files	Aspect Surveys	2020-11-03	N/A	A
[24] HVDC Subsea cable link route between Shetland and mainland Scotland Western Route (including alternative landing point) Marine Survey 2008 Volume 1	MMT	2009-01-02	100364	4
[25] HVDC Subsea Cable Link Route between Shetland and Mainland Scotland Eastern Route (Including Alternative Landing Point) Marine Survey 2008 Volume 2	MMT	2009-01-02	100364	4
[26] VDC Subsea cable link route between Shetland and mainland Scotland Biological report Marine Survey 2008	MMT	2009-01-02	100364	4

Where reference to the above documentation is made within this report, such references are in the form [14] etc.

For survey work performed in 2018, a previous RPL, RPL_LT009_01_20190125, were used as KP reference [14][15].

2.3 Geotechnical Survey

Geotechnical survey is the physical penetration of the seabed to test the soil strength and taking samples of the soil.

The geotechnical surveys consist of vibro-core sampling (VC) and cone penetration tests (CPT) [15].

Vibro-core

Table 2-2: Summary of Vibro Core Information

Information	Reason	Obtained from	Accuracy
Geological description	General description Possibility to identify geological risk.	Geology description	High
Layer thickness	Required for burial assessment	Core	Low to high

Information	Reason	Obtained from	Accuracy
Soil type	Possibility to take samples for lab tests	Lab samples	High
Soil strength	Required for burial assessment Strength determines burial speed and risks	Lab samples	Low to medium. However, often not possible

Cone penetration test

Table 2-3: Summary of CPT Information

Information	Reason	Obtained from	Accuracy
Geological description	General description	Geology description from CPT data	Medium
Layer thickness	Required for burial assessment	CPT data	High
Soil type	Can be obtained from CPT data Soil samples cannot be taken	CPT data	Medium
Soil strength	Required for burial assessment Strength determines burial speed and risks	CPT data	High

Quantities of Geotechnical Data Input

The reports received provide collocated CPT and VC data along the Shetland HVDC Link, [15][20][21][24][25]. The GIS data [23] includes a few more VC sample points, however these are not reported in the survey reports, which indicates the samples were not successful.

An overview is presented in Table 2-4.

Table 2-4: Geotechnical Stations Along the Shetland Link Route

Weisdale Voe to Noss Head (KP 0 – KP 251.961)			
Type	**Location**	**2018 Survey**	**Pre-2018 Survey**
VC	12NM Zone Shetland	80	37
	Offshore	106	42
	12NM Zone Scotland mainland	15	9
	Total	201	88
CPT	12NM Zone Shetland	79	37
	Offshore	142	42
	12NM Zone Scotland mainland	13	4
	Total	234	83
TOTAL		*435*	*171*

It is to be noted that the geotechnical data are generally available with an interval of approximately 1 – 3 km between the geotechnical stations (sample location) for the 2018 data, while the for the older data the interval is approximately 2.5 – 3.5 km between the samples.

Geotechnical Assessment

The geological and geotechnical assessments have been carried out in order to perform a burial assessment using the described trenching equipment (Section 4.2) and evaluate necessary remedial work where only trenching is not sufficient. The geotechnical data is also used for evaluating soil behaviour where rock berms are being placed as cable protection.

Summary of Geotechnical Survey

Approximately 42% of the route comprises greater than 1.8m thickness of seabed sediments (generally coarse Holocene non-cohesive material such as sand, gravelly sand, and sandy gravel) over bedrock.

- Approximately 35% of the route comprises bedrock, within the 1.8m of seabed. Generally, with an overlying layer of Holocene sediments (sand, gravelly sand and sandy gravel).
- Approximately 23% of the route comprises of a layer of fine-grained sediments, which mostly comprises very soft to soft clays and silts in conjunction with granular material. The layer thickness is between 1m and 5m.

Surveys where both geotechnical and geophysical surveys are performed the survey reports show a summary and conclusion which is based on both geotechnical and geophysical survey aspects regarding the soil layers, however, there seem to be a general agreement regarding the indications of certain soil characteristics between the sub-bottom profiler survey (as part of geophysical survey) and the test samples taken.

2.4 Geophysical Survey

Geophysical survey utilises non-intrusive survey techniques (i.e. techniques that do not require physical penetration of the seabed) to provide a complete and continuous picture of the soils along the route, the seabed movements and any potential obstacles on the seabed (e.g. boulders / wrecks / in service and out of service cables or pipelines). It is good survey practice for a thorough geophysical survey to be performed to support and supplement the geotechnical survey and clarify the variability in soil conditions between geotechnical sample points. These surveys are performed with a swathe at least equivalent to the route corridor and have the following functions:

1. Bathymetric survey – to provide details of the water depth and the seabed movements, such as sandwave migration.
2. Sidescan sonar survey – to provide images of the seabed and assist in identifying potential obstacles such as boulder outcrops, wrecks or other dropped objects like anchors along the route.
3. Magnetometer survey – to identify metallic objects buried/on the surface along the route, such as military ordnance, in-service and out of service cables and pipelines.
4. Electromagnetic survey – to identify metallic objects buried/on the surface along the route, such as military ordnance, in-service and out of service cables and pipelines.
5. Sub-bottom profiler survey – to get an interpretation of the soil layers present between the geotechnical stations using profile techniques.

This survey is important for the route engineering, to identify features for which the cable route can be adapted to avoid obstacles and any potential exclusion zones around them.

Geophysical Assessment

The geophysical evaluation is crucial for the cable routing and also forms a part of the input data for trenching and remedial activities together with the geotechnical information.

Boulders and UXOs Identification

The assessment of the survey data and associated reports on obstacles indicates:

- At total of 1730 Side Scan Sonar (SSS) anomalies were detected in the survey corridor [12].
- A total of 910 magnetic anomalies (linear trends and points) were detected in the surveyed corridor [12].
- A total of 87 electromagnetic anomalies were detected in the surveyed corridor [12].

A UXO ALARP Certificate is obtained for the route [09].

Multiple boulder fields have been identified along the route. Survey performed in 2021 identifies 163 boulder fields, defined as 7 or more boulders in an area less than 50m x 50m and 10 bedrock outcrops fully crossing the route corridor.

A boulder clearance operation is performed prior to the installation. However, the preferred mitigation is that of micro-rerouting within the existing survey corridor, especially regarding boulder fields.

Sandwaves

The term sandwaves is being used throughout this document section, which is an informal description terms of different type of bedforms. However, for this document, this definition is deemed sufficient for the assessments made.

Along the route several sandwaves were reported confirmed during the 2018 Survey.

The presence of mobile seabed features is reported in the surveys performed. See Figure 2-5 in Section 2.4.

Shetland 12NM Zone

Around KP 48 and KP 89 sandwaves were noted.

At KP 110 sandwaves are located at a depth of around 100 meters having in general a height of 10 meters above the surrounding seabed.

Offshore

Between KP 111 and KP 118 sandwaves are located at a depth of around 100 meters having in general a height of 10 meters above the surrounding seabed.

Scotland 12NM Zone

Between KP 243.5 and KP 246.45 various sandwaves up to 4 m high run parallel to the route with associated gradients of up to 10°. By comparing the data from 2013 to 2018, it has been estimated that the features have been moving North with approximately 2 meters a year based on NKT assessment.

Sub-Bottom Profiling

The seabed and shallow sub-surface soil conditions can also be assessed by means of a geophysical survey. Such information can be used to interpolate between the geotechnical locations (CPT and/or VC).

Along the Shetland HVDC Link cable route corridor geophysical surveys including sub-bottom profile surveys have been carried out. These surveys were carried out with a sub-bottom profiler that is suitable for investigating the upper 2-10 meters of soil.

It is to be noted that gravel and clay & silt layers (occasionally associated with gas charged sediments) can acoustically blank the underlying layers which is typically bedrock in the Fair Isle Channel area.

Bathymetry

At Weisdale Voe the assumed open trench runs until circa 10m LAT where the seabed decreases to a maximum depth of 124.8 m LAT close to KP 25, where after the seabed gradually rises to 100 m LAT around KP 81.

From KP 81 to approximately KP 94, the depth increases to 114.9m. From that point the seabed rises.

This increment gradually decreases, and from KP 115 to KP 247 the seabed depth range lies between 61 and 83 m LAT.

From KP 248.5 the depth decreases gradually towards 22m LAT close KP 251.8 where the assumed Noss Head HDD pop up hole is located.

A depth profile of the Weisdale Voe – Noss Head route is presented in Figure 2-2.

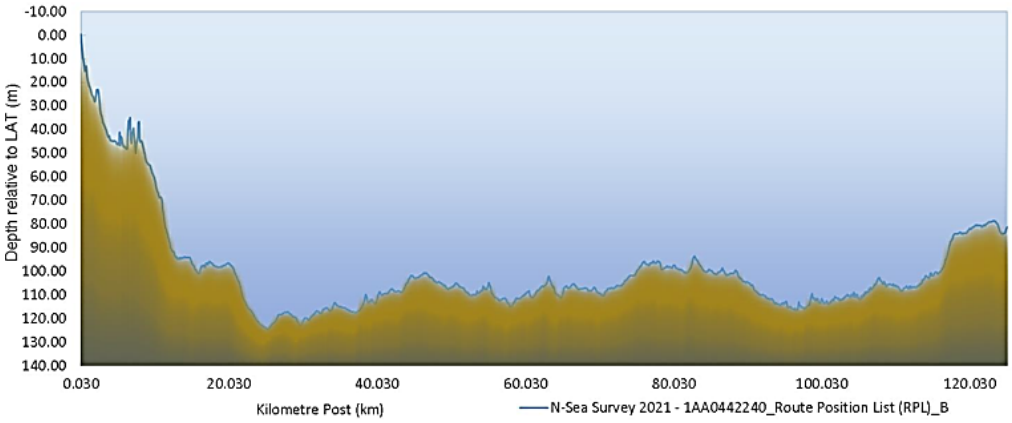

Figure 2-1: Depth Profile Weisdale Voe – Noss Head KP0-KP125.030 ***(source:[12])***

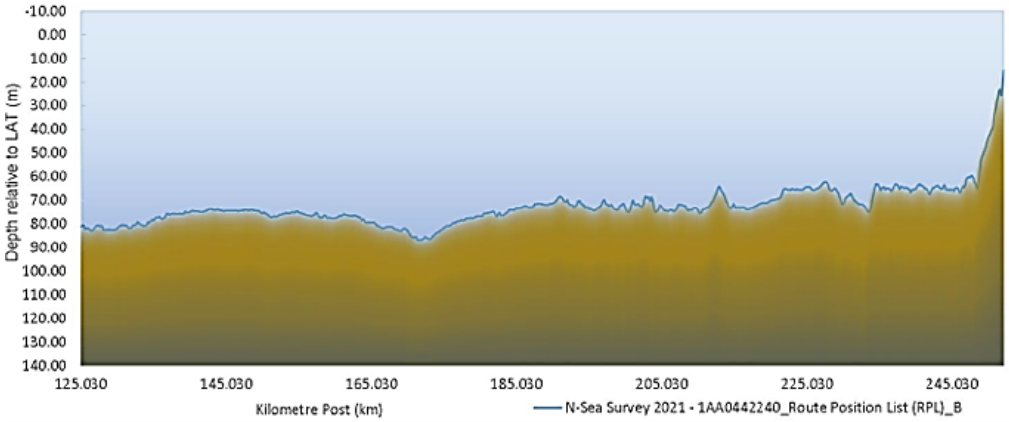

Figure 2-2: Depth Profile Weisdale Voe – Noss Head KP125.030-KP 252.080 ***(source:[12])***

Summary of Geophysical Survey

Summarizing the geophysical survey information from the above mentioned surveys, the following conclusions are drawn:

12NM Zone Shetland

- The northern area until approximately KP 21 comprises a relatively rough and uneven seabed, with mounds and ridges. One of the most prominent features in this section is an area of rocky outcrop. Also, shallow channels across the route can be found.

- From KP 21 the seabed consists of a relatively smooth surface. However, smaller geological features and sandwaves of different size are present.

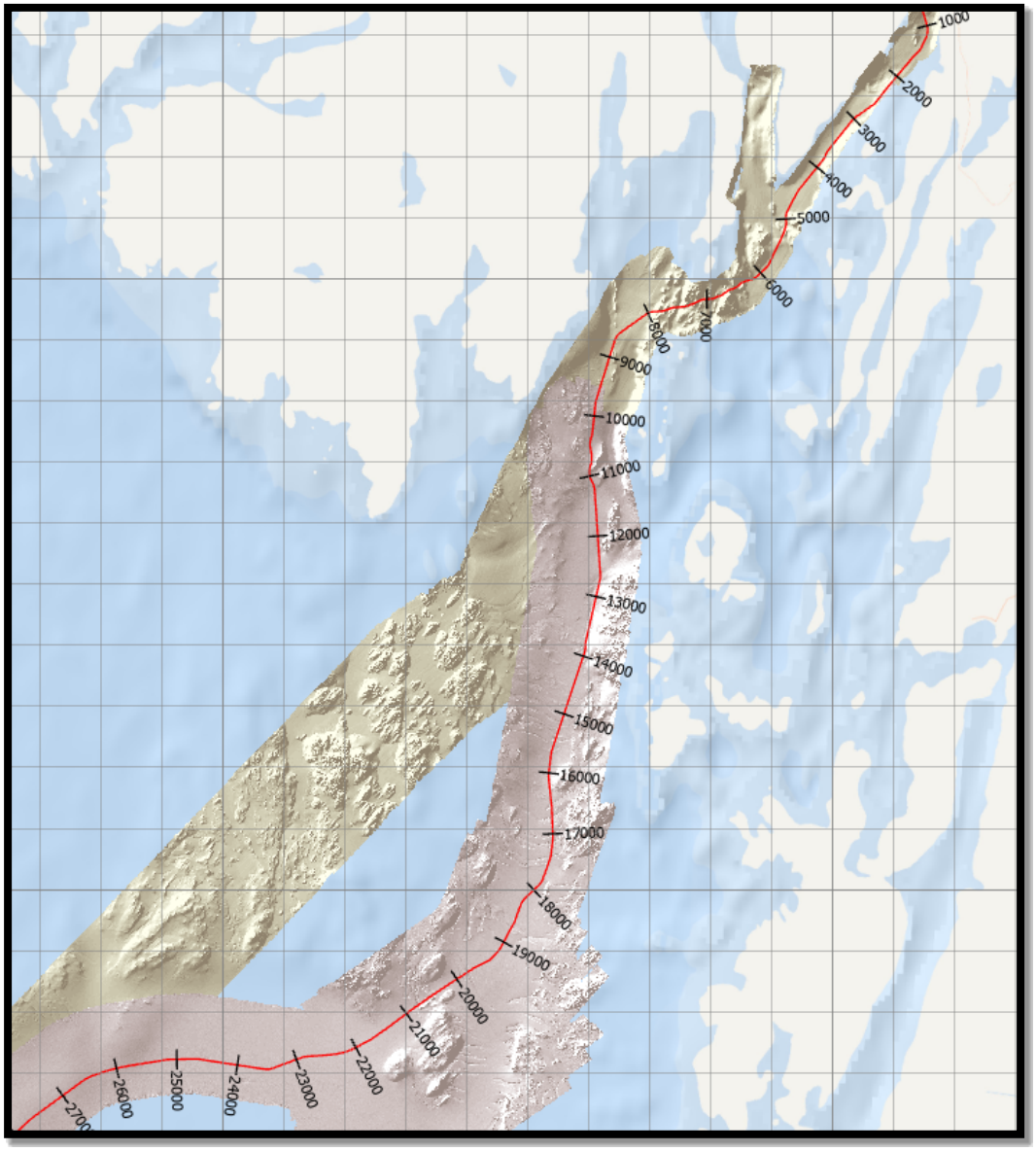

Figure 2-3: Seabed Overview Nearshore Shetland showing RPL [11] Survey data from .

Offshore

- One of the most prominent features in the middle section of the route are the sandwaves located between KP 110 (At the 12NM zone border) and KP 117.5. They are located at a depth of around 100 meters and have in general a height of 10 meters above the surrounding seabed. Since the corridor width at this location from the 2018 survey is not sufficiently wide, the assumptions for these sandwaves are based on survey data pre-2018.

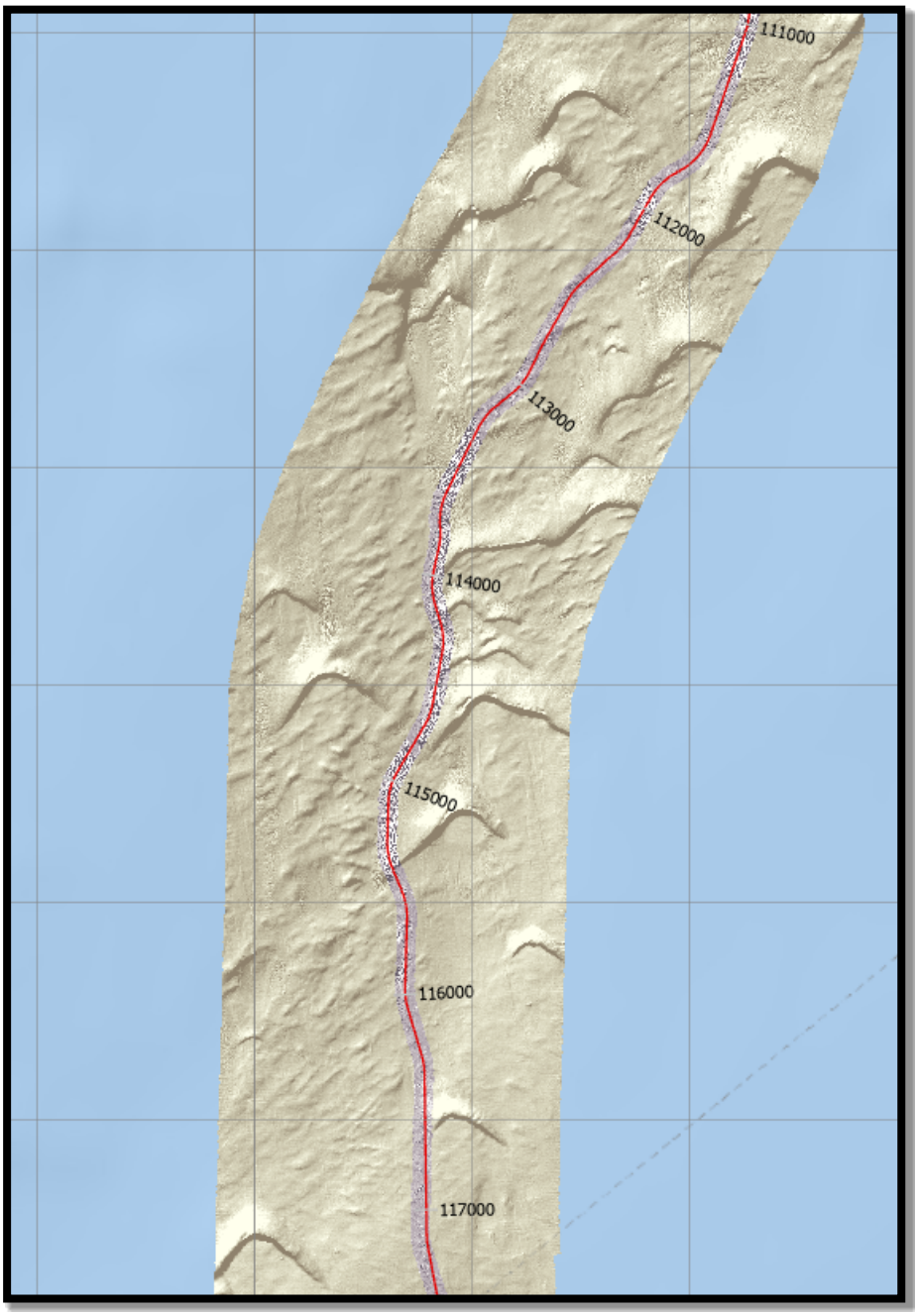

Figure 2-4: Subaqueous Barchan Sandwaves Shown in Survey Data Pre 2018

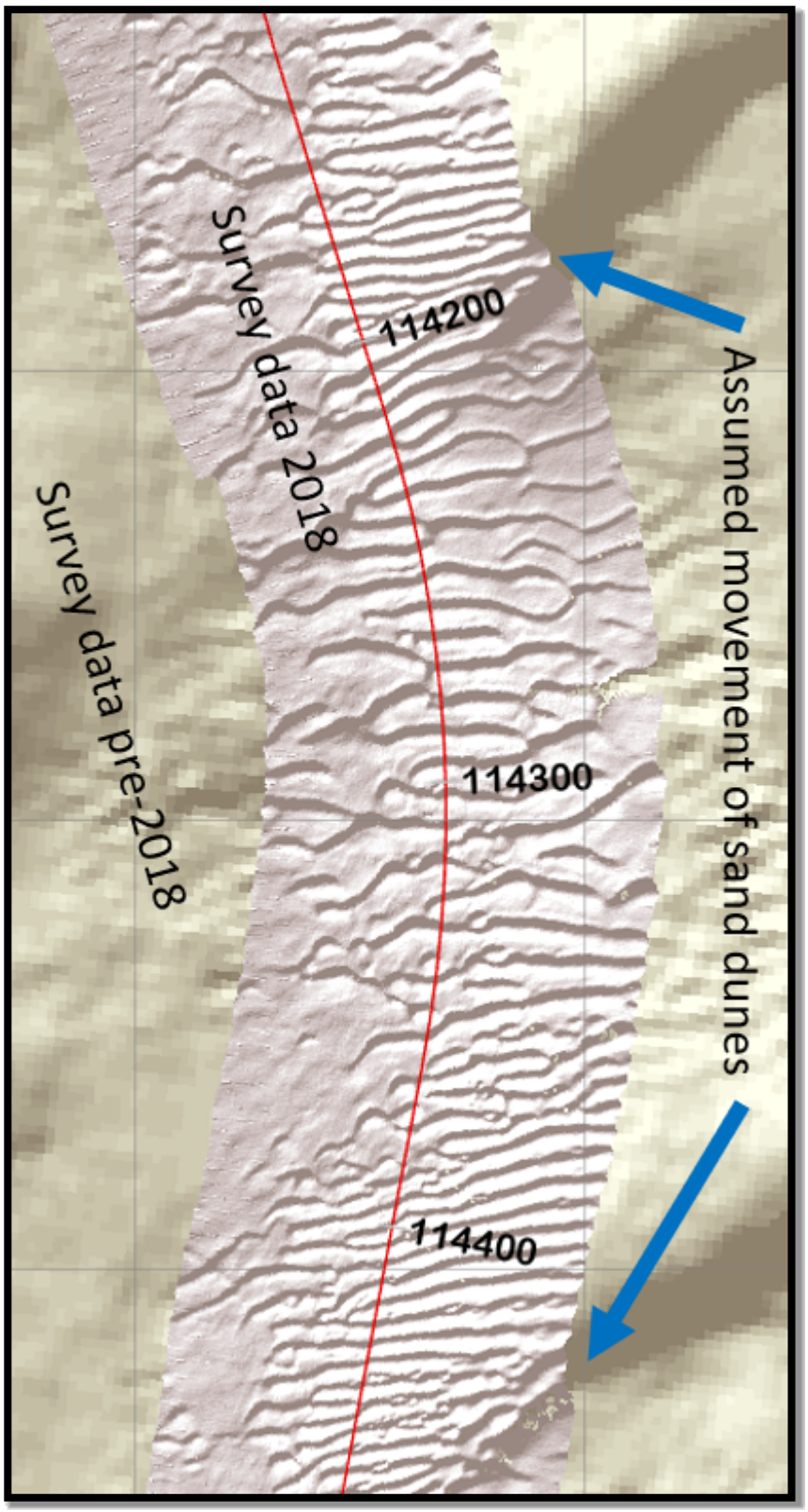

Figure 2-5: Comparing Survey Data from 2018 with Pre 2018 Survey Data

- Beginning at KP 176 numerous mounds intersect the surveyed corridor, which continue frequently to the southern extent of the survey area. The slope values range from moderate to gentle then back to moderate and steep as it moves south. The maximum slope angle of around 9° is found at KP 193.58.

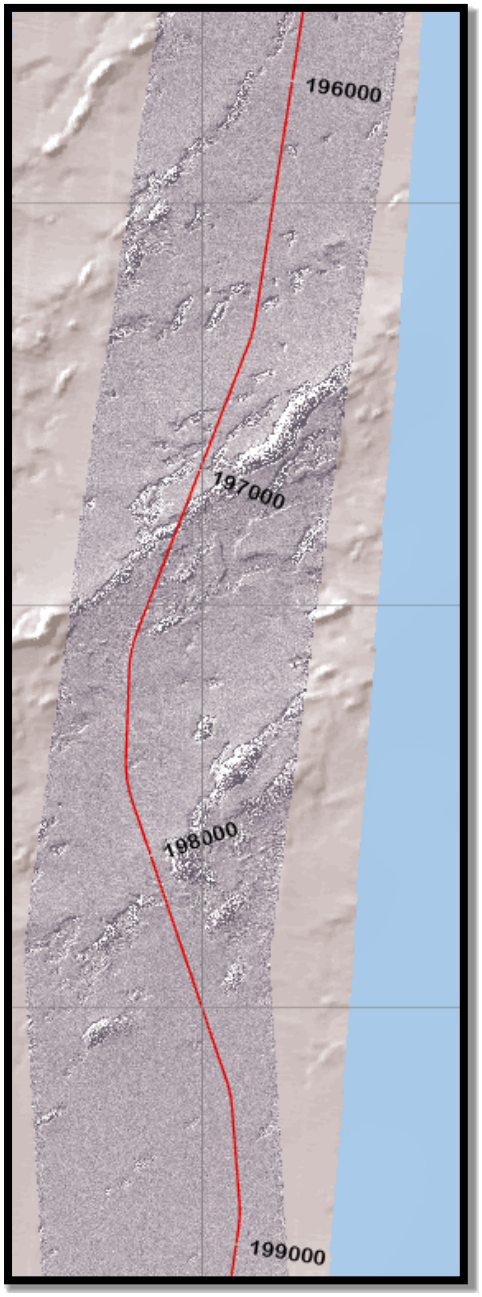

Figure 2-6: Irregular Seabed with Ridges Around KP 197

- From KP 206 towards approximately KP 228, a smooth seafloor with few geological features is present.

- After KP 228 the seafloor is characterized with sections of large sandwaves. One of the most prominent features are the sandwaves and scour areas which can be found between KP 242 and KP 247. These sandwaves have a height of around 3 meters above the surrounding seabed and indicate a complex current regime.

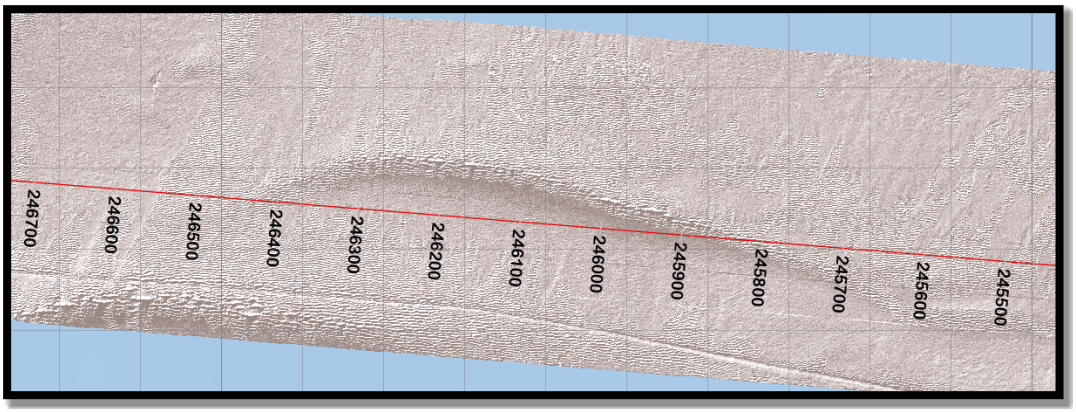

Figure 2-7: Sandwave Around KP 246

2.5 Benthic Survey

Grab sampling and camera equipped with both video and still camera were used in addition to geophysical surveys for the benthic surveys performed in 2013[22]and 2008[26].

When assessing the habitats encountered, the Marine Nature Conservation Review (MNCR) SACFOR abundance scale were used during both of the environmental surveys for recording the abundance of marine benthic flora and fauna.

> *Quoted from the 2008 Environmental Survey:*
>
> *"In order to evaluate the environmental impact, the biological sampling programme "Scope of Work for Biological Survey" was set up by SSE in collaboration with Scottish Natural Heritage, SNH. The primary aim of the biological survey was to identify species and biotopes along the route for further environmental evaluation. The methods used are mainly based on the procedural guidelines of Joint Nature Conservation Committee, JNCC, Marine Monitoring Handbook (Davies J. et al. 2001) and the biotope classification follows the Marine Habitat Classification for Britain and Ireland, originally developed by the Marine Nature Conservation Review (MNCR)."*
>
> *Quoted from the 2013 Environmental Survey:*
>
> *"One of the main objectives of this survey was to identify areas where sensitive or protected habitats and species occurred. Special emphasis was placed on the PMF (Priority Marine Features) species; the ocean quahog Arctica islandica and the heart cockle Glossus humanus.*
>
> *The ocean quahog is also listed on the OSPAR list of protected species and habitats (OSPAR Commission, 2008). Marine habitats and invertebrate species listed in the EC habitat directive (The Council of the European Communities, 1992) and the JNCC's lists of UK BAP (Biodiversity Action*

Plan) were also targeted in this survey (BRIG (ed. Ant Maddock), 2008 (Updated Dec 2011)).

Priority Marine Features, PMFs, are listed by the SNH (Scottish Natural Heritage) as a guidance to which species and habitats found in existing conservation mechanisms require conservation action in Scottish territorial waters (At the time of writing this list was not yet adopted by the Scottish Ministers). The OSPAR list of protected species and habitats lists sensitive habitats and species in need of protection in the North-East Atlantic. For the contracting parties it works as a complement to the EC habitats directives."

The 2013 survey classifies 15 different habitats along the route.

Ocean quahog (Arctica islandica) was observed in low abundance along the whole cable route [02][22][26]. The assessed impact significance of temporary and permanent habitat loss due to the marine works is considered "not significant" for this bivalvia species [02].

No specimens of the heart cockle Glussus humanus were found during the 2013 survey and is also not mentioned in the 2008 survey report.

12NM Zone Shetland

Seapens were observed along the cable installation corridor in Weisdale Voe, however these were not identified as sensitive biotopes for the Weisdale Voe nearshore works [02][22].

12NM Zone Scotland

During the biological surveys [18][22] an area inhabited by Modiolus modiolus (Horse Mussels) was detected to be present on the seabed along the route between KP 250.051 and KP 250.796 [18] within the Scottish 12NM Zone. This feature is classified as a biogenic reef.

Modiolus modiolus is a protected species and no burial or rock placement activities are allowed in this area. The area lies within the Noss Head Nature Conservation Marine Protected Area (MPA).

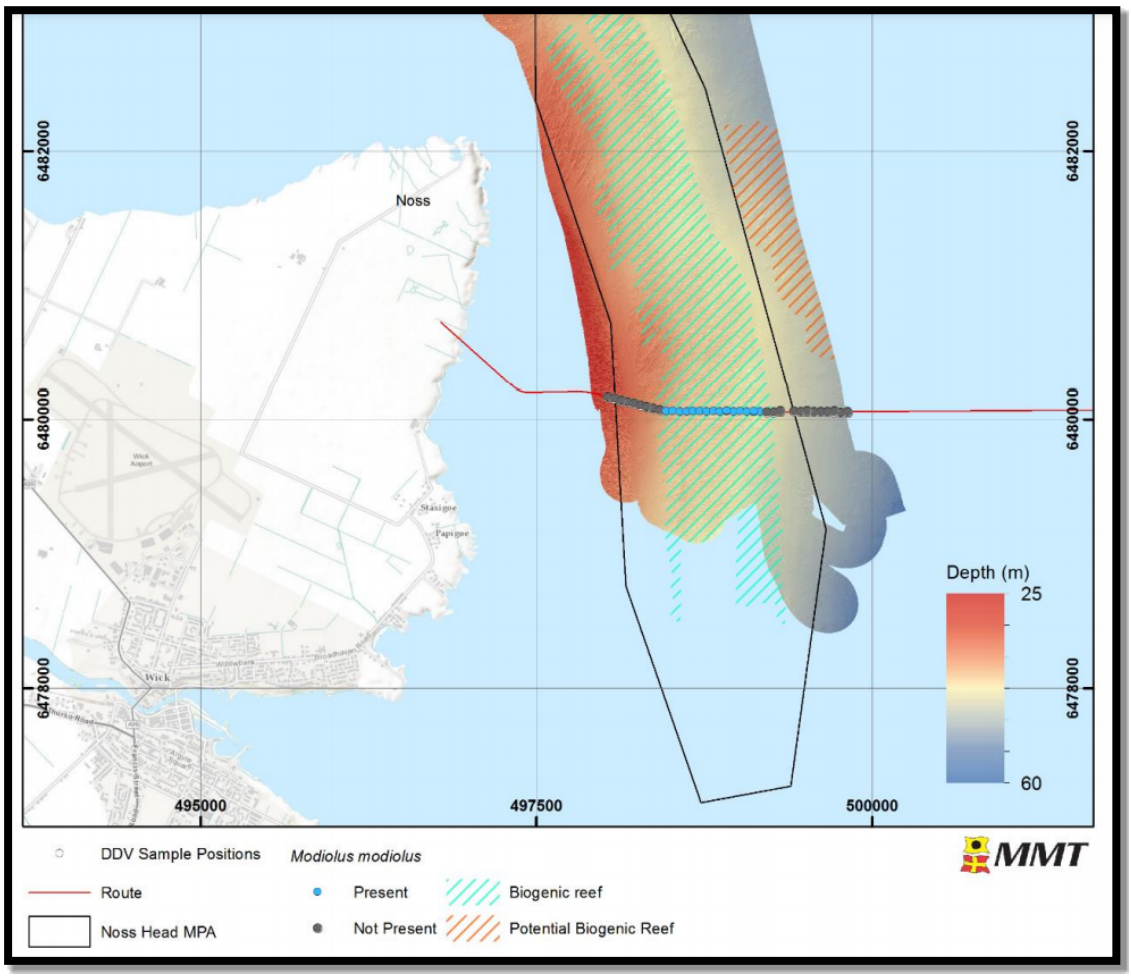

Figure 2-8: Horse Mussel Bed (Marine Growth) Extents (*source:* [18])

For protection method at the Horse Mussel Bed (HMB) see Section 4.4.

Sea-pens were also observed at the southern part of the cable route corridor but is not considered a sensitive biotope.

Offshore Zone

No sensitive biotopes were recorded for the cable corridor offshore. Reference is made to Environmental Appraisal [02].

3 Route Engineering

The process of route engineering assesses the best option to minimise installation and post-installation risk for the marine cable based on the survey data received. The shortest route is not always feasible and route engineering is the basis for any further burial and protection assessments considering the conditions which is encountered along the cable route. Examples such as obstacles at the seabed, steep slopes, pock marks, soil descriptions, bedrock formations and the marine cable crossing existing assets (in-service cables and pipelines) may enforce the cable routing to change heading at these specific locations.

Route engineering is an essential design activity to the planning of cable burial and protection which has consequential environmental benefits. It is the foundation for the further seabed assessments which is done with regards to preparation work such as pre-lay grapnel run (PLGR), boulder removal, trenching works and seabed rock placement. The minimum cable bending radius, minimum alter course radius trenching, maximum grading of trencher and the minimum alter course radius cable lay vessel gives restrictions in how to plan the route and must be adhered to when evaluating the route in regard to avoiding non- or less feasible areas along the planned cable corridor.

Re-routing of current route position list (RPL) within the consent corridor is performed during the engineering stage of the project, to avoid areas where excessive seabed preparation work or challenges to the burial and protection can be assumed from the available survey data. Micro-siting has been performed after retrieved data from 2021 survey, reference to Section 8.1.

4 Methods of Burial and Protection Proposed

For a more detailed description of the methods proposed, reference is made to the Construction Method Statement (CMS). [08].

Seabed features are anticipated to be within cable installation and protection tolerances given that micro-routeing will be conducted to avoid excess slopes.

For sections of the cable route where mega ripples and sandwaves are found, reference is made to CMS.

4.1 Overview

The points listed below will show which sections in the Constructor Method Statement (CMS) where more information regarding the specific activities can be found.

NKT will use the cable installation and protection strategy that comprises as a base case the following:

- PLGR and Route Clearance operations. Route clearance operations consists of boulder removal operations and Cut-and-Peel operations for the Out-of-Service (OOS) crossed assets. Mattress installation and pre-lay rock placement at crossing locations is also part of the preparation works for the cable lay. *CMS Section 8*

- Duct installation by HDD at Noss Head. *CMS Section 6*

- Open trench with PE duct and backfill and Cast-Iron Shells at Weisdale Voe. *CMS Section 5*

- Post cable lay jetting insofar as possible using a tracked jetting trencher. This would be undertaken as a full first-pass followed by a remedial jetting pass where considered necessary / beneficial based on the initial post-trench survey results. *CMS Section 10*

- Remedial rock placement where jetting is unsuccessful in achieving required minimum DOL and/or DOC based on the initial post trench survey results. *CMS Section 11*

- Buried cable (by jetting) with cable protection system at Subsea 7's bundle tow route. *CMS Section 4.4.4*

- Rock placement where trenching is not possible due to shallow soil and/or bedrock. Mechanical cutting tool is considered as an option, however currently not planned for. *CMS Section 11*

- Post lay rock placement at in-service crossings. *CMS Section 11*

- Surface laying the cable with cable protection for crossing the Horse Mussel Bed at Noss Head. *CMS Section 4.4*

- Rock placement at HDD exit area at Noss Head and until reaching Horse Mussel Bed and / or (partly) cable protection system. *CMS Section 11*

For sections of the cable route where mega ripples and sandwaves are found, NKT considerations are included in the Construction Method Statement (CMS). [08].

4.2 Trenching

Jet trenching is the preferred method for cable burial. The current burial assessment conducted identifies only jet trenching to be used. For further details on trenching equipment, see CMS Section 10.

4.3 Subsea Rock Installation

To provide sufficient cover to protect the cable in areas where jet trenching is restricted, or in areas where the backfilling has provided insufficient cover, rock placement will be applied as a methodology for cable protection. At the following locations rock placement shall be applied:

- Bedrock sections near Shetland
- Cable crossings along the route
- Joint locations (2)
- Inner edge of Horse Mussel Bed until HDD pop up hole at Noss Head
- Sections where after trenching works the DOL or DOC is insufficient, depending on the area's soil conditions and risk assessments regarding trawler or anchor impact, remedial rock placement may also be deemed necessary.

For further proposals regarding rock berm design and locations see Section 6.2.

4.4 Cable Protection Systems (CPS)

Four locations, three within the Scottish 12NM zone, and one within the 12NM zone of Shetland CPS will be used for both surface laid and buried cable.

Surface Laid Cable with Protection System, 12NM Zone Scotland

A cable protection system shall be applied to the cables within the Noss Head MPA where sensitive biological seabed features are encountered. The key protected biological seabed feature is the Horse Mussel Bed located within the Noss Head MPA.

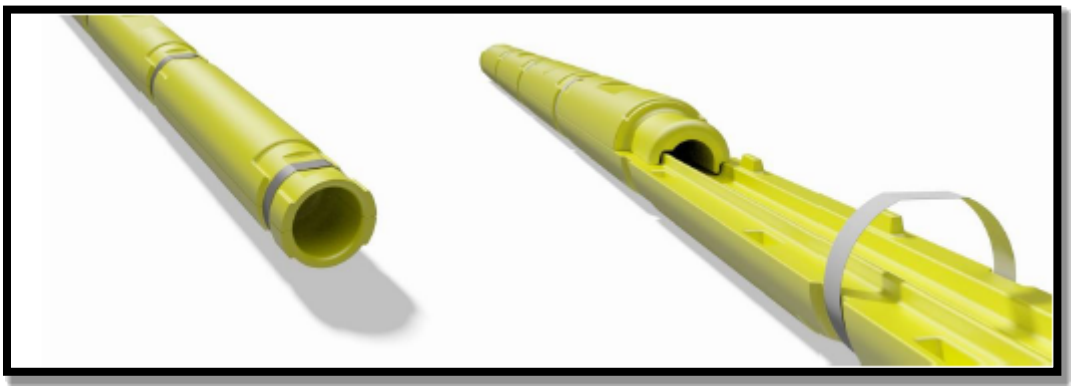

Figure 4-1: Example of External Polyurethane (PU) Protection Sleeve for Cable

The Horse Mussel Bed is considered to have a high sensitivity and is vulnerable to change and damage. Therefore, no trenching or rock placement will be utilised in this area. Instead the cables shall be surface laid and fitted with a ballasted cable protection sleeve. Ballasted cable protection system is required to ensuring on-bottom stability to minimise/prevent movement of the cable which might result in chafing/damage to the Horse Mussel Bed.

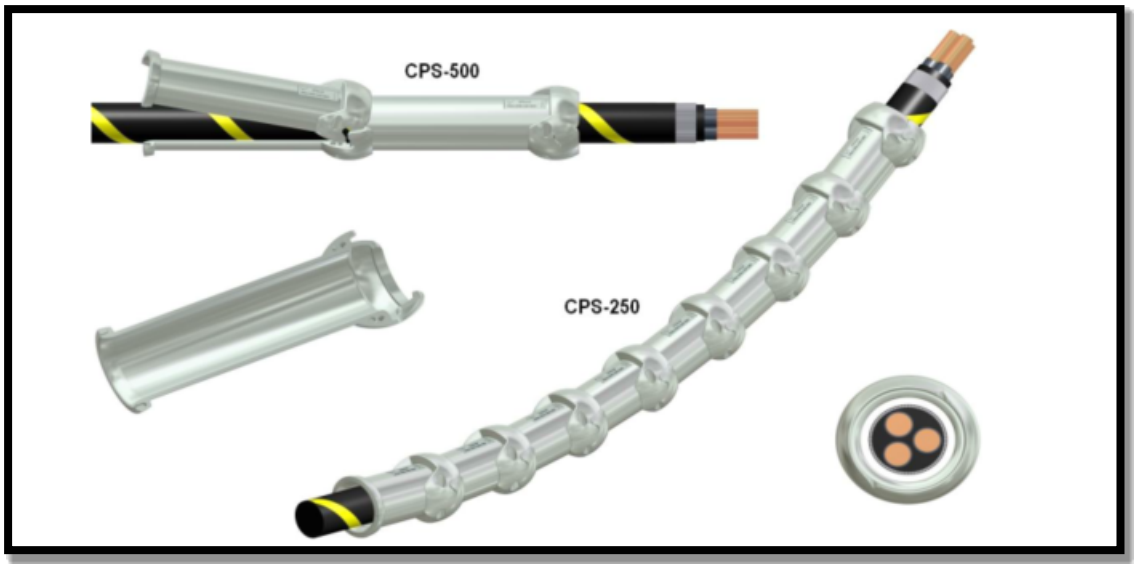

Figure 4-2: Cast-Iron Shell Cable Protection System Example

Application of external protection will be applied 100m before and after the Horse Mussel Bed area.

Buried Cable with Protection System, 12NM Zone Scotland

For the area where the cable is crossing the bundle tow route corridor from Subsea 7's facility at Bridge of Wester, the cable will also be installed with a cable protection system before burial. This is to prevent any potential damage to the cable in case of drag-chains being used for towing the pipe bundles from the production facility to offshore installation sites.

A cable protection system (Polyurethane sleeve) will also be used at the tow route.

CPS in Combination with Rock Berm at Noss Head

From exit point and approximate 80m outwards the cable will have a Cast-Iron Half-shell CPS as a means of protection, in combination with rock berm.

4.5 PE Pipes in Trench, 12NM Zone Shetland

Figure 4-3: Cross-section of Weisdale Voe Landfall Burial shows the cross section of the ducts in trench.

Table 4-1: Cable in Ducts at Weisdale Voe

Number of ducts	Cable bundled	
2	Yes	Bundle in one duct, one spare duct

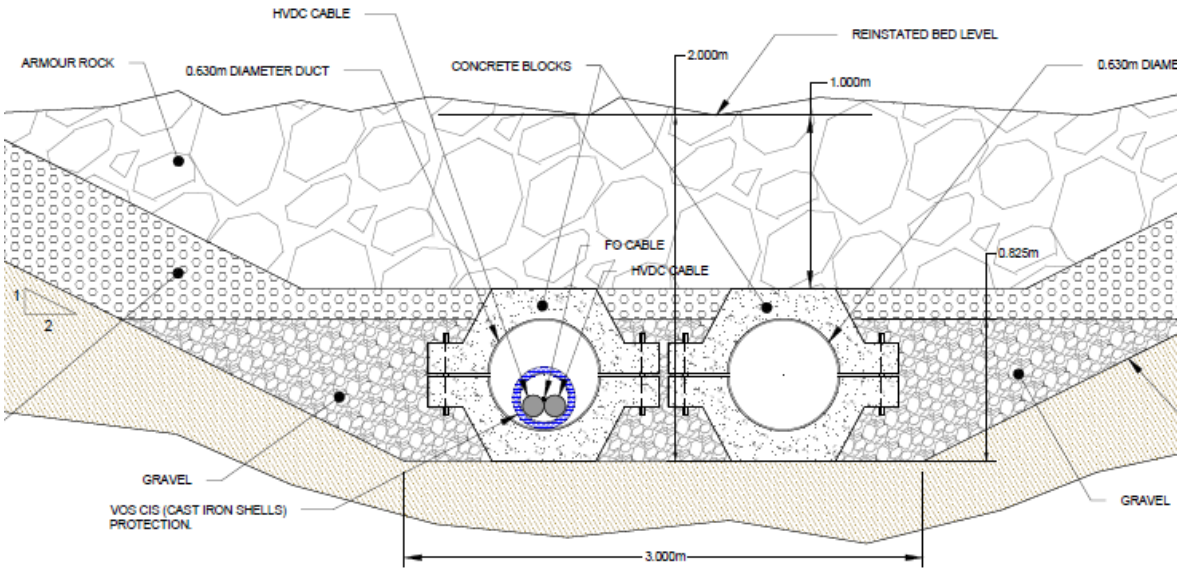

Figure 4-3: Cross-section of Weisdale Voe Landfall Burial in Trench

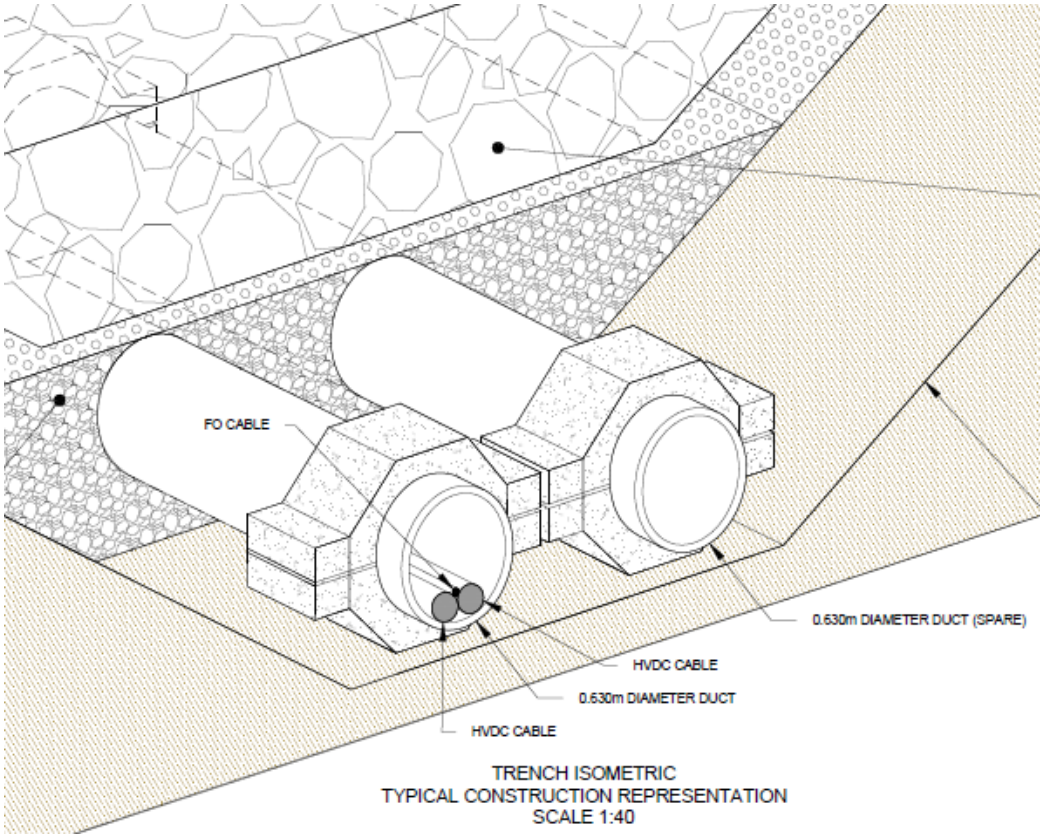

Figure 4-4: Isometric view of Weisdale Voe Landfall Burial in Trench

Cast Iron Half Shells at Weisdale Voe

The Weisdale Voe landfall include the use of cast iron half shells from end of PU ducts at 0.0mLAT (KP0.042) until 8.7mLAT (KP0.175) (planned design – refer to as-builts for final RPL and distances/positions). For further details see CMS Section 5.2. The shells will be lowered into the seabed by means of trenching.

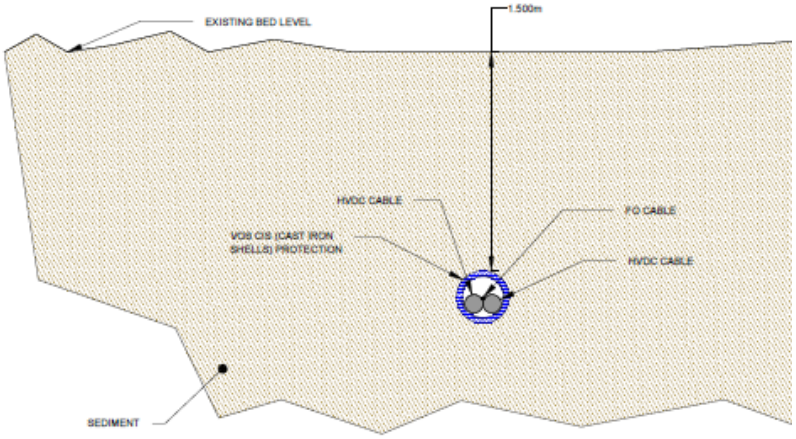

Figure 4-5: Crossection with cables in Cast-Iron Shells

4.6 Horizontal Directional Drilling (HDD), 12NM Zone Scotland

NKT will appoint dedicated subcontractor for the HDD work at Noss Head.

The drill site is located at the same field location at Noss Head which was used in the Caithness-Moray project via a single work site access track.

NKT shall install three (3) HDD steel ducts of 324mm in diameter of approximately 560m in length from the transition joint bay location (HDD Compound) to extend to outside the wave break zone. The HDD is planned at a rock outcrop

Some dive work at the exit point is expected after finalization regarding cutting of excess duct, fitting of steel bell mouths which are secured by welding and pigging of the duct. Further details of methods for the HDD is to be found in the CMS Section 6.

5 Best Method of Practice to Minimise Re-suspension of Sediments During the Works

Reference is made to CEMP Section 4.6.4.

5.1 Cable Lay Operations

Cable laying operations will be performed from a dedicated cable lay vessel, NKT Victoria. The cable will be laid on the seabed where burial by trenching or protection by means of rock placement will be performed by other vessels. Where CPS is installed on the cable, this will be done onboard NKT Victoria prior to lowering the cable to the seabed. Some re-suspension of sediments may be seen during cable-lay operations, however based on the soil data received from surveys, this is expected to be minimal. Silt and soft clay is not heavily represented (23% of the cable route) along the cable route, which will give rise to more sediment re-suspension than sand, gravelly sand and sandy gravel (73% of the cable route).

5.2 Trenching Operations

Trenching operations will be carried out using industry standard burial equipment, operated at minimum power levels required to achieve expected burial in order to maximise sediment retained in trench and thereby minimising re-suspension of sediments. The power levels used are common within the industry, to be able to minimise the sediment suspension during the works. The impact of re-suspension of sediments is expected only in the near vicinity of the trench, less than 10m on either side [02].

OSPAR Commission "Guidelines on Best Environmental Practice (BEP) in Cable Laying and Operation" (Agreement 2012-2) states that

> *"Installation via jetting by means of sledge or ROV or use of a plough involves the lowest environmental impacts. […] Another option is to dredge a trench in which the cable is laid and which is subsequently refilled. However, the latter burial method leads to significantly greater sediment displacement."*

5.3 Rock Placement

Turbidity in the water during the rock placement activities are expected due to the mass flow effect which occurs when the rocks are exiting the fall-pipe. Most of the cable route encompasses sandy gravel (Section 2.3), and where rock is being used as a means of remedial work higher bulk densities are seen for the soil material which in effect gives less sediment re-suspension.

Aggregates used for offshore rock placement should follow their respective grading requirements regarding fines content to reduce the turbidity during installation. Rock material produced for offshore installation generally follow the EN-13383-1 "Armourstone – Part1: Specification" with regards to quality requirements for the material. This standard specifies that the material *"shall not contain any foreign matter in a quantity that will cause damage to the structure or the environment in which it is used."*

To minimize any re-suspension of sediments due to rock placement, the aim is to critically evaluate the tonnage of rocks which will be needed, especially regarding remedial work.

This is done by route engineering and micro-siting to make sure sections which may be challenging to trench are minimized as far as reasonably possible.

Using a fall pipe vessel for rock placement operations increases control of rock placement and reduces speed of the rock placed on the seabed, hence reducing potential sediment disturbance.

For more detailed rock placement activities, reference is made to the Construction Method Statement *Section 11*.

5.4 Horizontal Directional Drilling, HDD

The HDD drill profile will most of the part drill through bedrock. Some discharge of cuttings and drilling fluids will be expected at the exit point for the bore hole. The drill fluid used on this project will be formed from a suspension of bentonite (montmorillonite clay) in fresh water. The drill fluid is fully biodegradable and certified for use in water-well drilling due to its biodegradability and lack of any form of toxicity.

The exit point is below water and, as such, there is little possibility to contain and control breakout as the drill approaches the exit point. Prior to breakout (c. 50m) a dedicated cleaning run of the bore using standard drilling fluid will be performed so as to flush any residual cuttings or detritus from the borehole. The drilling assembly is then run back into the hole and the drilling continues until the drill bit breaks through onto the seabed.

At the HDD exit point, minor to no seabed sediment disturbances are expected due to drilling.

For more detailed horizontal directional drilling activities, reference is made to the Construction Method Statement *Section 6*.

6 Cable Burial and Protection Assessment

Survey data described in Section 2 has been used for the assessment regarding burial and protection of the marine cable.

Where cable burial by trenching cannot be performed the alternative methods mentioned in Sections 4.3, 4.4 and 4.5 will be used. Reasons for no or limited burial by trenching are listed below:

- DOL or DOC achieved by trenching is deemed insufficient to meet the protection criteria,
- No trenching performed due to bedrock formations at the seabed,
- No trenching performed due to crossed assets,
- Environmental assessment in regard to marine flora and fauna restricts burial of the cable,
- No trenching due to water depth restrictions (at landfalls).

6.1 Soil Assessment in Relation to Trenching

The burial assessment performed is based on the latest RPL [11].

For a significant part of the route the soil is classified as coarse material (Holocene sediments). These are soils generally suitable for jet trenching. However, for these sections, remedial jetting passes may be required due to the quick sedimentation of the soil particles when being fluidised.

The main factors that affect jet trenching performance in clay are related to the undrained shear strength and plasticity of the clay. Along the Shetland HVDC Link route there are some sections with cohesive material which can consist of stiff to very stiff clay. A remedial jetting pass and/or remedial rock placement has been proposed as a mitigation measure in case the possibility of encountering stiff to very stiff clay is deemed feasible within trenching depth.

Also, very soft to soft clay and extremely/very soft silt is encountered along the route. With very soft clay a very low bearing capacity should be considered. The possibility of the jet trencher sinkage can occur where bearing capacity is less than 5kPa. This will be minimised with the buoyancy and bearing pressure of the jetting tool configuration.

Bedrock is reported to be within the trenching profile along the Weisdale Voe – Noss Head route. A jet trencher is not able to penetrate bedrock and thus it will impact the required trench depth. When bedrock is encountered the tools will be gradually graded out until the bedrock is passed where after it will be graded in back to required target depth of trench.

The following further burial risks have been identified along the route corridor which may have a possible negative effect on burial operations and feasible burial depth:

- Boulders,
- Other (buried or surface) obstructions along the route.
- Sandwaves

Reference is made to CBPP Overview Charts [10] for a visualization of the different protection methods of the cable.

The project cable protection requirements for DOL and DOC are shown in Table 6-1.

Table 6-1 : Cable Route Required DOL and DOC Zones

KP Start	KP End	DOL (m)	DOC (m)	Notes
0.00	0.22	1.7	1.7	12NM Zone Shetland Open trench with PE ducts and backfilled
0.22	0.165	0.2	0.2	12NM Zone Shetland CPS Section Nearshore trenching
0.165	0.402	1.5	0.3	12NM Zone Shetland Nearshore trenching
0.402	0.75	1.75	0.35	12NM Zone Shetland Start Offshore Trenching
0.75	2.00	1.75	0.35	12NM Zone Shetland
2.00	3.70	1.00	0.15	12NM Zone Shetland
3.70	5.48	1.25	0.35	12NM Zone Shetland
5.48	10.86	1.00	0.15	12NM Zone Shetland
10.86	12.56	1.75	0.35	12NM Zone Shetland
12.60	17.39	1.00	0.15	12NM Zone Shetland
17.39	18.46	1.25	0.35	12NM Zone Shetland
18.46	32.43	1.00	0.15	12NM Zone Shetland
32.43	34.70	1.50	0.35	12NM Zone Shetland
34.70	59.330	1.00	0.15	12NM Zone Shetland
59.330	64.032	1.00	0.15	Offshore
64.032	67.07	1.00	0.15	12NM Zone Shetland
67.07	81.47	1.25	0.15	12NM Zone Shetland
81.47	82.47	1.50	0.35	12NM Zone Shetland
82.47	86.97	1.00	0.15	12NM Zone Shetland
86.97	89.97	1.50	0.35	12NM Zone Shetland
89.97	92.37	1.00	0.15	12NM Zone Shetland
92.37	93.77	1.50	0.35	12NM Zone Shetland
93.77	107.11	1.00	0.15	12NM Zone Shetland
107.11	110.402	1.25	0.15	12NM Zone Shetland
110.402	114.61	1.25	0.15	Offshore
114.61	190.50	1.00	0.15	Offshore
190.50	196.00	1.25	0.15	Offshore
196.00	229.494	1.00	0.15	Offshore
229.494	240.30	1.00	0.15	12NM Zone Scotland
240.30	241.87	1.50	0.60	12NM Zone Scotland. *Bundle Tow Area*

KP Start	KP End	DOL (m)	DOC (m)	Notes
241.87	248.92	1.00	0.15	12NM Zone Scotland
248.92	250.23	-	-	12NM Zone Scotland *Horse Mussel Bed*
250.20	250.72	1.00	0.15	12NM Zone Scotland
250.70	252.30 (Pop-Out)	12NM Zone Scotland *Expected to be rock placement e.g., ≥ 0.6m rock cover*		
252.30 (Pop-Out)	TJB	HDD 12NM Zone Scotland		

Table 6-2 : Sections where Trenching Activities will be Performed

Start KP	Stop KP	Length [m]	Remedial rock work anticipated	Area
0.27	0.76	481	Yes	12NM Zone Shetland
0.76	**2.02**	**1 263**	**No**	**12NM Zone Shetland**
2.04	2.52	480	Yes	12NM Zone Shetland
2.52	3.70	1 180	Yes	12NM Zone Shetland
3.85	**5.16**	**1 314**	**No**	**12NM Zone Shetland**
5.27	5.39	119	Yes	12NM Zone Shetland
5.41	6.25	840	Yes	12NM Zone Shetland
6.25	6.58	330	Yes	12NM Zone Shetland
6.64	6.67	29	Yes	12NM Zone Shetland
6.80	6.97	173	Yes	12NM Zone Shetland
7.79	7.80	16	Yes	12NM Zone Shetland
7.99	**10.90**	**2 909**	**No**	**12NM Zone Shetland**
11.00	**30.44**	**19 440**	**No**	**12NM Zone Shetland**
30.55	**38.30**	**7 755**	**No**	**12NM Zone Shetland**
38.30	53.41	15 105	Yes	12NM Zone Shetland
55.70	59.36	12 836	Yes	12NM Zone Shetland
59.36	64.03	4 670	Yes	Offshore
64.03	68.53	4 503	Yes	12NM Zone Shetland
68.60	71.82	3 214	Yes	12NM Zone Shetland
71.89	103.90	32 014	Yes	12NM Zone Shetland
103.97	110.40	6 429	Yes	12NM Zone Shetland
110.40	115.91	5 215	Yes	Offshore
115.91	***116.81***	***897***	***No***	***Offshore***

Start KP	Stop KP	Length [m]	Remedial rock work anticipated	Area
123.63	124.69	1 059	Yes	Offshore
126.15	127.44	1 287	Yes	Offshore
127.44	127.80	363	Yes	Offshore
127.81	***128.10***	***293***	***No***	***Offshore***
128.10	132.18	4 075	Yes	Offshore
133.41	134.16	744	Yes	Offshore
134.16	***134.75***	***592***	***No***	***Offshore***
135.64	139.63	3 997	Yes	Offshore
139.70	158.00	18 296	Yes	Offshore
158.00	***165.80***	***7 800***	***No***	***Offshore***
165.80	170.20	4 400	Yes	Offshore
172.70	179.70	7 000	Yes	Offshore
179.70	***181.00***	***1 300***	***No***	***Offshore***
181.00	181.90	900	Yes	Offshore
181.90	***181.94***	***39***	***No***	***Offshore***
182.01	***193.62***	***11 608***	***No***	***Offshore***
190.50	193.50	3 005	Yes	Offshore
193.62	194.82	1 207	Yes	Offshore
194.85	***195.02***	***170***	***No***	***Offshore***
195.03	195.14	110	Yes	Offshore
195.17	***195.70***	***530***	***No***	***Offshore***
195.70	196.89	1 187	Yes	Offshore
196.94	197.11	175	Yes	Offshore
197.27	199.31	2 045	Yes	Offshore
199.33	199.59	260	Yes	Offshore
199.63	201.8	2 241	Yes	Offshore
201.90	203.56	1 660	Yes	Offshore
203.70	210.64	6 935	Yes	Offshore
210.66	212.15	1 490	Yes	Offshore
212.22	216.00	3 781	Yes	Offshore
216.00	***221.50***	***5 500***	***No***	***Offshore***
221.50	226.33	4 832	Yes	Offshore
226.40	229.50	3 098	Yes	Offshore
229.50	239.80	10 300	Yes	12NM Zone Scotland
239.80	***246.52***	***6 720***	***No***	***12NM Zone Scotland***

The total planned trenching length is approximately 231km where 101.2km will be within 12NM of Shetland, 112.8km Offshore and 17km within 12NM of Scotland.

Where burial by trenching is deemed insufficient, rock placement will be used to provide sufficient cover for the cable, see further details in Section 6.2

6.2 Alternative Subsea Cable Protection Measures

Where the cable is crossing third party assets such as in-service cables and pipelines, the cable will be laid on the seabed, and rock berms will be placed on top to protect the cable from impacts. Some areas are also not possible to trench due to bedrock formations at the seabed. These areas will also have rock berms protecting the cable on the seabed.

Table 6-3: Planned Surface Laid Cable Locations with Rock Berm Protection Prior to Trenching

Count	KP Start	KP End	Berm Length [m]	Concept	Campaign Schedule	Area
1	2.018	2.040	22	Rock Placement due to no trenching	CP2	12NM Zone Shetland
2	3.700	3.846	146	Rock Placement due to no trenching	CP2	12NM Zone Shetland
3	5.160	5.270	105	Rock Placement due to no trenching	CP2	12NM Zone Shetland
4	5.389	5.410	21	Rock Placement due to no trenching	CP2	12NM Zone Shetland
5	6.580	6.641	61	Rock Placement due to no trenching	CP2	12NM Zone Shetland
6	6.670	6.800	130	Rock Placement due to no trenching	CP2	12NM Zone Shetland
7	6.973	7.785	812	Rock Placement due to no trenching	CP2	12NM Zone Shetland
8	7.801	7.991	190	Rock Placement due to no trenching	CP2	12NM Zone Shetland
9	10.900	11.000	100	Rock Placement due to no trenching	CP2	12NM Zone Shetland
10	30.440	30.545	110	Crossing	CP2	12NM Zone Shetland
11	53.405	55.697	2292	Rock Placement due to no trenching	CP2	12NM Zone Shetland
12	56.995	57.015	25	Inline joint	CP2/CP3	12NM Zone Shetland
13	68.533	68.603	70	Crossing	CP3	12NM Zone Shetland
14	71.817	71.887	70	Crossing	CP3	12NM Zone Shetland
15	103.901	103.971	70	Crossing	CP3	12NM Zone Shetland
16	113.144	113.440	296	Rock Placement due to no trenching	CP3	Offshore
17	116.808	123.630	6822	Rock Placement due to no trenching	CP3	Offshore

Count	KP Start	KP End	Berm Length [m]	Concept	Campaign Schedule	Area
18	124.689	126.154	1465	Rock Placement due to no trenching	CP3	Offshore
19	127.804	127.807	3	Rock Placement due to no trenching	CP3	Offshore
20	132.175	133.414	1239	Rock Placement due to no trenching	CP3	Offshore
21	134.750	135.637	887	Rock Placement due to no trenching	CP3	Offshore
22	139.557	139.627	70	Crossing	CP3	Offshore
23	154.900	155.01	110	Omega Joint KP 155	CP1/CP3	Offshore
24	181.932	182.002	70	Crossing	CP1	Offshore
25	193.576	193.617	41	Rock Placement due to no trenching	CP1	Offshore
26	194.824	194.850	26	Rock Placement due to no trenching	CP1	Offshore
27	195.020	195.030	10	Rock Placement due to no trenching	CP1	Offshore
28	195.140	195.170	30	Rock Placement due to no trenching	CP1	Offshore
29	196.887	196.935	48	Rock Placement due to no trenching	CP1	Offshore
30	197.110	197.265	155	Rock Placement due to no trenching	CP1	Offshore
31	199.310	199.330	20	Rock Placement due to no trenching	CP1	Offshore
32	199.590	199.634	44	Rock Placement due to no trenching	CP1	Offshore
33	201.875	201.900	25	Rock Placement due to no trenching	CP1	Offshore
34	203.560	203.700	140	Rock Placement due to no trenching	CP1	Offshore
35	210.635	210.655	20	Rock Placement due to no trenching	CP1	Offshore
36	212.145	212.219	74	Rock Placement due to no trenching	CP1	Offshore
37	226.323	226.393	70	Crossing	CP1	Offshore
38	246.520	249.710	3190	Rock Placement due to no trenching	CP1	12NM Zone Scotland
39	249.710	249.990	280	Rock Placement due to no trenching	CP1	12NM Zone Scotland
40	250.896	251.892	996	Rock Placement due to no trenching	CP1	12NM Zone Scotland

Once the as-trenching results were available for review changes to the sections for planned rock placement as shown in Table 6-3 were made, which can be seen in Table 6-4 below.

Table 6-4: Planned Surface Laid Cable Locations with Rock Berm Protection After Trenching

Count	KP Start	KP End	Berm Length [m]	Concept	Campaign Schedule	Area
1	1.972	2.020	48	Rock Placement due to no trenching	CP2	12NM Zone Shetland
2	2.176	2.210	34	Rock Placement due to no trenching	CP2	12NM Zone Shetland
3	3.715	3.952	237	Rock Placement due to no trenching	CP2	12NM Zone Shetland
4	5.145	5.292	147	Rock Placement due to no trenching	CP2	12NM Zone Shetland
5	5.390	5.535	145	Rock Placement due to no trenching	CP2	12NM Zone Shetland
6	6.493	6.511	18	Rock Placement due to no trenching	CP2	12NM Zone Shetland
7	6.594	7.868	1274	Rock Placement due to no trenching	CP2	12NM Zone Shetland
8	7.930	7.957	27	Rock Placement due to no trenching	CP2	12NM Zone Shetland
9	10.920	10.990	70	Rock Placement due to no trenching	CP2	12NM Zone Shetland
10	30.461	30.567	106	Crossing: SHEFA-2 Seg 7-3 @ KP30.532	CP2	12NM Zone Shetland
11	53.427	55.727	2300	Rock Placement due to no trenching	CP2	12NM Zone Shetland
12	58.060	58.077	17	Rock Placement due to no trenching	CP2	12NM Zone Shetland
13	58.210	58.276	66	Inline joint - Rock Placement due to no trenching	CP3	12NM Zone Shetland
14	65.785	65.822	37	Rock Placement due to no trenching	CP3	12NM Zone Shetland
15	68.550	68.632	82	Havfrue Segment 5 Crossing	CP3	12NM Zone Shetland
16	70.073	70.140	67	Inline joint - Rock Placement due to no trenching	CP3	12NM Zone Shetland
17	70.140	70.160	20	Rock Placement due to no trenching	CP3	12NM Zone Shetland
18	71.836	71.918	82	AC1 Crossing	CP3	12NM Zone Shetland
19	103.850	103.910	60	R100 Crossing	CP3	12NM Zone Shetland
20	116.950	122.982	6032	Rock Placement due to no trenching	CP3	Offshore
21	136.995	138.455	1460	Rock Placement due to no trenching	CP3	Offshore
22	139.662	139.722	60	SHEFA-2 Seg 8 Crossing	CP3	Offshore
23	181.950	182.030	80	30 inch Piper to Flotta Oil Crossing	CP1	Offshore
24	193.580	193.650	70	Rock Placement due to no trenching	CP1	Offshore
25	194.829	195.082	247	Rock Placement due to no trenching	CP1	Offshore

Count	KP Start	KP End	Berm Length [m]	Concept	Campaign Schedule	Area
26	195.146	195.219	73	Rock Placement due to no trenching	CP1	Offshore
27	196.863	196.939	76	Rock Placement due to no trenching	CP1	Offshore
28	199.600	199.680	74	Rock Placement due to no trenching	CP1	Offshore
29	203.594	203.750	156	Rock Placement due to no trenching	CP1	Offshore
30	204.260	204.360	100	Rock Placement due to no trenching	CP1	Offshore
31	226.353	226.432	79	Shefa-2 Seg 9 @ KP226.388	CP1	Offshore
32	247.042	247.288	246	Rock Placement due to no trenching	CP1	12NM Zone Scotland
33	248.755	249.945	1190	Rock Placement due to no trenching	CP1	12NM Zone Scotland
31	250.923	252.004	1081	Rock Placement due to no trenching	CP1	12NM Zone Scotland

The trenching strategy is based on a confidence level for the tool reaching a certain DOL and achieving the required DOC as detailed in Table 6-1. This section below outlines the areas with medium and low trenching confidence as shown in Table 6-5 identified for remedial rock placement along the specified KP sections.

From Rev E (superseded) the burial assessment confidence levels are rated as following as an input to identify the locations and quantity for remedial rock placement:

- ***High confidence.*** Achieving the required DOL or DOC for more than 90% of the specified section length (KP start – KP stop) (10% remedial work)
- ***Moderate confidence.*** Achieving required DOL or DOC for 70% - 90% of the section (10-30% remedial work)
- ***Low confidence.*** Achieving required DOL or DOC for less than 70% of the section (more than 30% remedial work)

The as-trenched results as shown in Table 6-6 identify the locations for remedial rock placement.

Table 6-5: Areas with Medium and Low Trenching Confidence Level

Section		Section Length [km]	Trenching Success Confidence Level	Estimated Remedial Rock Work of Section Length		Campaign Schedule
KP start	KP End			[%]	[km]	
0.00	0.75	0.75	Low	Alternative protection method anticipated		CP3

2.02	2.45	0.45	Low	100	0.45	CP3
5.48	6.25	0.77	Medium	20	0.15	CP3
6.25	7.00	0.75	Low	100	0.45	CP3
7.80	9.00	1.20	Medium	20	0.24	CP3
56.00	62.80	6.80	Low	50	3.40	CP2/CP3
62.80	63.40	0.60	Low	80	0.48	CP2
63.40	67.00	3.60	Medium	30	1.08	CP2
78.40	81.40	3.00	Medium	10	0.30	CP2
81.40	82.40	1.00	Low	40	0.40	CP2
86.90	92.30	2.00	Medium	20	0.40	CP2
99.50	107.00	7.50	Low	50	3.75	CP2
107.00	114.50	7.50	Low	80	6.00	CP2
114.50	116.80	2.30	Medium	30	2.30	CP2
116.80	128.10	11.30	Low	100	11.30	CP2
128.10	134.00	5.90	Low	50	2.95	CP2
134.00	137.00	3.00	Low	75	2.25	CP2
137.00	151.00	14.00	Low	50	7.00	CP2
151.00	158.00	7.00	Medium	30	2.10	CP1/ CP2
165.80	170.20	4.40	Low	50	2.20	CP1
172.70	179.70	7.00	Low	50	3.50	CP1
190.50	196.00	5.50	Low	60	3.30	CP1
196.00	199.50	3.50	Low	60	2.10	CP1
201.80	205.00	3.20	Low	60	1.92	CP1
212.00	214.00	2.00	Medium	10	0.20	CP1
215.00	216.00	1.00	Low	75	0.75	CP1
221.50	231.00	9.50	Medium	20	1.90	CP1

The as-trenched results for those sections of medium and low confidence where remedial rock placement is required are shown in Table 6-6 identify the locations for remedial rock placement.

Table 6-6: Remedial rock berm locations

Start KP	End KP	Distance KP Start - KP End [m]	Concept	Campaign Schedule	Area
6.154	6.217	63	Remedial, post-trenching	CP2	12NM Zone Shetland
6.347	6.403	56	Remedial, post-trenching	CP2	12NM Zone Shetland
6.511	6.594	83	Remedial, post-trenching	CP2	12NM Zone Shetland
7.868	7.930	62	Remedial, post-trenching	CP2	12NM Zone Shetland
7.957	7.989	32	Remedial, post-trenching	CP2	12NM Zone Shetland
8.636	8.684	48	Remedial, post-trenching	CP2	12NM Zone Shetland
40.325	40.380	55	Remedial, post-trenching	CP2	12NM Zone Shetland

Start KP	End KP	Distance KP Start - KP End [m]	Concept	Campaign Schedule	Area
44.542	44.593	51	Remedial, post-trenching	CP2	12NM Zone Shetland
45.328	45.462	134	Remedial, post-trenching	CP2	12NM Zone Shetland
46.282	46.458	176	Remedial, post-trenching	CP2	12NM Zone Shetland
50.636	50.778	142	Remedial, post-trenching	CP2	12NM Zone Shetland
53.381	53.431	50	Remedial, post-trenching	CP2	12NM Zone Shetland
57.208	57.559	351	Remedial, post-trenching	CP2	12NM Zone Shetland
57.720	57.783	63	Remedial, post-trenching	CP2	12NM Zone Shetland
57.991	58.060	69	Remedial, post-trenching	CP2	12NM Zone Shetland
58.077	58.145	68	Remedial, post-trenching	CP2	12NM Zone Shetland
58.276	59.000	724	Remedial, post-trenching	CP3	12NM Zone Shetland
61.731	61.853	122	Remedial, post-trenching	CP3	Offshore
62.812	63.420	608	Remedial, post-trenching	CP3	Offshore
65.008	65.180	172	Remedial, post-trenching	CP3	12NM Zone Shetland
69.195	69.268	73	Remedial, post-trenching	CP3	12NM Zone Shetland
69.399	69.415	16	Remedial, post-trenching	CP3	12NM Zone Shetland
69.516	69.525	9	Remedial, post-trenching	CP3	12NM Zone Shetland
74.074	74.084	10	Remedial, post-trenching	CP3	12NM Zone Shetland
76.614	76.655	41	Remedial, post-trenching	CP3	12NM Zone Shetland
76.945	77.030	85	Remedial, post-trenching	CP3	12NM Zone Shetland
78.260	78.318	58	Remedial, post-trenching	CP3	12NM Zone Shetland
78.424	80.135	1711	Remedial, post-trenching	CP3	12NM Zone Shetland
80.259	80.594	335	Remedial, post-trenching	CP3	12NM Zone Shetland
81.007	81.310	303	Remedial, post-trenching	CP3	12NM Zone Shetland
81.835	81.875	40	Remedial, post-trenching	CP3	12NM Zone Shetland
81.975	82.150	175	Remedial, post-trenching	CP3	12NM Zone Shetland
84.452	84.945	493	Remedial, post-trenching	CP3	12NM Zone Shetland
85.031	85.975	944	Remedial, post-trenching	CP3	12NM Zone Shetland
86.098	86.728	630	Remedial, post-trenching	CP3	12NM Zone Shetland
86.810	86.875	65	Remedial, post-trenching	CP3	12NM Zone Shetland
86.917	87.077	160	Remedial, post-trenching	CP3	12NM Zone Shetland
87.280	87.330	50	Remedial, post-trenching	CP3	12NM Zone Shetland
88.465	88.832	367	Remedial, post-trenching	CP3	12NM Zone Shetland
90.095	90.295	200	Remedial, post-trenching	CP3	12NM Zone Shetland
91.925	92.130	205	Remedial, post-trenching	CP3	12NM Zone Shetland
92.265	92.315	50	Remedial, post-trenching	CP3	12NM Zone Shetland

Start KP	End KP	Distance KP Start - KP End [m]	Concept	Campaign Schedule	Area
93.105	93.150	45	Remedial, post-trenching	CP3	12NM Zone Shetland
93.405	93.705	300	Remedial, post-trenching	CP3	12NM Zone Shetland
94.059	94.101	42	Remedial, post-trenching	CP3	12NM Zone Shetland
94.350	94.370	20	Remedial, post-trenching	CP3	12NM Zone Shetland
94.468	94.573	105	Remedial, post-trenching	CP3	12NM Zone Shetland
95.095	96.305	1210	Remedial, post-trenching	CP3	12NM Zone Shetland
96.398	96.500	102	Remedial, post-trenching	CP3	12NM Zone Shetland
96.540	97.045	505	Remedial, post-trenching	CP3	12NM Zone Shetland
97.185	103.550	6365	Remedial, post-trenching	CP3	12NM Zone Shetland
103.600	103.850	250	Remedial, post-trenching	CP3	12NM Zone Shetland
103.910	105.325	1415	Remedial, post-trenching	CP3	12NM Zone Shetland
105.367	105.500	133	Remedial, post-trenching	CP3	12NM Zone Shetland
105.563	105.610	47	Remedial, post-trenching	CP3	12NM Zone Shetland
105.655	106.501	846	Remedial, post-trenching	CP3	12NM Zone Shetland
106.548	107.045	497	Remedial, post-trenching	CP3	12NM Zone Shetland
107.101	107.200	99	Remedial, post-trenching	CP3	12NM Zone Shetland
107.270	108.200	930	Remedial, post-trenching	CP3	12NM Zone Shetland
108.310	112.080	3770	Remedial, post-trenching	CP3	12NM Zone Shetland/Offshore
112.218	112.812	594	Remedial, post-trenching	CP3	Offshore
112.870	113.765	895	Remedial, post-trenching	CP3	Offshore
114.123	114.172	49	Remedial, post-trenching	CP3	Offshore
115.110	115.150	40	Remedial, post-trenching	CP3	Offshore
115.248	115.310	62	Remedial, post-trenching	CP3	Offshore
115.550	115.911	361	Remedial, post-trenching	CP3	Offshore
116.122	116.568	446	Remedial, post-trenching	CP3	Offshore
116.634	116.95	316	Remedial, post-trenching	CP3	Offshore
122.982	123.835	853	Remedial, post-trenching	CP3	Offshore
123.885	123.925	40	Remedial, post-trenching	CP3	Offshore
124.065	131.732	7667	Remedial, post-trenching	CP3	Offshore
131.813	131.826	13	Remedial, post-trenching	CP3	Offshore
131.870	133.520	1650	Remedial, post-trenching	CP3	Offshore
133.672	**133.845**	173	Remedial, post-trenching	CP3	Offshore
134.010	136.922	2912	Remedial, post-trenching	CP3	Offshore
139.410	139.662	252	Remedial, post-trenching	CP3	Offshore
139.722	142.291	2569	Remedial, post-trenching	CP3	Offshore

Start KP	End KP	Distance KP Start - KP End [m]	Concept	Campaign Schedule	Area
142.400	143.558	1158	Remedial, post-trenching	CP3	Offshore
143.832	143.842	10	Remedial, post-trenching	CP3	Offshore
143.896	143.986	90	Remedial, post-trenching	CP3	Offshore
144.052	144.140	88	Remedial, post-trenching	CP3	Offshore
144.302	144.328	26	Remedial, post-trenching	CP3	Offshore
144.925	145.432	507	Remedial, post-trenching	CP3	Offshore
146.160	146.545	385	Remedial, post-trenching	CP3	Offshore
146.592	146.612	20	Remedial, post-trenching	CP3	Offshore
146.962	147.243	281	Remedial, post-trenching	CP3	Offshore
147.306	147.337	31	Remedial, post-trenching	CP3	Offshore
147.381	148.002	621	Remedial, post-trenching	CP3	Offshore
148.932	148.942	10	Remedial, post-trenching	CP3	Offshore
149.100	149.240	140	Remedial, post-trenching	CP3	Offshore
149.290	149.895	605	Remedial, post-trenching	CP3	Offshore
150.100	150.500	400	Remedial, post-trenching	CP3	Offshore
150.635	151.249	614	Remedial, post-trenching	CP3	Offshore
152.508	152.518	10	Remedial, post-trenching	CP3	Offshore
152.664	152.692	28	Remedial, post-trenching	CP3	Offshore
153.032	153.052	20	Remedial, post-trenching	CP3	Offshore
153.110	153.322	212	Remedial, post-trenching	CP3	Offshore
153.368	153.404	36	Remedial, post-trenching	CP3	Offshore
153.890	154.172	282	Remedial, post-trenching	CP3	Offshore
154.240	154.270	30	Remedial, post-trenching	CP3	Offshore
154.357	154.415	58	Remedial, post-trenching	CP3	Offshore
154.464	154.505	41	Remedial, post-trenching	CP3	Offshore
0.078	0.120	42	Omega Joint @ KP155	CP3	Offshore
0.240	0.295	55	Omega Joint @ KP155	CP3	Offshore
0.430	0.457	27	Omega Joint @ KP155	CP3	Offshore
0.664	0.734	70	Omega Joint @ KP155	CP3	Offshore
155.000	155.050	50	Remedial, post-trenching	CP1	Offshore
155.380	155.590	210	Remedial, post-trenching	CP1	Offshore
155.670	155.790	120	Remedial, post-trenching	CP1	Offshore
155.830	156.530	700	Remedial, post-trenching	CP1	Offshore
156.650	156.840	190	Remedial, post-trenching	CP1	Offshore
157.160	157.560	400	Remedial, post-trenching	CP1	Offshore

Start KP	End KP	Distance KP Start - KP End [m]	Concept	Campaign Schedule	Area
157.720	157.850	130	Remedial, post-trenching	CP1	Offshore
158.430	158.710	280	Remedial, post-trenching	CP1	Offshore
160.200	160.278	78	Remedial, post-trenching	CP1	Offshore
160.340	160.390	50	Remedial, post-trenching	CP1	Offshore
160.440	160.560	120	Remedial, post-trenching	CP1	Offshore
160.600	160.650	50	Remedial, post-trenching	CP1	Offshore
160.720	160.850	130	Remedial, post-trenching	CP1	Offshore
161.100	161.200	100	Remedial, post-trenching	CP1	Offshore
161.240	161.290	50	Remedial, post-trenching	CP1	Offshore
161.491	161.547	56	Remedial, post-trenching	CP1	Offshore
161.601	161.712	111	Remedial, post-trenching	CP1	Offshore
161.950	162.000	50	Remedial, post-trenching	CP1	Offshore
162.160	162.238	78	Remedial, post-trenching	CP1	Offshore
164.930	164.980	50	Remedial, post-trenching	CP1	Offshore
167.840	167.930	90	Remedial, post-trenching	CP1	Offshore
167.950	168.000	50	Remedial, post-trenching	CP1	Offshore
168.200	168.250	50	Remedial, post-trenching	CP1	Offshore
169.710	169.760	50	Remedial, post-trenching	CP1	Offshore
170.640	170.690	50	Remedial, post-trenching	CP1	Offshore
174.510	174.560	50	Remedial, post-trenching	CP1	Offshore
188.550	188.600	50	Remedial, post-trenching	CP1	Offshore
190.850	190.900	50	Remedial, post-trenching	CP1	Offshore
191.330	191.380	50	Remedial, post-trenching	CP1	Offshore
192.080	192.130	50	Remedial, post-trenching	CP1	Offshore
192.420	192.508	88	Remedial, post-trenching	CP1	Offshore
193.650	193.809	159	Remedial, post-trenching	CP1	Offshore
194.400	194.450	50	Remedial, post-trenching	CP1	Offshore
196.940	197.050	110	Remedial, post-trenching	CP1	Offshore
197.308	197.410	102	Remedial, post-trenching	CP1	Offshore
199.300	199.350	50	Remedial, post-trenching	CP1	Offshore
201.500	201.550	50	Remedial, post-trenching	CP1	Offshore
201.650	201.700	50	Remedial, post-trenching	CP1	Offshore
201.880	201.930	50	Remedial, post-trenching	CP1	Offshore
202.800	202.850	50	Remedial, post-trenching	CP1	Offshore
203.400	203.450	50	Remedial, post-trenching	CP1	Offshore

Start KP	End KP	Distance KP Start - KP End [m]	Concept	Campaign Schedule	Area
203.940	203.990	50	Remedial, post-trenching	CP1	Offshore
204.070	204.140	70	Remedial, post-trenching	CP1	Offshore
204.450	204.500	50	Remedial, post-trenching	CP1	Offshore
204.710	204.810	100	Remedial, post-trenching	CP1	Offshore
205.150	205.200	50	Remedial, post-trenching	CP1	Offshore
206.450	206.500	50	Remedial, post-trenching	CP1	Offshore
206.800	206.850	50	Remedial, post-trenching	CP1	Offshore
207.010	207.150	140	Remedial, post-trenching	CP1	Offshore
207.330	207.380	50	Remedial, post-trenching	CP1	Offshore
207.500	207.550	50	Remedial, post-trenching	CP1	Offshore
207.700	207.950	250	Remedial, post-trenching	CP1	Offshore
207.990	208.130	140	Remedial, post-trenching	CP1	Offshore
208.280	208.370	90	Remedial, post-trenching	CP1	Offshore
208.950	209.000	50	Remedial, post-trenching	CP1	Offshore
210.050	210.100	50	Remedial, post-trenching	CP1	Offshore
212.710	212.770	60	Remedial, post-trenching	CP1	Offshore
212.820	212.960	140	Remedial, post-trenching	CP1	Offshore
213.500	213.640	140	Remedial, post-trenching	CP1	Offshore
213.785	213.945	160	Remedial, post-trenching	CP1	Offshore
214.060	214.185	125	Remedial, post-trenching	CP1	Offshore
214.630	214.800	170	Remedial, post-trenching	CP1	Offshore
214.880	214.900	20	Remedial, post-trenching	CP1	Offshore
215.000	215.050	50	Remedial, post-trenching	CP1	Offshore
215.230	215.710	480	Remedial, post-trenching	CP1	Offshore
221.760	221.880	120	Remedial, post-trenching	CP1	Offshore
222.150	222.200	50	Remedial, post-trenching	CP1	Offshore
222.400	222.510	110	Remedial, post-trenching	CP1	Offshore
223.850	223.900	50	Remedial, post-trenching	CP1	Offshore
224.190	224.470	280	Remedial, post-trenching	CP1	Offshore
224.700	224.790	90	Remedial, post-trenching	CP1	Offshore
224.850	224.970	120	Remedial, post-trenching	CP1	Offshore
225.030	225.090	60	Remedial, post-trenching	CP1	Offshore
225.150	225.810	660	Remedial, post-trenching	CP1	Offshore
226.110	226.310	200	Remedial, post-trenching	CP1	Offshore
227.010	227.990	980	Remedial, post-trenching	CP1	Offshore

Start KP	End KP	Distance KP Start - KP End [m]	Concept	Campaign Schedule	Area
228.100	228.150	50	Remedial, post-trenching	CP1	Offshore
228.990	229.040	50	Remedial, post-trenching	CP1	Offshore
229.320	229.370	50	Remedial, post-trenching	CP1	Offshore
234.130	234.180	50	Remedial, post-trenching	CP1	2NM Zone, Scotland
234.490	234.640	150	Remedial, post-trenching	CP1	2NM Zone, Scotland
235.170	235.230	60	Remedial, post-trenching	CP1	2NM Zone, Scotland
235.270	235.360	90	Remedial, post-trenching	CP1	2NM Zone, Scotland
235.580	235.630	50	Remedial, post-trenching	CP1	2NM Zone, Scotland
237.200	237.310	110	Remedial, post-trenching	CP1	2NM Zone, Scotland
237.620	237.780	160	Remedial, post-trenching	CP1	2NM Zone, Scotland
237.820	238.210	390	Remedial, post-trenching	CP1	2NM Zone, Scotland
238.610	238.660	50	Remedial, post-trenching	CP1	2NM Zone, Scotland
239.020	239.150	130	Remedial, post-trenching	CP1	2NM Zone, Scotland
239.260	239.360	100	Remedial, post-trenching	CP1	2NM Zone, Scotland
239.410	239.530	120	Remedial, post-trenching	CP1	2NM Zone, Scotland
246.420	246.470	50	Remedial, post-trenching	CP1	2NM Zone, Scotland
246.610	247.042	432	Remedial, post-trenching	CP1	2NM Zone, Scotland
247.288	248.755	1467	Remedial, post-trenching	CP1	2NM Zone, Scotland

Out-of-Service cables (OOS) are cut and removed from the cable corridor and at these locations, burial of the cable by trenching is expected. Exemption is OOS “UK-Faroes_Rev1” which is in the close vicinity of an existing crossing location. This cable was not detected during survey, however it has been decided to assume the informed crossing location.

Rock Berm Design

For areas where no trenching will be performed, the minimum DOC by rock placement will be 0.6m excluding the nearshore berm at Noss Head. Top width is 1m for all berms.

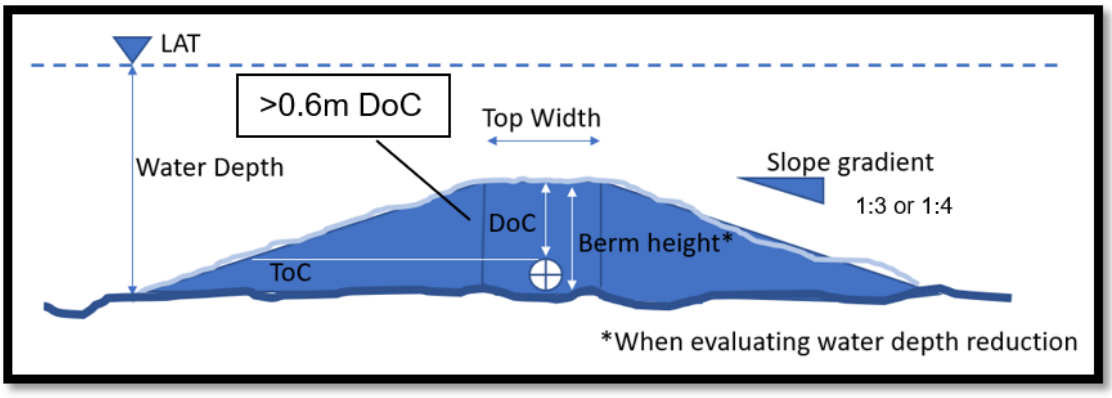

Figure 6-1: Rock Berm Design for Cable on Seabed (Not to Scale)

For trenched areas where the burial of the cable by trenching is deemed not sufficient, remedial rock placement is required. The total cover of the cable shall be minimum 0.6m, however this cover will be a combination of the trenched seabed material and additional rock cover which makes sure the DOC is a minimum of 0.6m.

In Section 7 it has been assumed a theoretical rock berm height of 0.3m on top of seabed for remedial rock placement areas where DOL is 1.0m. 0.3m is normally quoted as a minimum berm height from an operational perspective as any lower height is unfeasible to produce by a standard DPFPV using and offshore aggregate material grading 22-125mm (1-5”).

The remedial berm height is dependent on local soil conditions and assumptions of seabed morphology within that certain region along the route. The berm height varies between 0.3m to 0.6m top of seabed depending on the location of the berm.

From REV E: In Section 7 it has been assumed a 0.3m rock berm on top of seabed for remedial rock placement areas. 0.3m is normally quoted as a minimum berm height from an operational perspective as any lower height is unfeasible to produce by a standard DPFPV using and offshore aggregate material grading 22-125mm (1-5”).

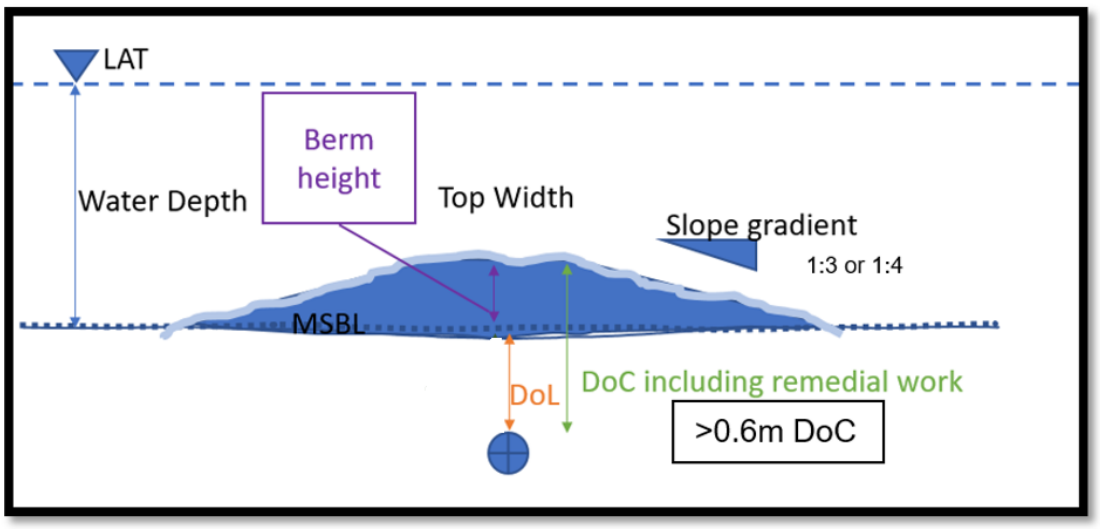

Figure 6-2: Remedial Rock Berm Design (Not to Scale)

DOL from trenching + Berm Height (on top of as-found seabed, not MSBL) = DOC including remedial work.

After trenching, DOC and DOL is assessed. Then a final decision is made on the extent of remedial rock berms.

Material sizes (grading) intended for the rock berms are further discussed in CMS, Section 11.5.

Nearshore Rock Berm Noss Head

Between the HDD exit point at Noss Head and the start of the Horse Mussel Bed the cable will be surface laid with a double layer rock berm protection. This is subject to detailed engineering.

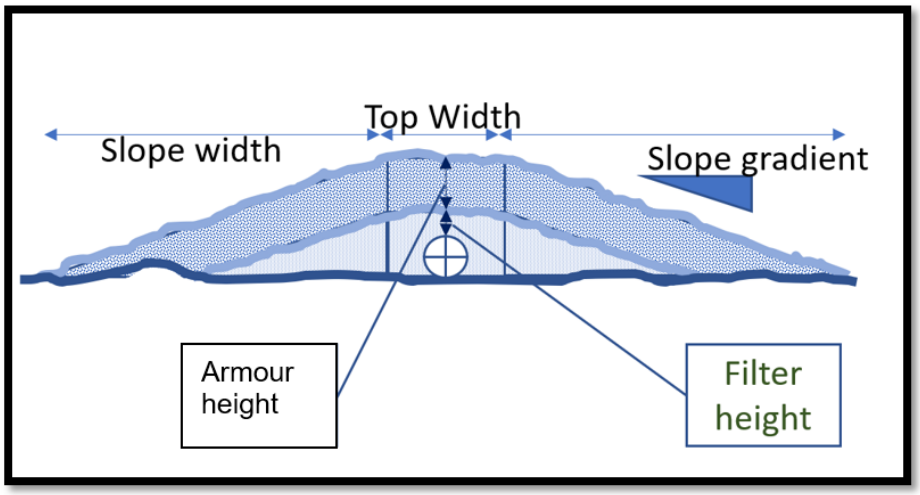

Figure 6-3: Noss Head Nearshore Berm Design Profile (Not to Scale)

Rock Characteristics

Only crushed fresh and un-weathered rock will be used. All rock shall be of sound origin, chemically stable, strong, hard, durable, and of limited porosity.

Furthermore, all rock shall be free of adhering coatings, clay lumps, coal/coal residue, contamination from hazardous materials (hazardous being a substance that can cause harm to the environment or living organisms) and organic materials.

Rock Material Testing and Inspection

Quality control (QC) testing and inspection is intended at the investigation / selection stage of the supply followed by regular QC testing and inspection during production and transport. All testing will be conducted by a certified independent instance. EN 13883-1:2013 is a widely used standard, recognized by several countries for quality control of the rock material used in construction works both offshore and onshore. It defines some of the more standard aggregates and requirements mentioned in this document are also to be found in this norm.

In accordance with EN 13883-2:2019, samples for testing of the mechanical properties are selected from the blasted rock. They will be marked, documented and reported.

Rock Installation Material

The rock berms shall be stable under the governing hydraulic conditions. For the nearshore location at Noss Head from the HDD duct exits, given the relatively shallow

water depths and potentially severe wave conditions, large rock grading are required as shown in Table 6-7.

The minimum design specification rock materials for the Works are to have the following characteristics:

Type: Freshly crushed rock, Granite/Gneiss.

For rock material used as protection for the crossings, cable on seabed and trenching remedial work:

Rock grading: 22/125mm (1-5")

Specific density: Approximately 2.65 MT/m^3.

Rock will originate from Norwegian quarries.

For nearshore berm at Noss Head the following rock gradings have been identified, in Table 6-7, which can be used as light grading rock armour layer, the definitions of gradings follow the European Standard EN13383:

Table 6-7: Rock grading for Noss Head

Material Density	1:3 Side slope berm	1:4 Side slope berm	1:4.5 Side slope berm
3100kg/m^3	$LMA_{5/40}$	$LMA_{5/40}$	$LMA_{5/40}$
3100kg/m^3	$LMA_{60/300}$		

Note:

1. LMA means Light Mass Aggregate, grading 5/40 is 5kg-40kg and 60/300 is 60kg to 300kg.

Filter layer for the nearshore berm will be 22/125mm (1-5"), normal density

Where the design identifies high density rock, then gabbronorite or eclogite rock type is being used.

Rock Berm and Volume

Estimated rock berm tonnages, locations and lengths are included in the tables below.

Table 6-8: Estimated Rock Tonnages

Estimate Rev E	Post Trenching Estimate	NKT Summary of Estimated Rock Tonnages
402,177	**572,741**	Estimated Total Rock tonnage [t] all Protection Works, inclusive vertical tolerance and estimated losses due to immediate penetration, settlement and installation/operational factors Value rounded up to nearest 100t.
185,080	**254,124**	Inside 12nm - Estimated Total Rock tonnage [t] all Protection Works, inclusive vertical tolerance and estimated losses due to immediate penetration, settlement and installation/operational factors. Value rounded up to nearest 100t.
217,097	**318,617**	Outside 12nm - Estimated Total Rock tonnage [t] all Protection Works, inclusive vertical tolerance and estimated losses due to immediate penetration, settlement and installation/operational factors. Value rounded up to nearest 100t.

Tonnage from vertical tolerance is calculated from the cross-sections shown in Figure 6-4.

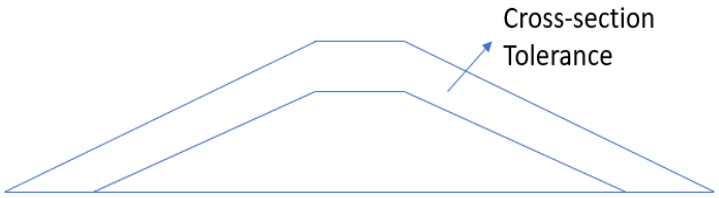

Figure 6-4: Vertical tolerance cross-section

Table 6-9: Marine Scotland - Licence Rock Tonnages

Licence Tonnages		Change Value (worst case)
287,975	MT Inside 12nm zones	-33,851
245,090	MT Outside 12nm zone	+73,527

Table 6-10: Estimated Rock Length

Estimate Rev E	Post Trenching Estimate	Summary of Rock Lengths
90,915m	**73,619m**	Estimated Total Length of Rock Berms
45,075m	**33,820m**	Inside 12NM - Estimated Total Length of Rock Berms
45,840m	**39,800m**	Outside 12NM - Estimated Total Length of Rock Berms

Table 6-11: Marine Scotland - Licence Rock Lengths

Licence Lengths		Change Value
45,075m	Inside 12NM	-11,255m
45,840m	Outside 12NM	-6,040m

Total rock berm length for the whole cable route is estimated to be approximately 74km.

Table 6-12: Marine Scotland - Licence Rock Area (Footprint)

Footprint		Change Value
840,353 m^2	Licence Footprint	
543,039m^2	Total revised estimated footprint	297,314m^2
242,343m^2	Inside 12NM	
300,696m^2	Outside 12NM	

6.3 Weisdale Voe Landfall, Shetland

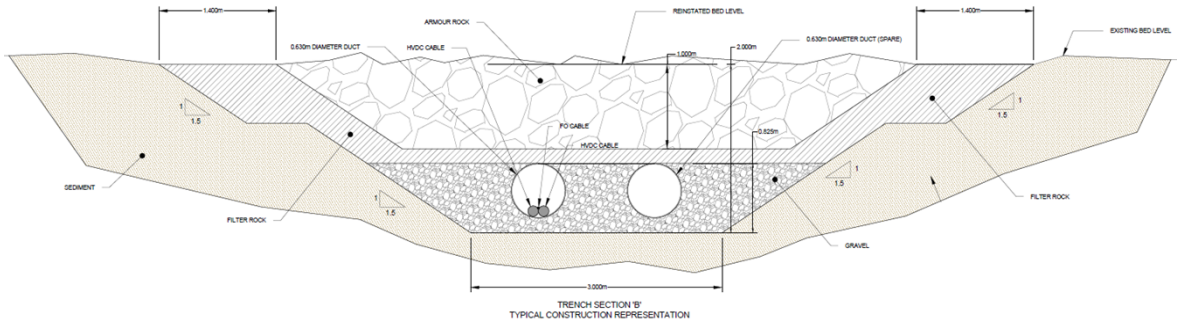

Figure 6-5: Burial of Ducts in Open Trench

The burial and protection philosophy described in Section 4.5, with a filter layer covering the ducts below an rock armour layer and gravel at the bottom of the trench, Figure 6-5. The ducts will be approximately 28m in length and exit point will be at 1m above LAT. For further details see CMS Section 5.

6.4 Noss Head Landfall, Scotland

The shoreline is highly irregular, and consists of rock, in the shape of cliffs, a rock platforms and further submerged rock structures. Many geological faults and joints are present in the area. The geological structure in the area is shown in Figure 6-7.

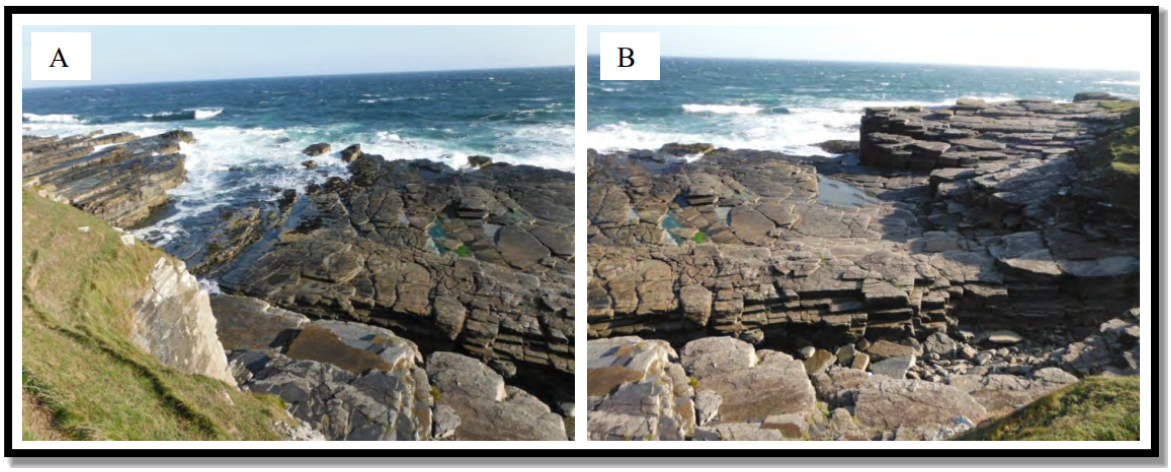

Figure 6-6: Coast at Noss Head Within Onshore Target Zone 1, Picture A Looking Towards Offshore Target Zone 2 , north-east (source: [17])

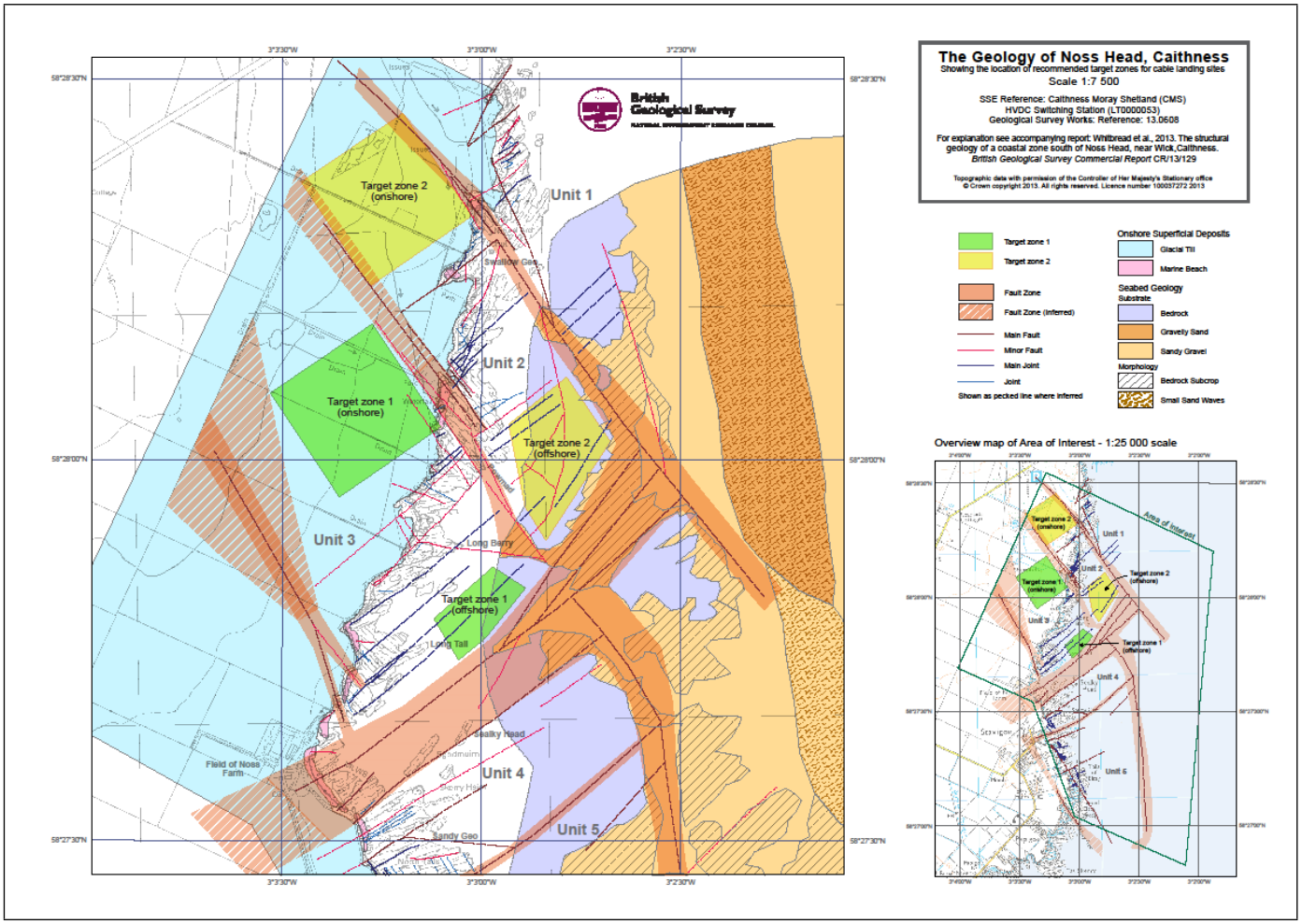

Figure 6-7: Seabed Geology at Noss Head (source: [16])

At the Noss Head landfall, the pop-out will be on the edge or slightly outside Target Zone (TZ) 2, see Figure 6-8. The exit point in will be around 20m LAT. Route TZ2 Offshore to TZ1 in Figure 6-8 is the planned duct route. Due to drilling through the PowMad fault zone a pilot drill will be performed to assess the material encountered. Route TZ2-TZ2 (red-black) line is a contingency drill route.

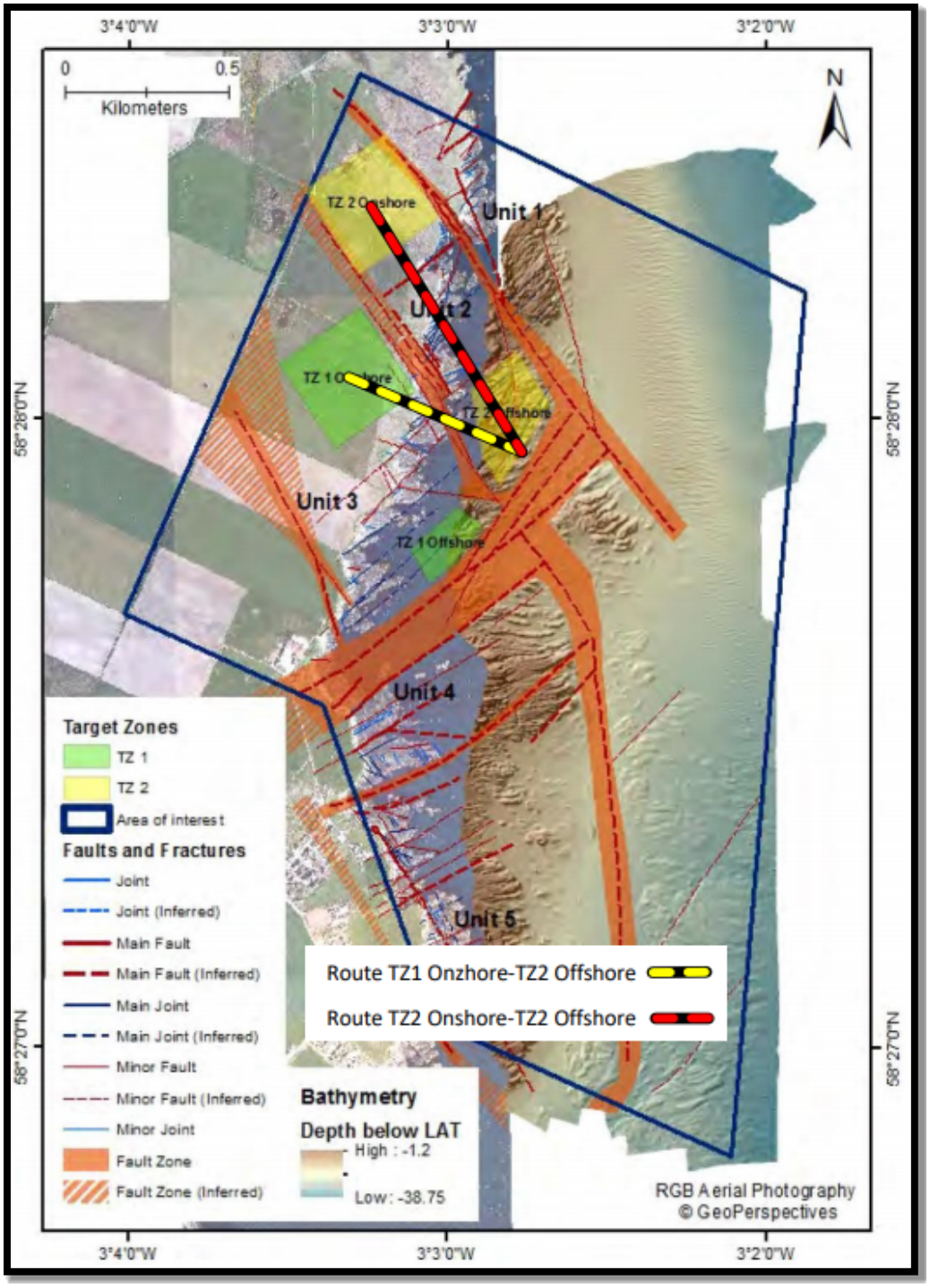

Figure 6-8: Landfall Noss Head with HDD Routes Showing Geological Fault Lines

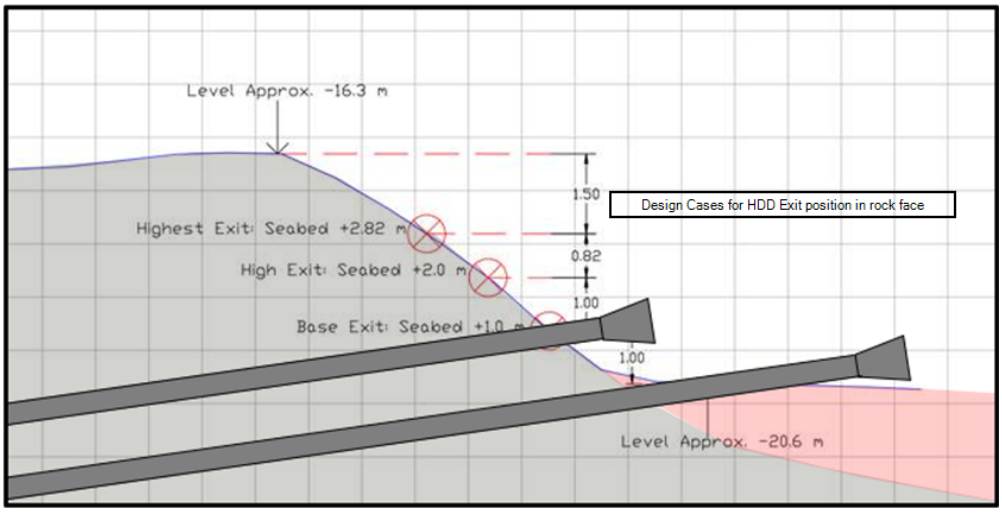

Figure 6-9: Design cases for HDD Exit Position - Noss Head

Exit points (red lines) occur in a rock outcrop on the edge of TZ2 Offshore. Base exit is set to 19.6m. This will be the point for the central drill; the other two drills exit from this same rock outcrop, the (orange line is a distance guide). See image below.

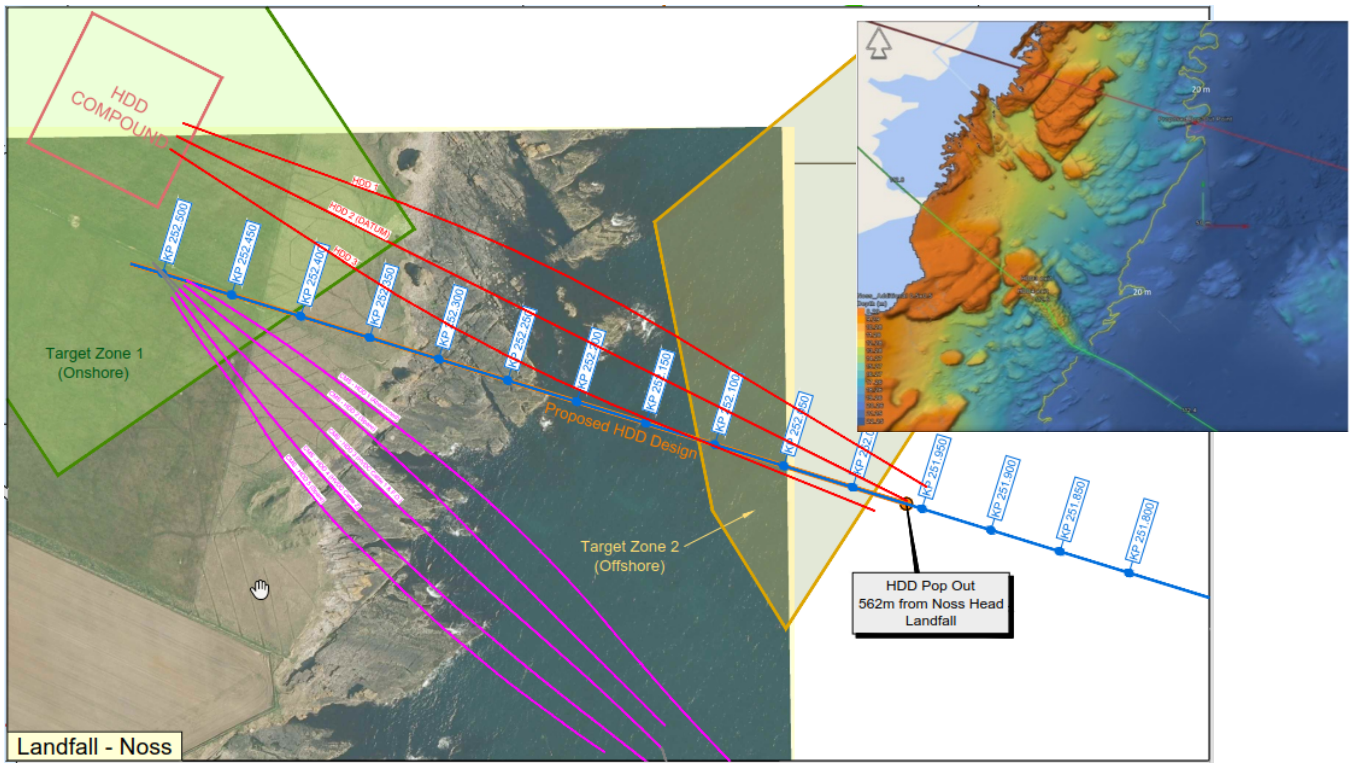

Figure 6-10: Noss Head Landfall and HDD duct routes

7 Reduction in Water Depth

For the cable burial and protection, an assessment for the worst-case scenario regarding water depth reduction has been performed. This assessment allows for a vertical installation tolerance of 0.4m for the remedial and crossing rock berms. For the nearshore rock berm at Noss Head, which consists of larger material, the tolerances for the inner part differ from the outer part due to different size material being used. Clear communication towards rock placement operator is necessary to make sure any exceedance in maximum tolerance do not compromise the reduction in water depth.

Table 7-1: Water Depth Reductions

Item ID	Description	Height from seabed	Water depth (mLAT)	Name/KPs	Easting Start/Stop	Northing Start/Stop	% water depth reduction	% Value Rev E
1	Lowering of CPS, WD>12mLAT (jetting or divers)	0.0	0.0 - 12.0	N/A	N/A	N/A	0	0
2	Jet trenching and remedial rock	Post-lay rock +vertical tolerance used= 0.55+0.08=0.63m	13.00 - 13.5	KP0.748-KP0.756	593430.55/ 593403.34	6676744.17/ 6676704.63	4.8%	4.9%
3	No trenching due to bedrock	Cable diameter + post-lay rock heigh + tolerance = 0.125+0.6+0.3=1.025m	22.7 - 23.0	KP2.176-KP2.210	593314.84/ 593295.14	6676576.16/ 6676548.45	4.5%	4.9%
4	Crossing: Type 1 Mattress+ post lay berm	Mattress thickness + cable diameter+ post lay rock height+ tolerance = 0.3 + 0.125 + 0.6 + 0.3 = 1.325m	65.20	Crossing SHEFA 2 Seg 9, KP226.367	522340.17	6484311.26	2.2%	2.0%

Item ID	Description	Height from seabed	Water depth (mLAT)	Name/KPs	Easting Start/Stop	Northing Start/Stop	% water depth reduction	% Value Rev E
5	Crossing Type 2: Mattress + post lay berm	½ exposed pipe + pre-lay mattressing + cable diameter +post-lay rock height +vertical tolerance = 0.38 + 0.3 + 0.125+0.6+0.3= 1.805m	75.16	Crossing 30¨Piper to Flotta Oil, KP181.974	541427.12	6515165.56	2.4%	2.9%
6	Crossing Type 3: Cable protection System (CPS)	Outer diameter = 0.190m	34.00	Horse Mussel Bed, no-trenching zone, shallowest point, end of CPS, KP250.901	498372.26	6480362.41	0.6%	0.9%
				Near shore rock berm Noss Head:				

Item ID	Description	Height from seabed	Water depth (mLAT)	Name/KPs	Easting Start/Stop	Northing Start/Stop	% water depth reduction	% Value Rev E
7	Inner Part of Nearshore Rock Berm, Noss Head, duct termination (LMA 60/300 armour material).	a) Duct termination above seabed b) + 0.5*CIS outer diameter c) + filter layer rock berm above cable d) +armour layer e) +maximum vertical tolerance armour layer = a) 1.6m b) +0.15m c) +0.3m d) +1.0m e) +0.8m =3.1m	20.65	HDD Exit Point, 69pprox.. KP 251.980	497325.90	6480560.67	15%	Worst case scenario: 25% Base case scenario: 18%
8	Inner Nearshore Rock Berm, Noss Head, cable on seabed (HD LMA 60/300 armour material)	Rock berm filter from seabed +rock berm armour +maximum vertical tolerance (filter+armour) = 0.65m+1.0m+1.1m =2.75m	21	Touchdown seabed after free-span, 69pprox.. KP 251.976	497329.22	6480556.65	13%	12%

Item ID	Description	Height from seabed	Water depth (mLAT)	Name/KPs	Easting Start/Stop	Northing Start/Stop	% water depth reduction	% Value Rev E
9	Inner Nearshore Rock Berm (LMA 60/300 armour material, end of HD LMA 60/300 material)	Rock berm filter from seabed +rock berm armour +maximum vertical tolerance (filter+armour)= 0.65m+1.0m+1.1m =2.75m	23.6	End inner berm, 70pprox.. KP 251.636	497656.51	6480507.84	12%	12%
10	Start Outer Part of Nearshore Rock Berm (HD LMA 5/40 armour material)	Rock berm filter from seabed +rock berm armour +maximum vertical tolerance (filter+armour)= 0.5m+0.5m+0.7m =1.7m	23.7	Start outer berm 70pprox.. KP 251.633	497659.34	6480506.85	7.2%	7.3%
11	Outer Part of Nearshore Rock Berm (HD LMA 5/40 armour material)	+ rock berm filter from seabed +rock berm armour + vertical tolerance= 0.5m+0.5+0.7m =1.7m	34.0	End outer berm 70pprox.. KP 250.880	498393.28	6480360.33	5%	5.1%

*) The inner part of the nearshore rock berm includes a CPS.

The nearshore berm at Noss Head between KP 250.880 and KP 251.900 has a total length of 1020m.

It should be noted that the pop-out at Noss Head is due to the HDD exit hole being on the face of the cliff-side. The navigable depth is actually at the top of the 'cliff', so having a rock berm that extends up the cliff, isn't reducing the navigable depth.

Reviewing the AIS data available for the nearshore Noss Head area, over a time span of 2 years (31 October 2018- 31 October 2020) smaller vessels with a shallow draught are sailing in this area. Smaller vessels with a very limited draft, largest seen are all 10m or less, such as crew boats / passenger vessels, pleasure boats and pilot vessels are also seen crossing the cable corridor at the planned berm location.

Comparing to activities further away from shore, especially outside the Noss Head MPA, the vessel activities near HDD exit point can be seen as marginal. No large deep draught vessels such as tankers, offshore construction vessels or similar sizes which would be affected by the depth reduction has been reported in the 2-year timespan for this area.

For the Weisdale Voe landfall and nearshore area no traffic was recorded in the AIS between 31 October 2018- 31 October 2020.

8 Further Investigations

8.1 Pre-lay and UXO Survey

A pre-lay survey with focus on UXO mapping and confirming crossing locations was carried out between June and September 2021 [12].HMB survey was also included.

Reference is made to the CMS Section 7 "Offshore Works – Pre-lay and UXO Survey" for further details.

8.2 Pre-cable Lay Preparation Work

Prior to cable lay, activities performed such as boulder clearance and PLGR gives the opportunity to further assess the cable route.

Table 8-1: Route Clearance Reporting

Document
Final reporting of boulder clearance work
Final reporting of crossing preparations
Final reporting of PLGR -CP1
Final reporting of PLGR -CP2/3

9 As-Built Data and Documentation

As-Built Report and data shall be provided to the marine licensing authorities on completion on the cable protection works.

Table 9-1: As-Built Data

Document
Noss Head Nearshore As-Built Final Report
Weisdale Voe Nearshore As-Built Final Report
As-Trenched Final Report & Data CP1 (KP246.5-KP155)
As-Built Rock Placement Final Report & Data CP1
As-Trenched Final Report & Data CP2 (KP57-KP0)
As-Built Rock Placement Final Report & Data CP2
As-Trenched Final Report & Data CP3 (KP57-KP155)
As-Built Rock Placement Final Report & Data CP3
Final As-Built Cable Route Report & Data

Further details of the as-built data can be found in the Construction Method Statement, Section 14 [08].

Table of Modifications

Rev.	Date	Prepared by	Description
A	2020-12-11	Sondenaa, Elisabeth	First issue of document
B	2021-01-29	Sondenaa, Elisabeth	Second issue after received comments
C	2021-02-25	Kerkhoff, Duncan	Updated after comments received
D	2021-03-18	Sondenaa, Elisabeth	Updated after comments received, second review-cycle
E	2021-04-19	Sondenaa, Elisabeth	Updated after comments received, engineering review-cycle
F	2022-02-02	Sondenaa, Elisabeth	Updated after revised burial assessment and boulder clearance performed
G	2022-11-30	Sondenaa, Elisabeth	Updated after revised landfall design Weisdale Voe
H	2023-02-06	Sondenaa, Elisabeth	Updated after revised landfall design Weisdale Voe
I	2023-08-28	Sondenaa, Elisabeth	Updated after comments received
J	2023-10-17	Sondenaa, Elisabeth	Updated after comments received

K	2023-10-25	Sondenaa, Elisabeth	Updated after comments received
L	2023-10-31	Sondenaa, Elisabeth	Updated after comments received
M	2023-10-31	Buchan, Ian	Updated after comments received

Appendix 1 CBPP Overview Charts

Refer to document - 1AA0428474 CBPP Overview Charts, (NKT, 2023)