

Project: Orkney Caithness 220kV link LT000017
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Subject: Marine Licence Condition 3.3.1 Construction Risk Assessment

1 Introduction

As part of the proprietary works for the Orkney Caithness Link project a Marine Licence was required to govern the construction of works within the marine area proposed. As such, the Marine Licence addendum was granted on 16th December 2022 with the validity of works to be completed prior to 31 December 2027.

Stated within the Orkney Caithness Link Project Marine Licence, within section 3.3 during the Licenced Activity, seasonal restrictions have been outlined for specific construction operations outlined in Condition 3.3.1. A direct reference to this condition has been extracted and is shown below:

3.3.1 *The licensee must not carry out nearshore, landfall or cable pulling works between 01 April and 31 July inclusive.*

1.1 References

Table 1: References

Item	Document Title	Document Number
[1]	MARINE (SCOTLAND) ACT 2010, PART 4 MARINE LICENSING, LICENCE TO CONSTRUCT, ALTER OR IMPROVE WORKS IN THE SCOTTISH MARINE AREA	MS-00010072
[2]	Annex H – Technical – Detailed methodology procedure for Cable System installation	01010673
[3]	LT17 Dounreay Landfall Review 2023_Issue_V2.1	B2387300-TM-LT17-002.1
[4]	LT17 Warebeth Landfall Orkney – Rev001	B2387300-TM-LT17-003
[5]	LT17 Orkney – Mainland HVAC 220 kV Subsea Link Environmental Appraisal	A-100413-S02-REPT-002
[6]	Orkney Caithness 220kV Link Weather Spells Analysis Report	P2636_R6147_Rev2

Table 2: Abbreviations & Acronyms

Abbreviation	Meaning
CIS	Cast Iron Shells
CLV	Cable Lay Vessel
COA	Certificate of Approval
DP	Dynamic Positioning
DSV	Dive Support Vessel
HDD	Horizontal Directional Drilling
HVAC	High Voltage Alternating Current
kV	Kilovolts
m	Metre
m/s	Metre Per Second
MWS	Marine Warranty Surveyor
P	Probability
PLGR	Pre-lay Grapnel Run
RHIB	Rigid Inflatable Boat
RPL	Route Position List
TBD	To be Determined
WoW	Waiting on Weather
WSA	Weather Spells Analysis

1.2 Technical Note Requirement

This technical note aims to provide information and risk assess the implications and knock-on effects of Condition 3.3.1 within the Orkney Caithness Link Project Marine Licence to marine installation operations.

2 Technical Note

To further understand the technical inputs and resulting implications of Condition 3.3.1 the following information has been provided.

2.1 Installation Vessels and Operations

To allow for the Orkney Caithness Link cable to be installed successfully there will be multiple vessels working directly on and in the vicinity of Nearshore, Landfall and Cable Pulling Works. The following vessels set out in Table 3 are expected to be used for operations.

Table 3: Installation Vessels and Operations

Marine Operation	Vessel	Max Sig Wave (m)	Max Wind (m/s)	Max Current (m/s)	Directly Impacted by 3.3.1 (Y/N)*
Pre-lay Engineering Survey	TBD	TBD	TBD	TBD	N
HDD/ Pull-in Duct/Bellmouth Installation Orkney (Divers)	Multicat / Dive Vessel	1	10	0.51	N
HDD/ Pull-in Duct/Bellmouth Installation Dounreay (Divers)	Multicat / Dive Vessel	1	10	0.51	N
PLGR Operations	DP2 OFFSHORE VESSEL SIMA	2.5	15	1	N
Crossing Preparations	Multicat	1	10	1	N
Pull-in Preparation – Plate Removal Orkney (Divers)	Multicat / Dive Vessel	1	10	0.51	Y
Cable Pull-in Orkney (1 st End)	Nexans Skagerrak	1	8	0.5	Y
Cable Laying	Nexans Skagerrak CLV	3	15	1.3	N
Cable Stabilisation Orkney (Rock Bags)	Multicat	1	10	1.5	N
Cable Stabilisation Orkney – Clamps (Divers)	Multicat / Dive Vessel	1	10	0.51	N
Pull-in Preparation – Plate Removal Dounreay (Divers)	Multicat / Dive Vessel	1	10	0.51	Y
Cable Pull-in Orkney (2 nd End)	Nexans Skagerrak CLV	1	8	0.5	Y
2 nd End Float In Support	RHIB	TBD	TBD	TBD	Y
Cable Stabilisation Dounreay (Rock Bags)	Multicat	1	10	1.5	N
Cable Stabilisation Dounreay – Clamps (Divers)	Multicat / Dive Vessel	1	10	0.51	N
Cable Burial - Capjet	Nexans Skagerrak	3.5	15	1	N
Rock Protection	Fall Pipe Vessel	3.5	17.5	1.3	N

*Note: Green and red indicators have been used within Table 3 to highlight the direct impact of Condition 3.3.1.

2.2 Installation Weather Analysis

As part of the planning activities carried out for the Orkney Caithness Link project a weather spells analysis and programme assessment has been carried out on the operations outlined in Section 0.

The weather spells analysis reviews and presents an overview of the statistics of the key meteorological and oceanographic (metocean) parameters likely to affect the construction activities throughout the calendar year. This has been further analysed with use of a programme assessment utilising the information gathered in the weather spells analysis, applying working vessel limits, required installation timelines, and the proposed installation programme.

Understandably within the weather spells analysis carried out for the project the more favourable weather is reflected over the summer months predominantly in May through to July. Coupled with this reflection, it has been highlighted that the nearshore tidal currents specific to Orkney are a primary concern for works within this area which further amplifies the seasonality and sensitivity of Nearshore, Landfall and Cable Pulling Works.

As part of the installation programme assessment it was found that the operations required for the installation of the Orkney Caithness Link project had varying sensitivities to seasonality. These are shown below in Figure 1 emphasising the seasonal impact of campaign timing on HDD diving works, PLGR, cable pull-in at Orkney and CIS clamp installation:

Campaign	Seasonal	Sensitive
Pre-Lay Engineering Survey	High	Medium
HDD works (diving)*	High	High
Crossing preparations	Medium	Low
Pre Lay Grapnel Run	High	High
HVAC cable pull-in Orkney*	High	High
HVAC cable laying	Medium	Low
HVAC cable pull-in Dounreay	Medium	High
Cast Iron Shells clamps installations*	High	High
HVAC cable trenching burial	Medium	Low

Figure 1: High Level Categorisations of Campaigns by Seasonality and Sensitivity

As part of the installation programme assessment this sensitivity to seasonality was reflected when assessing various campaign installation start dates. This assessment considered a consecutive programme for all projected installation works in 2026 beginning with PLGR operations. Based on a P50 scenario for weather allowance the following requirements for vessel days were generated in Figure 2.

PLGR start date	End Date 2026 campaigns		Vessel days
	Nexans	SSEN	SSEN
31/03/2026	08/07/2026	28/06/2026	187
30/04/2026	22/07/2026	15/07/2026	171
31/05/2026	12/08/2026	11/08/2026	164
30/06/2026	18/09/2026	14/10/2026	199
31/07/2026	24/10/2026	28/04/2027	369
31/08/2026	29/03/2027	19/05/2027	369
30/09/2026	02/05/2027	02/06/2027	366
31/10/2026	24/05/2027	09/06/2027	335
30/11/2026	01/06/2027	10/06/2027	303

Figure 2: P50 Programme Analysis Scenario Results

Based on the results of the programme analysis it has further highlighted the knock-on effect of Condition 3.3.1 outlining the increase in vessel days to complete the planned installation works. For operations beginning in August it can be seen that the vessel days drastically increase due to the programme of works being carried out in the later end of the calendar year. Linked to this, it was also observed within the weather spells analysis that the typical ‘winter storms’ events have been observed within the Autumn months (September – December).

This is due to the highly seasonal and sensitive operations that initiate the cable installation (diving works, cable pull-in etc.) being pushed to later months in the year where they will be greatly affected by weather. Therefore increasing the installation programme to a greater risk of exposure to possible weather events and increased downtime.

2.3 HDD Engineering

To allow us to work within Condition 3.3.1 SSEN have carried out HDD feasibility studies at both locations (Dounreay and Warebeth) to review options of HDD alignments and lengths. As a result from these assessments, SSEN believe that the HDD proposals for Dounreay and Warebeth locations are fit for purpose and reduce the impact of operations within the nearshore area as low as reasonably practicable. This has also taken into consideration additional HDD risks if HDD’s at both locations were to be extended further from shore.

- **Warebeth HDD** – the proposed Warebeth HDD offshore pop out location has been engineered to target an area of SAND at ~16m LAT between rocky outcrops at a length of 1200m. This HDD alignment is known as LT17-B-06 red. Consideration has been given to extend the HDD to further out, but this has resulted in extending the HDD length to over 2000m which in turn has substantial challenges involved and increase drilling/installation risk.

Additional risks/engineering include:

- Additional HDD reaming operations over HDD lengths of 1200 – 1500m requiring pull methodology requiring jack up vessel support.
- Additional sealing and casing of the HDD to ensure there is no drilling fluid lost to sea.
- Increased risk of friction and buckling of the drill pipe within the HDD
- Additional risk and complication on adopting intersection proposal (drilling from both onshore and offshore locations).

Options considered as part of this engineering study have been provided as an appendix in Appendix A: Warebeth HDD Alignment and Appendix B: Warebeth HDD Feasibility Assessment.

- **Dounreay HDD** – as part of the Dounreay HDD feasibility study 4 HDD alignment options have been considered to reduce the impact of nearshore working whilst maintaining HDD integrity. Of these HDD options at the Dounreay end there is an additional risk to drilling due to the known geotechnical fault locations. As part of this assessment the most feasible option considered was the LT17-A05b short proposal to avoid large intersections of fault locations that could result in the loss of drilling fluid and/or HDD drilling failure.

Options considered as part of this engineering study have been provided as an appendix in Appendix C: Dounreay HDD Feasibility Assessment.

2.4 Impact and Risks of Condition 3.3.1 to Operations

2.4.1 Programme

Within section □ one of the main recurring aspects that has a resulting impact of Condition 3.3.1 is the project programme. The following items have been highlighted as high risk with programme knock-on considered:

- HDD drilling and timing of pop-out.
- Knock on as Nearshore, Landfall, Cable Pulling Works are the initiation works for the project to progress – therefore on the critical path for installation.
- Overall project vessel days – including all offshore scopes.
- Key project milestones - energisation
- Key vessel availability
- Increase in overall carbon footprint of the project

Figure 3 below shows a comparison between the expected vessel days and completion dates for the projected project timelines based on Condition 3.3.1 being applied and beginning operations earlier on in the year (June used as an example).

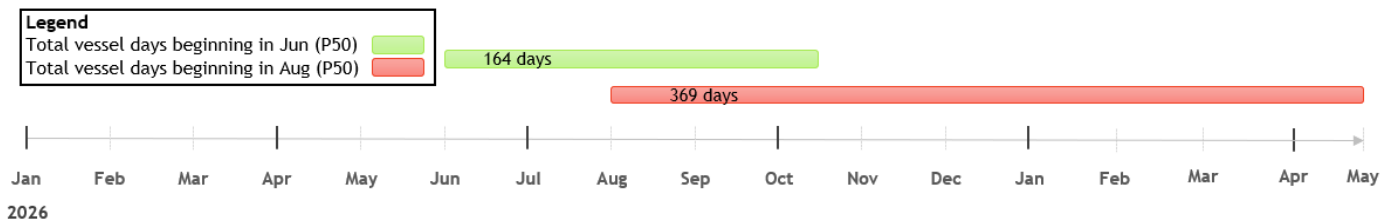


Figure 3: P50 Total Vessel Days

2.4.2 Offshore Operations

Due to the seasonal restriction of Condition 3.3.1 there is a severe risk to offshore operations as they move into more unfavourable months.

- **Orkney HDD pop-out and end preparation** – due to this operation being carried out via divers it is highly sensitive to weather and weather windows available. This applies to not only to the divers but the dive vessel they are working from ensuring they can maintain location whilst subsea works are being carried out. The weather spells analysis has highlighted to the project team that diving at Orkney is the highest risk operation not only to personnel but the programme too.

Prior to diving works, due to the pop-out of the HDD drilling occurring subsea the HDD contractor will have to take into consideration breaking ground subsea until 1st August 2026. This could affect HDD contractors' availability to carry out the works as it reduces their flexibility to complete drilling operations restricting them to seasonal constraints.

- **Orkney 1st end cable pull-in** – Dependant on the completion of the HDD end preparation dive works the cable lay vessel will move into position to initiate cable pull in works. Due to the alignment of the HDD duct the cable lay vessel has a very limited tolerance on vessel heading and setup therefore prevailing weather conditions are vital. As the weather spells analysis has highlighted, the cable pull-in operation at Orkney is a highly sensitive seasonal activity and therefore, the knock-on effect of Condition 3.3.1 could result in the cable lay vessel waiting on weather for a prolonged period as a 24hr weather window is required to issue a COA from the MWS for installation.
- **Cable lay** – as a follow-on operation from the initial cable pull in the vessel is then fixed at one end to allow the cable lay to be conducted. If the cable lay was to be carried out in the proposed timeline stated in Condition 3.3.1 the vessel would be at a higher risk to weather downtime and the cable would be further exposed to additional dynamic loading as a result of this WoW.
- **Orkney nearshore cable stabilisation (rock bags, divers)** – with diving operations being highly sensitive to weather, Condition 3.3.1 increases the risk of weather downtime dramatically for the divers and the dive vessel as the WSA indicates. Knowing the Orkney nearshore area is very turbulent with currents leading to possible delays in stabilisation works, the cable is at a higher risk of exposure to dynamic loading and/or the possibility of being moved off the RPL. During this period where the cable is exposed additional guard vessels would be required to sit on position to warn other seafarers of the exposed cable on the seabed.
- **Dounreay HDD pop-out and 2nd end preparation** – Condition 3.3.1 impact in line with Orkney HDD pop-out and end preparation.
- **Dounreay 2nd end cable pull-in** - 2nd end cable pull-in operations are more sensitive to hydrodynamic loading compared to 1st end installation due to the nature of the operation. Therefore a knock-on effect of weather accumulated throughout the 1st end pull-in and lay operations further pushes out the date for 2nd end installation. Nexans proposal is to stream the 2nd end of the cable and pull in via work boats rather than use of a quadrant reduces the weather limits as more workboats will be required to manage the slack cable and floats on the surface of the water.
- **Dounreay nearshore cable stabilisation (rock bags, divers)** - Condition 3.3.1 impact in line with Orkney nearshore cable stabilisation (rock bags, divers).

- **Cable burial** – by carrying out the initial diving works and cable pull-in operations on the months leading into the winter period there is an increased risk of trenching operations being exposed to substantial weather downtime. Excluding weather allowance cable trenching works is the longest offshore duration predicted to take ~23 days on site.
- **Cable Protection – Mattress Installation/Rock protection** – by carrying out diving works, cable installation and trenching works during the winter period there is a significant risk that rock placement operations would incur substantial weather downtime due to operations being at the end of the installation programme. This operation is of the highest risk of weather knock-on due to operations being carried out at the end of the scheduled marine works.

2.4.3 Safety

2.4.12.4.1 Safety of the operations is of the upmost priority during the planning and execution of the works. The following items have been highlighted at a higher risk to safety given the requirements set out in Condition 3.3.1:

- With the programme moving into the latter end of the year the safety of personnel both on and offshore is at higher risk.
 - For onshore work, construction works is at a higher risk due to unfavourable conditions and exposure to weather considering the wetter colder months for HDD construction, landfall and subsea cable pulling works.
 - For the offshore aspect seafarers are exposed longer durations offshore in more extreme metocean conditions (wind, wave and currents), putting them at a higher risk when carrying out installation operations over a longer duration due to weather.
- As the seafarers may be working offshore with increased weather exposure, crew changes specifically with cable lay could be at higher risk due to the CLV being fixed to one end of the cable length as it is being laid. At this time if crew changes were to take place (dependant on timeline) then a crew transfer vessel would need to be used as the cable would not be cut to allow for the CLV to come into port. This is unless the weather conditions are close to exceeding the positioning capability of the vessel resulting in cable abandonment and the CLV seeking sheltered waters.
- The safety of the diving activity will be at substantial risk due to personnel working within the water column tethered to the dive support vessel in higher risk conditions and exposure to sporadic weather windows. Weather forecasts will be used throughout the project to support and plan operations but in the instance where the weather is favourable verging on marginal the DSV will need to travel to site and assess the conditions prior to a go/no go decision is made.

2.4.4 Financial

With the current proposal with Condition 3.3.1 it is clear to see that the seasonal sensitivity of the Orkney Caithness Link Project offshore operations is of the highest consideration for planning and operational durations. As outlined within the installation weather analysis, allowing installation works that follow on from cable pulling, nearshore and landfall operations to be carried out within the summer months dramatically decreases the number of vessel days operating on the project. Another result of this with less vessel days at sea we also reduce the environmental impact overall.

As expected with a reduction in overall vessel days on the project a financial saving can be made which in turn reduces the overall cost to the electricity bill payer.

3 Conclusion/Alternative Proposal

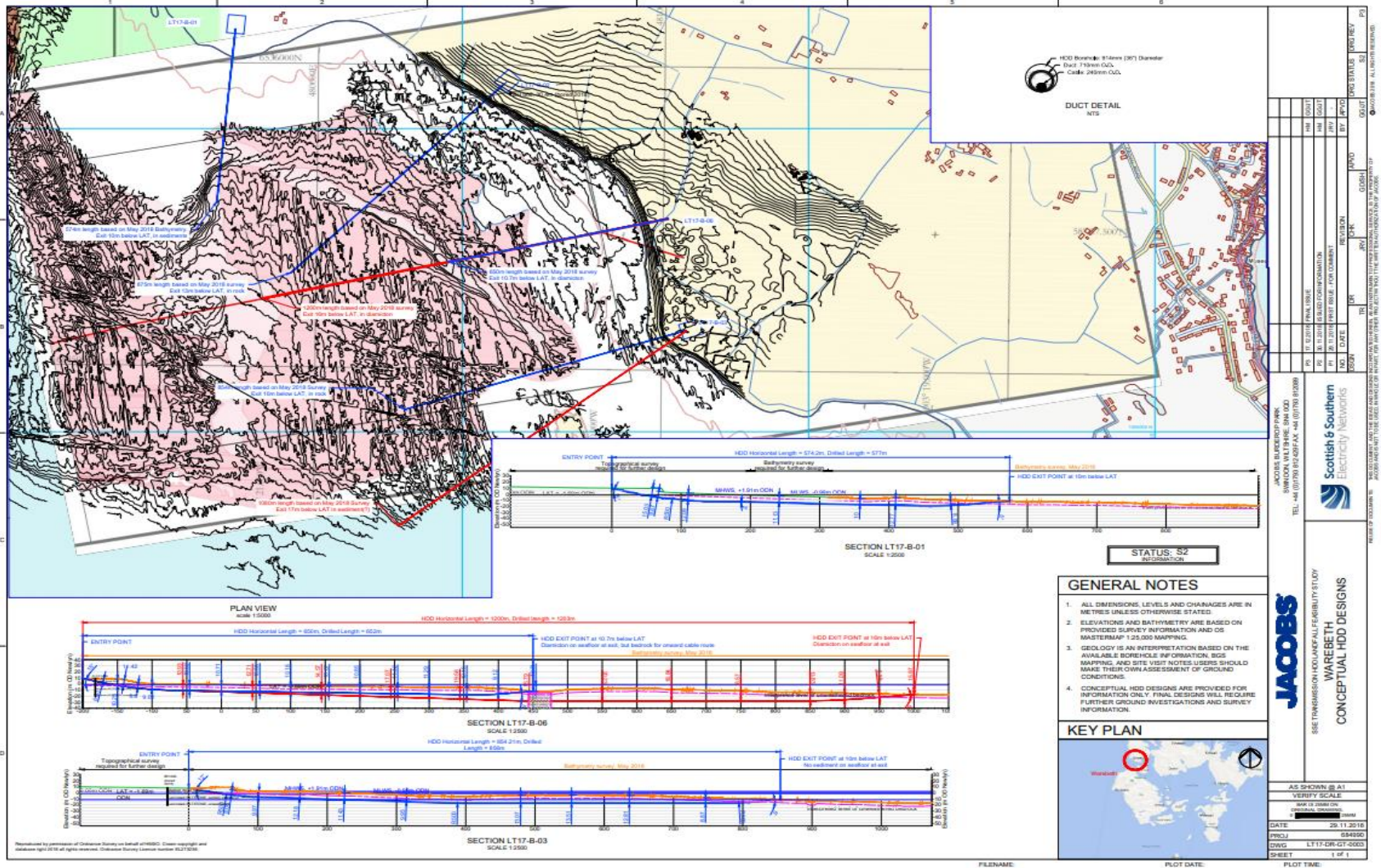
Given the licence condition outlined within Condition 3.3.1 stating that the licensee must not carry out nearshore, landfall or cable pulling works between 01 April and 31 July inclusive, the purpose of this technical note was to provide information and risk assess the implications of said Condition for the Orkney Caithness Link Project.

If submarine cable installation operations were to take place in line with Condition 3.3.1, there is a substantial risk to the project exceeding planned durations therefore exposing all project personnel and equipment to additional unnecessary risk.

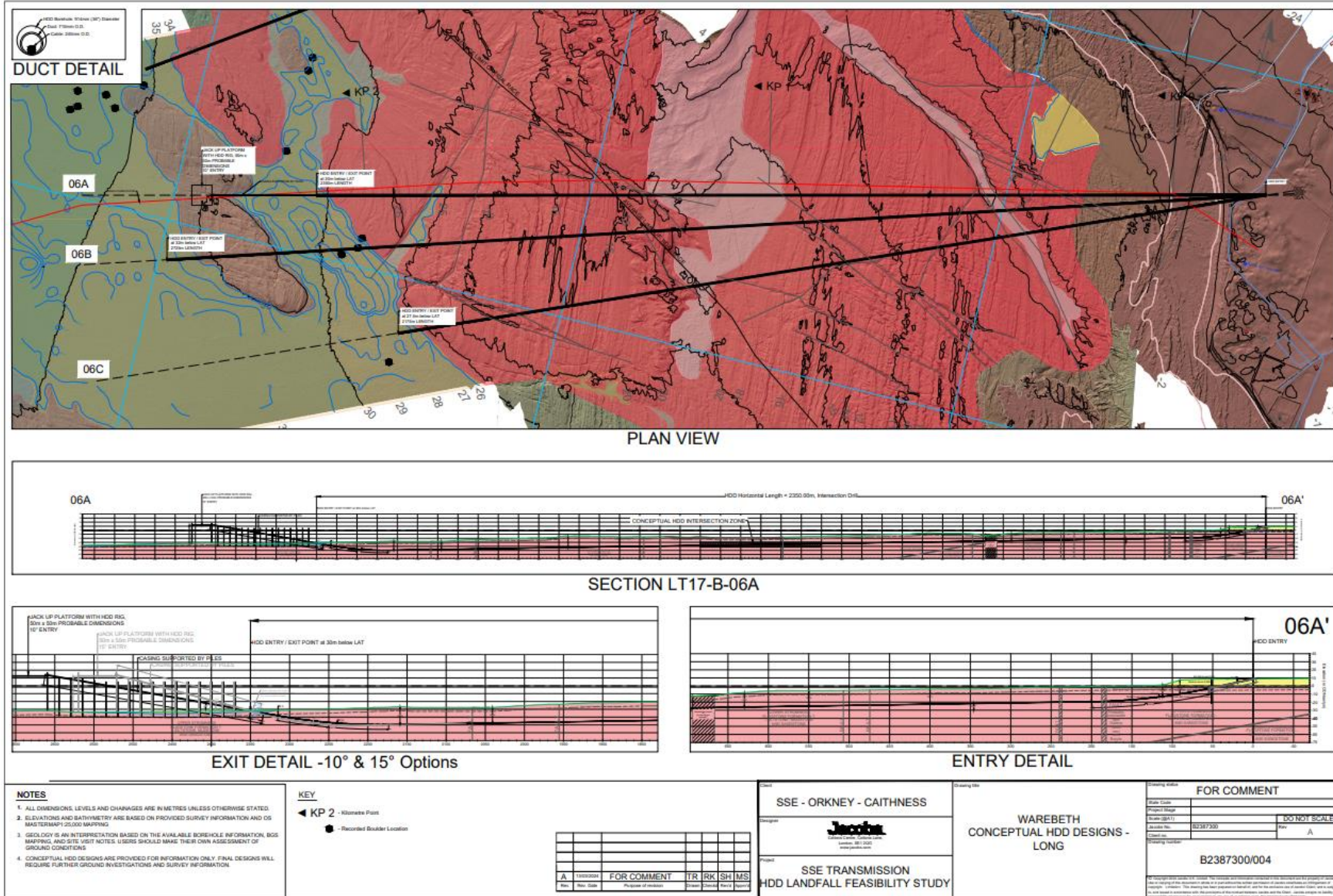
An alternative proposal for nearshore, landfall or cable pulling works to be carried out safely and efficiently would be the following:

- SSEN Transmission request a marine licence variation to allow the capping of the Horizontal Directional Drilling (HDD) popout ends at each landfall during a 1-month window from the end of April-July 2025 and to work nearshore to complete pull in works during a 1-month window from the end of April to July 2026. To confirm that would be 2 days at Warebeth and an expected 2 days at Dounreay for each operation (the capping of the HDD in 2025 and subsequently the pull in operations in 2026), a total of 8 days expected in for 2025 and 2026.

Appendix A: Warebeth HDD Alignment



Appendix B: Warebeth HDD Feasibility Assessment



Appendix C: Dounreay HDD Feasibility Assessment

