MARINE LICENCE CML2365

CONDITION 3.19: CABLE SPECIFICATION AND INSTALLATION PLAN

Liverpool Bay CCS Project

Marine and Coastal Access Act 2009

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TABLE OF CONTENTS

TABLES

1. INTRODUCTION

1.1. PURPOSE, SCOPE AND OBJECTIVES

1.1.1. This document is the **Cable Specification and Installation Plan (CSIP)** for **Licenced Activity 1** (cable installation and protection) and provides the information to fulfil the requirements of Marine Licence **CML2365: Condition 3.19**.

1.1.2. **Table 1-1** provides signposting to where in this **CSIP** the information required by **Condition 3.19** can be found.

Table 1-1 – Requirements of CML2365 Condition 3.19 and where they have been addressed

Reference		Requirements	Location
(i)	Technical specifications	Provide full cable technical specifications	**Section 3 – Technical Specifications** Includes cable type, voltage, dimensions, armour, bend radius, and design life.
(ii)	Location	Provide route with burial, crossings, and surface-laid sections	**Section 2 – Cable Route and Location** Route maps, burial sections, surface-laid justification, and crossings identified.
(iii)	Timings	Duration and schedule of works	**Section 5 – Cable Laying and Installation** Start/end dates, seasonal restrictions, vessel programme.
(iv)	Burial Risk Assessment	Define burial depths, laying techniques, and protection; identify areas where protection >5% of navigable depth and mitigation for navigation safety	**Section 4 – Cable Burial Risk Assessment** (supported by **Section 3.2 – Cable Protection Strategy**) Includes risk register, burial depth specification, and steps to manage navigational safety.
(v)	Cable protection deposits	Proposed locations, types, and quantities of protection	**Section 3.2 – Cable Protection Strategy** **Section 5.7 Post Lay Mattresses and Rock Protection at Cable Crossings** Rock placement, mattresses, ducts, with justification and volumes.
(vi)	Installation techniques	Installation and laying methodology	**Section 5.6 – Cable Laying and Installation** Burial tools, methods of lay, and seabed disturbance controls.
(vii)	Crossing armouring	Methodology for cable crossings	**Sections 3.2: Cable Protection Strategy Sections 3.3, 3.4 – Cable Crossings and protection, Section 5.7 -Installation of mattresses and rock.** Drawings, armouring, mattresses, third-party agreements.
(viii)	Machinery contingency	Contingency for installation machinery failure	**Section 6 – Contingency Plan** Redundancy, emergency response, stakeholder notifications.
(ix)	Transport plan	Transport and navigation management plan	**Section 7 – Transport and Vessel Management** Fleet details, marine coordination, stakeholder liaison, navigation warnings.
(x)	Wet storage	Locations, types, quantities, and duration of wet-stored cables/protection	**Section 5.6.17 – Cable Wet Storage** Storage sites, monitoring, and navigation marking.
(xi)	Monitoring proposals	Risk-based monitoring of cables and protection over operational lifetime	**Section 8 – Monitoring and Maintenance** Post-lay and periodic surveys, shallow burial management, reporting.

1.1.3. This CSIP provides information relating to cables, including a construction programme, the final technical specification of the cables, a detailed installation plan, including a Cable Burial Risk Assessment (CBRA), cable protection measures, and monitoring offshore cables.

1.1.4. This CSIP details mitigation measures relevant to the installation of the cables which will be adhered to during construction.

1.2. LOCATION OF PROJECT

1.2.1. Located in the Eastern Irish Sea, the Liverpool Bay CCS Project spans both Welsh, and English Waters. Figure 1-1 and the charts in Appendix A, show the location of the Project and identifies the individual components.

1.2.2. The Project comprises a mixture of new, and re-purposed existing infrastructure, with the following Marine Licensable activities (CML2365), located in Welsh Waters:

- Electrical cable from Point of Ayr (PoA) to Douglas CCS Platform (Activity 1).
- Inter-platform electrical cables (Activity 1).
- New pipeline spools (Activity 2).
- Unexploded Ordnance (UXO) clearance (Activity 3).
- Douglas CCS jacket (Activity 4).
- Douglas CCS platform (Activity 4).

1.2.3. This CSIP concerns Activity 1 – Electrical Cables. The following sections therefore include further detail on these elements to provide a background on their need and their relationship to the other Liverpool Bay CCS Project infrastructure. An overview is also provided on the vessels involved in cable installation.

1.2.4. Activity 1 involves the following activities in Welsh Waters:

- Laying, and burial of submarine 33kV armoured power cable with integrated fibre-optic cable connections from PoA Terminal onshore to the Douglas CCS platform.
- Laying, and burial of three submarine 33kV armoured power cable with integrated fibre-optic cable connections, one each from the Douglas CCS platform connecting with the Hamilton Main, Hamilton North, and Lennox platforms.
- Installation of concrete mattresses an external rock protection at crossing so existing cables and pipelines.

1.2.5. Prior to laying the cables, pre-lay mattress installation will be undertaken to stabilise the seabed and provide protection at third-party cable crossings along the planned cable route. The third-party cables are export cables and inter-platform cables associated with the Burbo Bank, North Hoyle, and Gwynt y Mor offshore wind farms, and the Western Link HVDC cables, as shown in Figure 1-1.

1.2.6. The existing pipelines crossed are located close to the new Douglas CCS platform, within the 500m exclusion zone. These comprise a variety of pipelines formerly used to transport oil, natural gas, condensate, produced water, and methanol.

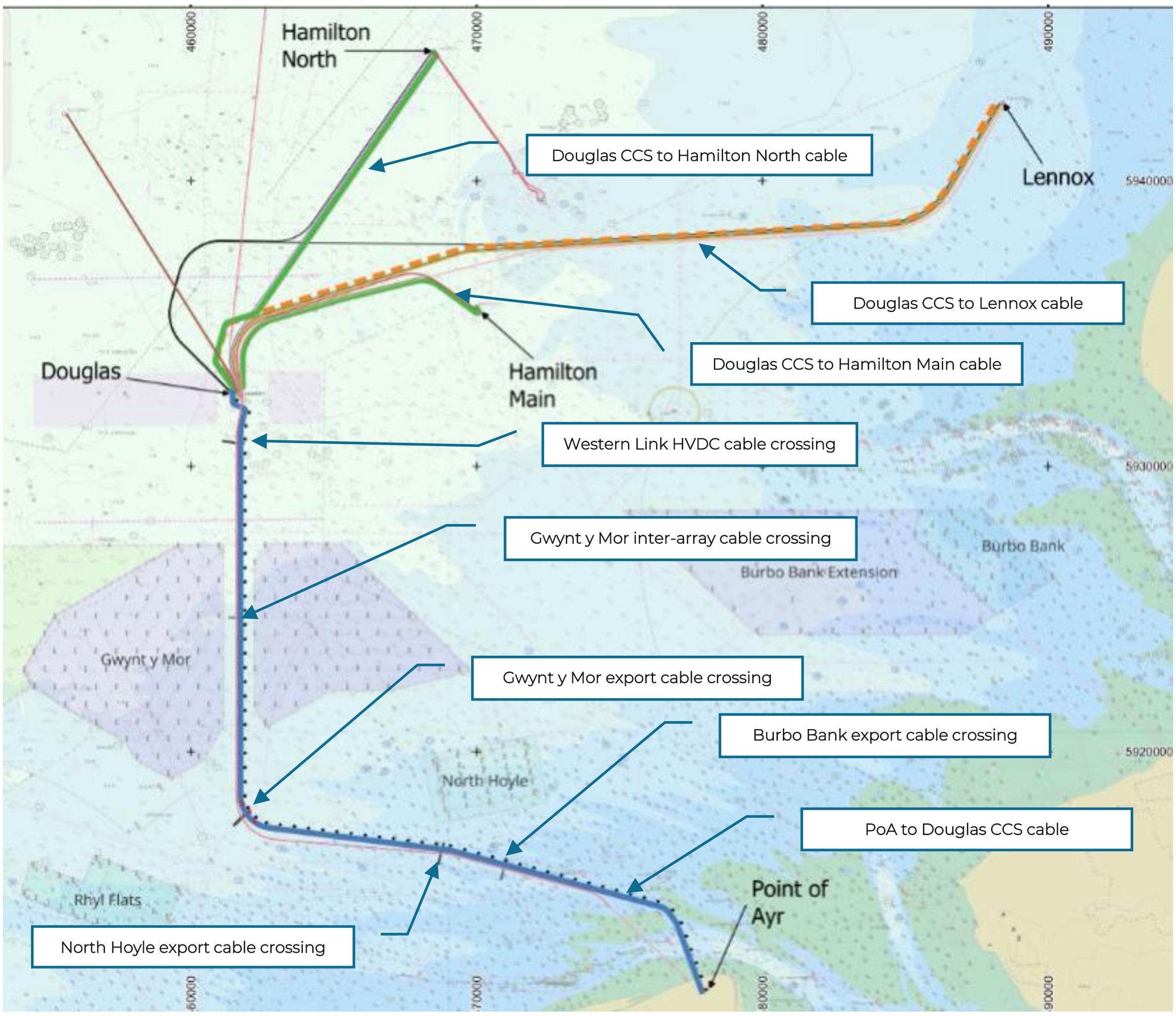


Figure 1-1: Location of cables and crossings for pre-lay activities

1.3. CONSTRUCTION

1.3.1. The works programme for the PoA to Douglas CCS and inter-platform cables is described in detail in Section 5, and spans 2026 and 2027, with activities scheduled outside the winter exclusion window (01 November to 31 March). The project is meticulously phased, beginning with surveys and seabed preparation, followed by cable laying and burial, and concluding with the installation of mattresses and rock protection at crossings.

1.3.2. Construction operations employ a variety of specialist vessels to ensure safety, environmental compliance, and efficient logistics. The 2026 schedule focuses on the PoA to Douglas CCS cable, while 2027 covers connections from Douglas CCS to satellite platforms, including Hamilton Main, Hamilton North, and Lennox. Each phase is carefully timed to optimise vessel use and to account for weather and tidal constraints, supporting the secure and timely delivery of the Liverpool Bay CCS Project's cable infrastructure.

1.3.3. Section 5 describes the planned methodology, equipment, and vessels for cable laying and installation in the Liverpool Bay CCS Project. The process includes phased works for four cable routes, beginning with pre-construction surveys and seabed preparation such as boulder relocation, mattress installation, dredging, pre-trenching, and grapnel runs.

1.3.4. Cable installation methods vary by route and include simultaneous lay and burial in shallow waters, free lay and post-lay burial in deeper areas, and wet storage with subsequent recovery for platform pull-in. Specialist vessels are detailed in Section 5 for each stage, including cable lay, support, burial, mattress, and rock installation, with indicative specifications provided. Cable burial relies on ploughs and trenchers, depending on seabed conditions, followed by mattress and rock placement as protection measures. As-built surveys will be conducted by Liverpool Bay CCS Limited post-installation to verify cable burial depth and seabed conditions.

1.4. INTERFACES AND ASSOCIATED DOCUMENTS

1.4.1. The considerations, mitigation and measures that are described in this CSIP are informed by relevant assessments and descriptions contained within the Offshore Environmental Statement (ES) that supported the Marine Licence (CML2365) application. The relevant ES chapters are as follows:

- ES Volume 2, Chapter 4: The Proposed Development;
- ES Volume 2, Chapter 7: Other marine users;
- ES Volume 2, Chapter 8: Fish and shellfish ecology;
- ES Volume 2, Chapter 9: Benthic, subtidal and Intertidal Ecology;
- ES Volume 2, Chapter 11: Marine mammals; and
- ES Volume 2, Chapter 13: Shipping and navigation.

1.4.2. This CSIP also interfaces with several other management plans, and method statements. It has been drafted to be consistent with the timings, approaches and controls set out in the preconstruction plans and documents submitted for approval under Marine Licence CML2365. Specifically, implementation of this CSIP will require interface with the following Management Plans, which are all Activity-specific Conditions of Marine Licence CML2365:

- Construction Environmental Management Plan (CEMP), as required in Condition 3.25;
- Written Scheme of Investigation (WSI), as required in Condition 3.24;
- Marine Mammal Management Plan (MMMP), as required in Condition 3.26;
- Vessel Management Plan (VMP), as required in Condition 3.27;
- Navigation and Safety Plan (NSP), as required in Condition 3.29;
- Lighting and Marking Plan (LMP), as required in Condition 3.30; and
- Cable crossing and working agreements, as required in Condition 3.31.

1.4.3. On completion of the cable laying activities Liverpool Bay CCS Limited will undertake the following;

- Compass Deviation Survey, as required in Condition 3.28;
- Installed Cable and Pipeline Report, as required in Condition 3.32; and
- Post Construction As-Built Report, as required in Condition 3.33.

2. CABLE ROUTE AND LOCATION

2.1. OVERVIEW

2.1.1. The charts in Appendix A illustrate the proposed and existing offshore infrastructure in Liverpool Bay, focusing on the cable and pipeline routes between key platforms and facilities, including Hamilton Main, Hamilton North, Lennox, Douglas CCS, and the Point of Ayr Gas Plant.

2.1.2. The charts show the proposed cable crossings of existing infrastructure, such as the export cables from offshore wind farms. Aggregate extraction areas, and anchorages are also shown, along with the charted depth of the navigable waters..

2.1.3. The cable routing has been selected to avoid, as far as practicable, existing infrastructure in Liverpool Bay. Where the cables cross third-party cables, crossing agreements have been secured between Liverpool Bay CCS Limited and the relevant operators. These cable crossing and working agreements have been obtained to satisfy the requirements of Marine Licence CML2365 Condition 3.31.

2.2. KEY FEATURES IN PROJECT AREA

OFFSHORE COMBINED ELECTRICAL AND FIBRE OPTIC CABLE LAYOUT

2.2.1. The routing of the proposed four power cables will, as a general principle, follow the alignment of existing pipelines, at an offset of around 100 m, with some micro-routing around identified obstructions.

2.2.2. Proposed PoA to Douglas CCS Cable Route: The approximately 35 km length of combined electrical and fibre optic cable, connecting Point of Ayr to Douglas CCS will be installed, mainly in parallel to the existing PL1030 gas export pipeline, which will be repurposed for the transport of CO_2. This route is shown alongside existing infrastructure on the charts in Appendix A.

2.2.3. Proposed Douglas CCS to Satellite Platforms Cable Routes: There is an additional requirement of 62 km of cabling to connect Douglas CCS with each of the three satellite platforms. Approximately 15 km of this subsea cabling will connect Douglas CCS to Hamilton North Offshore Platform (OP), 12 km would connect to Hamilton Main OP, and 35 km to the Lennox OP. Each of the cables will have to cross several existing pipelines and cables.

2.2.4. Proposed Cable Crossings: The number of crossings by each cable, and the typical composition of the external cable protection at these locations is described in the Technical Specification in Section 3. The routes of these cables are shown alongside existing infrastructure on the charts in Appendix A.

2.2.5. Existing Power Cables and Pipelines: Multiple existing cables and pipelines are mapped, including gas export, oil export, methanol, condensate, water injection, and umbilicals. These connect various platforms and facilities in the area.

GEOGRAPHICAL AND ENVIRONMENTAL CONTEXT

2.2.6. Wind Farms and Mining Areas: The maps in Appendix A show the proximity to several wind farms (Gwynt-y-Mor, Rhyl Flats, North Hoyle, Burbo Bank Extension) and mining areas (Hilbre Swash Mersey sand mining area, Hanson Aggregates mining area).

2.2.7. Anchorage Zones: Areas where anchorage is prohibited are clearly marked, ensuring protection of the subsea infrastructure.

2.2.8. Spoil Grounds and Exclusion Zones: Spoil grounds and exclusion zones (such as the Resurgam exclusion zone) are identified to guide marine operations.

BATHYMETRY AND NAVIGATIONAL FEATURES

2.2.9. Water Depths and Shipwrecks: The plans in Appendix A provide information on water depths and shipwreck locations, which are important for cable routing and marine safety.

2.2.10. Shipping Lanes and Marine Traffic: Marine traffic corridors and offshore buffers are shown to highlight navigational considerations.

TECHNICAL NOTES AND REFERENCE SYSTEMS

2.2.11. All dimensions and coordinates on the charts and plans in Appendix A use the European Datum 1950 UTM Zone 30N, with details on projection and units provided. Section 3: Technical Specification provides all coordinates in WGS84 system.

2.2.12. Please note that the routing and crossings, describe in this CSIP, and shown in Appendix A, could be subject to minor changes in the field, based on survey information and in-field adjustments.

3. TECHNICAL SPECIFICATION

3.1. OVERVIEW

3.1.1. This section details the technical specifications of the offshore electrical cables for the LB CCS Project. Full details of the proposed parameters for each cable are presented in the following sections. The cables are designed for static operation for the 25-year service life of the Liverpool Bay CCS Project.

3.1.2. The cable performance parameters for the medium voltage (MV) cables, physical characteristics, mechanical performance, and calculated continuous current ratings are set out in Table 3-1.

Table 3-1 – Design parameters for offshore electrical cables

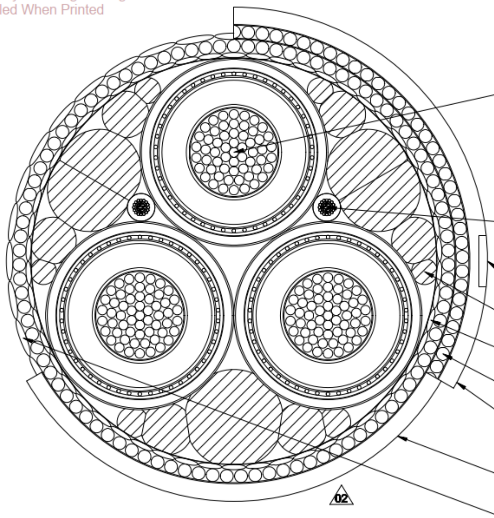
Parameter	Douglas CCS to satellites cables		PoA to Douglas CCS Cable		
	cable on seabed (single wound roved)	cable in J-tube (single wound sheathed)	cable on seabed (single wound roved)	cable in J-tube (single wound sheathed)	Cable in HDD conduit (double wound sheathed)
Overall diameter (mm)	140 (+/- 4)	147 (+/- 3)	177 (+/- 4.5)	186 (+/- 3.5)	197 (+/- 3.5)
Weight in air (kg/km)	30,070	31,720	40,470	43,050	59,970
Weight in seawater - unflooded (kg/km)	N/A	14,320	N/A	15,170	28,700
Weight in seawater - flooded (kg/km)	17,120	16,970	19,240	18,990	33,190
Specific gravity in seawater	2.09	1.82	1.76	1.54	1.92
Minimum breaking strength (kN)	805	805	1,135	1,135	2,240
Estimated maximum permissible impact energy (kJ/m)	15	15	15	15	15
Minimum bend radius for drumming, loadout & storage (m)	1.40	1.47	1.77	1.86	1.97
Maximum allowed tension for drumming, loadout & storage (kN)	23.8	25.0	30.1	31.6	33.5

3.1.3. The cables have been designed to operate at 18/30(36)kV with an increased insulation to meet Category C as defined in IEC 63026.

3.1.4. The 36/60~69(72.5) kV cables are designed to be operated in all electrical systems with maximum system voltages up to Um = 72.5 kV respectively, so long as they fall into category A or B as defined in IEC 63026.

3.1.5. Accordingly, the 36/60~69(72.5) kV cable will be qualified and tested in accordance with the voltage levels given in the U = 60 to 69 kV, Um = 72.5 kV, U0 = 36 kV row of Table 4 of IEC 63026 without adjustment.

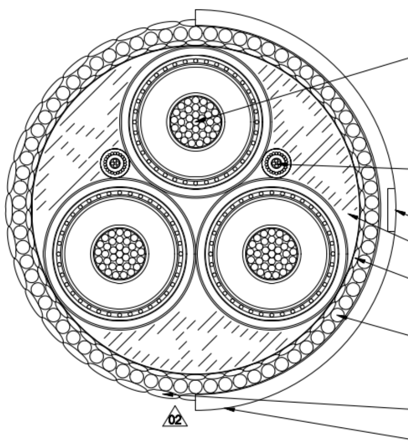
IF IN DOUBT - ASK DO NOT SCALE	REVISION	DATE	REV	DRWN	CHKD (DES)	CHKD (MFG)	APPD
	INITIAL ISSUE	03 APR 2025	00	DM	MO	LJ	GC
	UPDATED FOR CLIENT COMMENTS	16 MAY 2025	01	DM	MO	N/A	GC
	UPDATED FOR CLIENT COMMENTS	07 JUL 2025	02	DM	MO	N/A	GC



CALCULATED CABLE PROPERTIES	SWR	SWS	DWS
OUTER DIAMETER	176 ± 4.5 mm	185 ± 3.5 mm	196 ± 3.5 mm
WEIGHT IN AIR	38,990 kg/km	41,500 kg/km	58,320 kg/km
WEIGHT IN SEAWATER - UNFLOODED	N/A	13,920 kg/km	27,360 kg/km
WEIGHT IN SEAWATER - FLOODED	17,960 kg/km	17,660 kg/km	31,770 kg/km
MAX. CONDUCTOR TEMPERATURE		90 °C	

Figure 3-1: Section of PoA to Douglas CCS electrical and fibre-optic cable

IF IN DOUBT - ASK DO NOT SCALE	REVISION	DATE	REV	DRWN	CHKD (DES)	CHKD (MFG)	APPD
	INITIAL ISSUE	03 APR 2025	00	DM	MO	LJ	GC
	UPDATED FOR CLIENT COMMENTS	16 MAY 2025	01	DM	MO	N/A	GC
	UPDATED FOR CLIENT COMMENTS	07 JUL 2025	02	DM	MO	N/A	GC



CALCULATED CABLE PROPERTIES	SWR	SWS
OUTER DIAMETER	140 ± 4 mm	147 ± 3 mm
WEIGHT IN AIR	30,070 kg/km	31,720 kg/km
WEIGHT IN SEAWATER - UNFLOODED	N/A	14,320 kg/km
WEIGHT IN SEAWATER - FLOODED	17,120 kg/km	16,970 kg/km
MAX. CONDUCTOR TEMPERATURE	90 °C	

Figure 3-2: Section of Douglas CCS to satellites electrical and fibre-optic cable

3.2. CABLE PROTECTION STRATEGY

3.2.1. The principal cable protection method is burial. The Cable Burial Risk Assessment (CBRA) summarised in Section 5, and detailed in Appendix B, has identified a uniform Depth of Cover (DoC) of 2.0 meters along the entire PoA to Douglas CCS cable route, and the cable lengths in Welsh Waters from Douglas CCS to satellite platforms, except at crossings and locations protected by concrete mattresses or rock berms. This depth is designed to mitigate the combined risks from fishing, shipping, and sediment mobility. Table 3-2 provides a summary of the recommended burial depths.

Table 3-2 – Summary of recommended burial depths for PoA to Douglas CCS cable

Route Section / Key Point	Recommended Burial Depth (DoC)	Notes
General Route	2.0 m	Applies to most of the route
Crossings / Mattress-Protected	As per design / protection	Depth may be reduced where additional protection is present
Welsh Channel (KP 1.5–2.5)	2.0 m	Ensures 9 m water depth, addresses high vessel traffic
TSS Corridor (KP 29–32.5)	2.0 m	High anchor strike risk
Near Douglas Platform (KP 32.5+)	2.0 m (with mattresses)	High anchor risk and seabed mobility,

3.2.2. The design of the crossings of existing, third-party subsea cables and pipelines, focusses on the use of concrete mattresses and rock berms. The crossing designs have been chosen to ensure the stability and integrity of the proposed crossings under environmental and operational loading conditions.

3.2.3. The concrete mattresses selected are 6 m in length, 3 m in width, and 0.3 m in thickness, with a density of approximately 2,400 kg/m^3 and edge blocks of 3,600 kg/m^3. For rock berms, a two-layer system has been adopted, comprising an inner fill layer with rock sizes ranging from 25 mm to 150 mm, and an armour layer with rock sizes between 150 mm and 600 mm. The location, and amount of cable protection required at each of the crossings is set out in a series of tables throughout Section 3.3, and Section 3.4, which are supported by the design drawings in Appendix B.

3.2.4. The cables will be installed through Simultaneous Lay and Burial (SLB) to achieve the 2.0 m DoC. The cable trencher will perform some pre-trenching in areas with stiff sediments to facilitate effective burial.

3.3. POA TO DOUGLAS CCS CABLE

CABLE SPECIFICATION

3.3.1. The Point of Ayr (PoA) to Douglas CCS cable will comprise a 3-core, 33 kV, armoured electrical cable with bundled fibre-optic cable and a variable external diameter of 177 - 197mm. The single armoured submarine cable comprises an aluminium conductor, XLPE (Cross Linked Polyethylene), coper wires, and copper foil bonded to the polyethylene sheath. The design parameters for the PoA to Douglas CCS cable are set out in Table 3-3.

Table 3-3 – Design parameters for PoA to Douglas CCS cable

Parameter	Maximum parameter	
Cable length	35,000 metres	
Cable start and end	E: 3 20 22.74 N: 53 21 16.56	E: 4 34 58.04 N: 53 32 19.94
Median Line crossed	Cable entirely in Welsh waters. No median line crossed by cable	
Cable diameter	156 mm	
Burial depth	2-3 m	
Cable trench width	1-1.5 m	
Voltage	33kV 50Hz	

CABLE CROSSINGS AND PROTECTION

3.3.2. The newly installed combined electrical and fibre-optic cables from PoA to the Douglas CCS platform, along with the three inter-platform cables, will necessitate the implementation of protective measures at all cable crossing locations. In total, 27 crossings will be present across the four cable routes, 23 of which are in Welsh Waters. Full details of these crossings can be found in the following sections.

3.3.3. To safeguard these crossings, concrete mattresses and rock berms are being used for safe separation and protection of the subsea assets. They will provide a stable, heavy platform that maintains the required vertical clearance between pipelines and cables. Simultaneously, the mattresses and rock berms will provide mechanical protection against hydrodynamic forces and prevents exposure. The design also prevents seabed scour, and external impacts, and ensures that individual rock articles, and the berm, remain stable under combined wave and current loading throughout the 25-year design life.

3.3.4. A typical crossing with a concrete mattress involves placing a pre-lay concrete mattress on top of the existing line (if exposed) or above the buried line on the seabed to achieve the minimum vertical separation of 300mm (as per FEED design) for crossings. The cable is then laid over the pre-laid concrete mattress. Sandbags may be used to support cable free spans if necessary, ensuring a smooth cable profile. Finally, post-lay concrete mattresses are placed over the cable to protect the cable.

3.3.5. The concrete mattress have been designed to ensure the stability of both the mattress itself and the cable or pipeline section it covers or underlays. The mattress will remain in its installed position throughout the design life and shall not be dislodged or displaced under any environmental loading conditions. To achieve these goals, the design has addressed the following critical failure scenarios:

- Mattress Dislodging: Resistance against hydrodynamic forces (drag and lift) that could cause the mattress to move or overturn.
- Cable Pull-Out: Prevention of lateral movement of the covered section beneath the mattress due to excess hydrodynamic or operational forces.
- Hydraulic Stability: Ability to withstand seabed shear stresses and prevent winnowing or scour beneath the mattress.
- Total System Stability: Ensuring the combined mattress–pipeline/cable system does not slide across the seabed under extreme conditions.

3.3.6. **PoA to Douglas CCS Cable**, Ten crossings over existing third-party assets, including wind farm export cables (Ørsted Burbo Bank, Greencoat North Hoyle, Gwynt y Môr) and National Grid/Scottish Power HVDC Western Link, plus existing condensate and gas pipelines.

3.3.7. Liverpool Bay CCS Limited has secured crossing agreements with all these third parties. The coordinates and the name of the existing asset crossed are set out in Table 3-4 and shown in the design drawings in Appendix B.

Table 3-4 – Design parameters for PoA to Douglas CCS cable crossings

Crossing ID	Crossings	Easting (DD MM SS)	Northing (DD MM SS)	Kilometre point (KP)
PoAX-1	Ørsted Burbo Bank wind farm	03 26 16.63	53 23 25.2	9+842
PoAX-2	Greencoat UK Wind North Hoyle wind farm	03 38 14.81	53 23 41.99	12+089
PoAX-3		03 28 15.83	53 23 42.03	12+108
PoAX-4	Gwynt y Môr OFTO, Gwynt y Môr wind farm	03 34 28.38	53 24 20.1	19+276
PoAX-5		03 34 29.99	53 24 21.84	19+338
PoAX-6		03 34 41.76	53 28 4.58	26+248
PoAX-7	National Grid/Scottish Power, Western Link HVDC cable	03 34 44.44	53 31 21.46	32+333
PoAX-8		03 34 44.46	53 31 22.48	32+364
PoAX-9	Existing 2 x 3" Condensate PL1032 + PL1033	03 34 42.59	53 32 1.96	33+671
PoAX-10	Existing 20" Gasa PL1030	03 29 17.26	53 32 3.56	33+682

Note: Coordinates in WGS84 DD MM SS.

3.3.8. **PoA to Douglas CCS Cable**, Ten crossings over existing third-party assets, including wind farm export cables (Ørsted Burbo Bank, Greencoat North Hoyle, Gwynt y Môr) and National Grid/Scottish Power HVDC Western Link, plus existing condensate and gas pipelines. This cable has the protection requirements set out in Table 3-5.

Table 3-5 – Material quantities for protection at PoA to Douglas CCS cable crossings

Crossing ID	Pre-lay protection	Total quantity (Nos)	Post-lay protection	Total length (m)	Total quantity / volume (Nos. m^3)
PoAX-1	Concrete mattress	1	Concrete mattress	134	23 Nos
PoAX-2 & 3	Concrete mattress	2	Concrete mattress	159	27 Nos
PoAX-4 & 5	Concrete mattress	2	Rock berm	193	1,593 m^3
PoAX-6	Concrete mattress	1	Rock berm	134	536 m^3
PoAX-7 & 8	Concrete mattress	2	Rock berm	165	660 m^3
PoAX-9 & 10	Concrete mattress	2	Concrete mattress	147	25 Nos

Note: All quantities within parameters in Marine Licence CML2368

3.4. INTER-PLATFORM CABLES

CABLE SPECIFICATION

3.4.1. Each of the cables from Douglas CCS to the three satellite platforms will comprise a 3-core, 33 kV, armoured electrical cable with bundled fibre-optic cable and an external diameter of 156 mm. Each of the single armoured submarine cables comprises a copper conductor, XLPE, copper wires, and copper foil bonded to the polyethylene sheath. The design parameters for the inter-platform cables from Douglas CCS to the three satellites are set out in Table 3-6.

Table 3-6 – Design parameters for Douglas CCS to satellites cables

Parameter	Maximum parameter	
Douglas CCS to Hamilton North		
Cable length	15,000	
Cable start and end	E: 3 28 41.09 N: 53 38 46.91	E: 3 34 58.04 N: 53 32 19.94
Median Line crossed	Cable starts at Douglas CCS in Welsh waters and terminates at Hamilton Main in English Waters. Crosses median line at: E: 3 34 67.21, N: 53 33 41.43	
Cable diameter	156 mm	
Burial depth	2-3 m	
Cable trench width	1-1.5 m	
Voltage	33kV 50Hz	
Douglas CCS to Hamilton Main		
Cable length	12,000	
Cable start and end	E: 3 27 16.15 N: 53 33 57.47	E: 3 34 58.04 N: 53 32 19.94
Median Line crossed	Cable starts at Douglas CCS in Welsh waters and terminates at Hamilton Main in English Waters. Crosses median line at: E: 3 34 21.37, N: 53 33 22.65	
Cable diameter	156 mm	
Burial depth	2-3 m	
Cable trench width	1-1.5 m	
Voltage	33kV 50Hz	
Douglas CCS to Lennox		
Cable length	35,000	
Cable start and end	E: 3 10 35.62 N: 53 37 52.81	E: 3 34 58.04 N: 53 32 19.94
Median Line crossed	Cable starts at Douglas CCS in Welsh waters and terminates at Hamilton Main in English Waters. Crosses median line at: E: 3 34 55.79, N: 53 33 40.68	
Cable diameter	156 mm	
Burial depth	2-3 m	
Cable trench width	1-1.5 m	
Voltage	33kV 50Hz	

CABLE CROSSINGS AND PROTECTION

3.4.2. The newly installed combined electrical and fibre-optic cables from the Douglas CCS to the three satellite platforms will necessitate the implementation of protective measures at all cable crossing locations. In total, 23 crossings will be present across the three cable routes.

3.4.3. To safeguard these crossings, various protection strategies will be employed. These include the use of concrete mattresses in differing quantities depending on each route, rock placement for most of the routes. The protection requirements for the cable crossings are summarised in the following sections.

3.4.4. Douglas CCS to Hamilton Main Cable: Five crossings over Eni-owned pipelines, including oil export, gas export, methanol, and injection lines. This cable has the protection requirements set out in Table 3-7.

Table 3-7 – Material quantities for protection at Douglas CCS to Hamilton Main cable crossings

Crossing ID	Pre-lay protection	Total quantity (Nos)	Post-lay protection	Total length (m)	Total quantity / volume (Nos. m^3)
DHMX-1, 2, 3, 4, & 5	Concrete mattress	1	Concrete mattress	454	76 Nos

Note: All quantities within parameters in Marine Licence CML2365

3.4.5. The crossings for the Douglas to Hamilton Main inter-platform cable are over existing Eni owned pipelines and cables. The coordinates and the name of the existing asset crossed are set out in Table 3-8.

Table 3-8 – Design parameters for Douglas CCS to Hamilton Main cable crossings

Crossing ID	Crossings	Easting (DD MM SS)	Northing (DD MM SS)
DHMX-1	8" Production (PL2939) + 3" Condensate (PL2941) to CONWY	03 34 48.66	03 32 27.88
DHMX-2	8" Water Injection (PL2940) to CONWY	03 34 46.80	03 32 28.30
DHMX-3	14" Oil Export (PL1031) to OSI	03 34 45.71	03 32 28.55
DHMX-4	14" Gas (PL1041) + 2" Methanol (PL1042) from Hamilton North	03 34 44.28	03 32 28.88
DHMX-5	Existing power cable to Hamilton North	03 34 43.32	03 32 29.10
DHMX-6	Existing power cable to Hamilton Main	03 34 42.75	03 32 29.23
DHMX-7	16" Gas Injection (PL1035) from Lennox	03 34 41.66	03 32 29.47
DHMX-8	14" Oil Export (PL1034) + 2" Methanol (PL1037) from Lennox	03 34 40.31	03 32 29.78
DHMX-9	12" Gas Injection (PL1036) + 2" Wax Inhibitor (PL1038) to Lennox	03 34 39.02	03 32 30.07
DHMX-10	20" Gas Export (PL1039) + 2" Methanol (PL1040) from Hamilton Main	03 34 37.84	03 32 30.35
DHMX-11	12" Gas Injection (PL1036A) to Lennox	03 34 35.74	03 32 30.82

Note: Coordinates in WGS84 DD MM SS.

3.4.6. **Douglas CCS to Hamilton North Cable:** Six crossings over Eni-owned pipelines and a power cable, including Conwy production, condensate, water injection, umbilical lines, oil export, gas/methanol, and an existing Hamilton North power cable. This cable has the protection requirements set out in Table 3-9.

Table 3-9 – Material quantities for protection at Douglas CCS to Hamilton North cable crossings

Crossing ID	Pre-lay protection	Total quantity (Nos)	Post-lay protection	Total length (m)	Total quantity / volume (Nos. m^3)
DHNX-1, 2, & 3	Concrete mattress	2	Rock berm	174	696 m^3
DHNX-4	Concrete mattress	1	Rock berm	134	536 m^3
DHNX-5, & 6	Concrete mattress	2	Rock berm	180	720 m^3

Note: All quantities within parameters in Marine Licence CML2365

3.4.7. The crossings for the Douglas to Hamilton North inter-platform cable are over existing Eni owned pipelines and cables. The coordinates and the name of the existing asset crossed are set out in Table 3-10.

Table 3-10 – Design parameters for Douglas CCS to Hamilton North cable crossings

Crossing ID	Crossings	Easting (DD MM SS)	Northing (DD MM SS)
DHNX-1	8" PL2939 Production to Conwy	03 35 29.52	53 33 3.27
DHNX-2	3" PL2941 Condensate to Conwy	03 35 29.52	53 33 3.27
DHNX-3	8" PL2940 water injection to Conwy + Control umbilical PLU2942 from Douglas to Conwy	03 35 28.93	53 33 4.52
DHNX-4	14" Oil Export PL1031 to OSI	03 34 58.92	53 33 41.09
DHNX-5	14" Gas Export PL1041 + 2" Methanol PL1042 from Hamilton North	03 34 27.15	53 33 47.24
DHNX-6	Existing power cable to Hamilton North	03 34 24.76	53 33 47.7

Note: Coordinates in WGS84 DD MM SS.

3.4.8. **Douglas CCS to Lennox Cable:** Six crossings over Eni-owned pipelines and an existing power cable, similar asset set to the Douglas–Hamilton North route. This cable has the protection requirements set out in Table 3-11.

Table 3-11 – Material quantities for protection at Douglas CCS to Lennox cable crossings

Crossing ID	Pre-lay protection	Total quantity (Nos)	Post-lay protection	Total length (m)	Total quantity / volume (Nos. m^3)
DLX-1, 2, & 3	Concrete mattress	2	Rock berm	174	696 m^3
DLX-4	Concrete mattress	1	Rock berm	132	528 m^3
DLX-5 & 6	Concrete mattress	2	Rock berm	181	724 m^3

Note: All quantities within parameters in Marine Licence CML2365

3.4.9. The crossings for the Douglas to Hamilton North inter-platform cable are over existing Eni owned pipelines and cables. The coordinates and the name of the existing asset crossed are set out in Table 3-12.

Table 3-12 – Design parameters for Douglas CCS to Lennox cable crossings

Crossing ID	Crossings	Easting (DD MM SS)	Northing (DD MM SS)
DLX-1	8" PL2939 Production to Conwy	3 .21 12.72	5 21 58.82
DLX-2	3" PL2941 Condensate to Conwy	3 35 28.33	53 33 2.19
DLX-3	8" PL2940 water injection to Conwy	3 35 27.76	53 33 3.41
DLX-4	14" Oil export PL1031 to OLU	3 34 59.06	53 33 40.05
DLX-5	14" Gas export PL1041 + 2" Methanol PL1042 from Hamilton North	3 34 28.69	53 33 45.92
DLX-6	Existing power cable to Hamilton North	3 34 26.27	53 33 46.39

Note: Coordinates in WGS84 DD MM SS.

3.5. REVIEW OF CABLE ROUTE LOCATIONS WHERE WATER DEPTH REDUCED BY >5%

3.5.1. This section incorporates the findings of the Cable Burial Risk Assessment (CBRA) (see Section 4) encompassing the identification of any cable protection that exceeds 5% of navigable depth referenced to Chart Datum. Where there are any areas of cable protection and crossings exceeding 5% of navigable depth, details of any steps to be taken are provided.

ASSESSMENT OF HYDRODYNAMIC INFLUENCE FROM CABLE CROSSINGS

3.5.2. An assessment was undertaken to determine whether any proposed cable protection at existing infrastructure crossings would result in a reduction in local water depth greater than 5%, which is considered a threshold for potential hydrodynamic or sediment transport effects.

3.5.3. Each crossing was evaluated by comparing the crossing height above seabed against the charted Lowest Astronomical Tide (LAT) water depth at the crossing location. The percentage reduction in water depth was calculated as:

- *Reduction (%) = (Crossing Height / Water Depth) × 100*

3.5.4. The analysis presented in Table 3-13 shows that five of the proposed crossing arrangements result in a reduction in water depth greater than 5%, specifically: PoAX-1, PoAX-6, PoAX-2 & PoAX-3, PoAX-4 & PoAX-5, and PoAX-7 & PoAX-8. These reductions range from approximately 5.5% to 18%. The remaining crossing, PoAX-9 & PoAX-10, results in a reduction of approximately 3.2%, below the 5% threshold.

3.5.5. Although several crossings exceed the 5% criterion, the absolute changes in water depth are small (0.9–1.7 m), and the modifications represent localised, static seabed features associated with standard cable protection (mattresses or rock berms). Such features are not anticipated to significantly alter tidal flows, induce scour beyond the immediate footprint, or materially influence wider sediment transport patterns. The extent of each crossing structure is limited and does not form a continuous obstruction capable of generating appreciable hydrodynamic effects.

3.5.6. On this basis, the proposed crossing protection is not expected to result in any meaningful change to baseline hydrodynamic or morphological conditions and therefore does not pose an increased risk to cable burial integrity or seabed stability.

Table 3-13 – Change in water depth for PoA to Douglas CCS cable crossings

Crossing ID	Water Depth (m, LAT)	Crossing Type	Crossing height above seabed (m)	% reduction in water depth
PoAX-1	5	Mattresses	0.9	18.0
PoAX-6	20	Berm	1.1	5.5
PoAX-2 & PoAX-3	7	Mattresses	0.9	12.9
PoAX-4 & PoAX-5	12	Berm	1.5	12.5
PoAX-7 & PoAX-8	30	Berm	1.7	5.7
PoAX-9 & PoAX-10	28	Mattresses	0.9	3.2

CABLE CROSSING RISK RATING

3.5.7. A CBRA risk rating was undertaken for ten cable crossings (PoAX-1 to PoAX-10) using the Carbon Trust OWA methodology. Each hazard was assessed for probability and severity, with risk calculated as the product of these scores. Risks were categorised as Low, Moderate, High, or Very High, and mitigation measures were prioritised accordingly. Residual risk was reassessed post-mitigation to ensure all risks are reduced to ALARP.

3.5.8. The assessment considered three hazards: (H1) local hydrodynamic and morphological change around the crossing protection; (H2) third-party interaction (notably benthic fishing gear); and (H3) emergency anchor interaction. Probability (P) and Severity (S) were scored on a 1–5 scale with Risk R=P×S.

3.5.9. As described in paragraph 3.5.3, based on the LAT depth, protection type and crossing height, five crossings exceed the >5% depth-reduction screening threshold (PoAX-1; PoAX-6; PoAX-2&3; PoAX-4&5; PoAX-7&8). These are assessed as Moderate pre-mitigation for H1 and/or H2, primarily due to shallow water and protrusion height. The remaining crossing (PoAX-9&10) is Low for H1 (3.2% reduction) and Moderate for H2 prior to mitigation.

3.5.10. The following measures are embedded: tapered transitions/ramps and mattress fringing to remove steps, pre- and post-lay surveys with targeted re-instatement if required, and third-party controls comprising Notices to Mariners, Kingfisher bulletins, fisheries liaison and AtoNs where appropriate. With these measures in place, residual risks reduce by ~1 likelihood grade, resulting in Low to Moderate residual scores across all crossings.

3.5.11. No material change to baseline hydrodynamic or morphological conditions is anticipated given the small absolute changes in depth (0.9–1.7 m) and the localised footprint of the engineered protection.

4. CABLE BURIAL RISK ASSESSMENT

4.1. INTRODUCTION

4.1.1. The following sections provide a detailed assessment of cable burial risks and routing factors to emerge from the Cable Burial Risk Assessments (CBRA) that have informed the final design of the PoA to Douglas CCS, and Douglas CCS to satellites cable routes and burial strategies within the Liverpool Bay CCS Project. This includes considerations regarding the micro-routing, specified target burial depths, and the determination of appropriate cable protection measures and types.

4.1.2. The CBRA that have been carried out are present in Appendix C. There is a CBRA for each of the four cables. The PoA to Douglas CCS cable is located entirely in Welsh Waters. The Douglas CCS to satellite cables are partially in Welsh Waters, as set out in Table 4-1. The coordinates for the point at which each of the Douglas CCS to satellite cables crosses the median line between Welsh and English Waters are presented in Table 3-6.

Table 4-1 – Cable Burial Risk Assessments prepared for CML2365 Activity 1

CBRA Title and document number	Length of cable in Welsh Waters
CBRA PoA to Douglas CCS: 10562701DSQJ1025W_EXDE_02	~35,000m
CBRA Douglas CCS to Hamilton North: 10265601DSQJ1027W_EXDE_00	~2,900m
CBRA Douglas CCS to Hamilton Main: 10255601DSQJ1026W_EXDE_00	~2,100m
CBRA Douglas CCS to Lennox: 10245601DSQJ1028W_EXDE_00	~2,900m

4.1.3. Determining the appropriate burial depths for the subsea power cable, has balanced protection from external threats, installation feasibility, environmental considerations, and lifecycle cost, and has followed the relevant standards and guidance (e.g., Carbon Trust, IEC 62913, DNVGL-RP-0360).

4.1.4. Key objectives have been to ensure cable integrity, minimise risk of exposure, and provide input into the burial depth specification.

4.1.5. For the PoA to Douglas CCS cable, the CBRA has identified three primary risks influencing burial depth requirements:

- Fishing: Bottom trawling activity and associated equipment penetration.
- Shipping: Anchor strike risk, especially near high-traffic areas.
- Sediment Mobility: Seabed changes due to sandwaves, bedforms, and historical mobility.

4.2. DATA COLLECTION AND REVIEW

SEABED SURVEYS

4.2.1. As part of the planning, assessment and development of the Liverpool Bay CCS Project, a geophysical survey covering the full extent of the development area (including the cable corridors) has been undertaken. This has provided information on seabed elevation and surficial sediment type, as well as the nature and thickness of underlying sedimentary units. Further details of data and assessments that have informed the considerations on cable installation and specification are set out in Table 4-2 and Table 4-3.

Table 4-2 – Summary of available bathymetric data for the cables

Source	Summary	Coverage of project area
Geophysical survey	High resolution geophysical survey of the area (July – September 2025)	Complete coverage of the Cable Route
Navigation charts (UKHO)	Description of bathymetry and general seabed type at a regional scale	Complete coverage of the Cable Route
ABPmer SEASTATES Wave Hindcast Database	Hindcast database of wave height, period and direction (approximately 40 years, 1979 to near present) approximately 5 km resolution.	Complete coverage of the Cable Route
ABPmer SEASTATES Tide and Surge Hindcast Database	Hindcast database of water levels, current speed and direction (approximately 40 years, 1979 to near present) approximately 2 km resolution.	Complete coverage of the Cable Route
NOAA Climate Forecast System Reanalysis (CFSR)	Hindcast database of wind speed and direction (approximately 40 years, 1979 to near present) approximately 2 km resolution.	Complete coverage of the Cable Route
Wave Buoy	Observations of wave height, period and direction (approximately 10 years used, January 2015 to near present)	Complete coverage of the Cable Route
Benthic Survey	Benthic survey including sediment grab samples at multiple locations within the Project Area. Data reported in 2023 Environmental Statement and supplemented by Pre-construction Baseline scheduled for summer 2025.	Complete coverage of the Cable Route
National Tide and Sea Level Facility	Tide gauge collecting water level data since 1990.	Complete coverage of the Cable Route

OTHER DATA SOURCES

4.2.2. The project-specific data, surveys, and assessments that have informed the CBRAs are set-out in Table 4-3.

Table 4-3 – Data and assessments informing cable burial risk

Topic	Data
Unexploded Ordnance (UXO)	Magnetometry seabed survey data (Gardline, 2025) Magnetometry drone survey data (SENSYS, 2025) UXO Hazard Assessment (Zetica, 2021)
Archaeology	Tetra Tech RPS Energy, Offshore Written Scheme of Investigation and Protocol for Archaeological Discoveries, 19 December 2025
Fishing	AIS and boat-based survey
Shipping	AIS and boat-based survey Anchor drag study (Anatec, 2023)
Dredging and dumping	Dredging and dumping sites from publicly available sources including UKHO, The Crown Estate (TCE) and DEFRA. British Marine Aggregate Producers Association (BMAPA) transit routes, indicating marine aggregate dredger activity (BMAPA) Marine aggregate dredging areas (licenced and active) (TCE)
Existing infrastructure	Existing sources including the Kingfisher Information Service – Offshore Renewable and Cable Awareness (KIS-ORCA) project.

4.2.3. The Assessment of Seabed Conditions arising from the review of the available data is presented in the following sections.

4.3. EXTERNAL THREATS ASSESSMENT

4.3.1. This section Identifies and characterises the threats to the four subsea cables that the burial has been designed to mitigate. The following threats have been evaluated, and the identified key risks have informed the prescribed burial depths:

- Fishing activity (trawling, dredging, scallop fishing).
- Shipping and anchoring (commercial vessels, anchorage zones, emergency anchoring risk).
- Seabed mobility (sand waves, mega ripples, scour, slope instability).
- Geohazards (boulders, hard ground, landslides).
- Third-party infrastructure (pipelines, telecom cables, crossings).
- Construction and O&M activities (rock placement, repair campaigns). Each threat should be described with reference to available data (AIS, VMS, fishing intensity maps, hydrographic charts, geophysical survey).

4.3.2. The evaluation has identified the following threats as relevant to the PoA to Douglas CCS cable

FISHING RISK

4.3.3. The maximum penetration depth for typical fishing gear is 0.3 m. Applying a factor of safety of 2, a minimum burial depth of 0.6 m is required where bottom trawling occurs. However, actual trawling activity is minimal along this route, so this is not the governing factor.

SHIPPING RISK

4.3.4. Along the PoA to Douglas CCS cable, anchor strike risk is highest:

- Near the Douglas platform (KP 33.0–33.5)
- In the Liverpool Bay Traffic Separation Scheme (TSS) corridor (KP 29.0–32.5)
- In the Welsh Channel (KP 1.5–2.5)

4.3.5. For the Douglas CCS to Hamilton North cable, anchor strike risk is highest:

- Near the Douglas platform (KP 0.5–1.0)
- In the Liverpool Bay Traffic Separation Scheme (TSS) corridor (KP 1.5–4.0)

4.3.6. Along the Douglas CCS to Hamilton Main cable, anchor strike risk is highest:

- Near the Douglas platform (KP 0.5–1.0)
- In the Liverpool Bay Traffic Separation Scheme (TSS) corridor (KP 2.0–3.5)

4.3.7. Along the Douglas CCS to Lennox cable, anchor strike risk is highest:

- Near the Douglas platform (KP 0.5–1.0)
- In the Liverpool Bay Traffic Separation Scheme (TSS) corridor (KP 1.5–4.0, and KP 10.5-16.0)

4.3.8. For all cables, the probabilistic analysis shows that increasing burial depth significantly reduces anchor strike risk. For example, at 2.0 m DoC, the return period for an anchor strike exceeds 2.3 million years.

SEDIMENT MOBILITY

4.3.9. Most of the cable routes experiences less than 1 m of seabed variation over recent years, except at the following locations:

- The first 4.5–6 km of the PoA to Douglas CCS cable (Welsh Channel and West Hoyle Spit) experiences higher historical mobility, with seabed changes up to 2 m.
- Spikes in mobility, associated with sandwave regions, are observed along the Douglas CCS to Hamilton North cable route from KP 9.0 to 12.0.
- Along the Douglas CCS to Hamilton Main cable route a spike in mobility is observed at KP 4.0.
- Seabed variations >1 m, associated with sandwave regions, are noted along the Douglas CCS to Lennox cable route between KP 9.0–15.0 and KP 22.5–25.
- For all cables near the Douglas platform, but these sections will be protected by mattresses.

4.3.10. For all cables, a 2.0 m burial depth has been selected to ensure the cable remains protected even in areas of significant seabed mobility.

SPECIAL CASES

4.3.11. Crossings and Protected Areas: Where the cables cross other infrastructure or are protected by mattresses/rock berms, the burial depth may be reduced as additional protection is provided.

4.3.12. Welsh Channel: The 2.0 m DoC ensures compliance with the Port of Mostyn requirements for maintaining a minimum water depth of 9 m.

4.4. RISK METHODOLOGY

OVERVIEW

4.4.1. The CBRA presented in Appendix B establishes the foundation for the burial depth recommendations by identifying the main risks and specifying how each should be managed. The most significant risks influencing burial depth are fishing, shipping (anchor strike), and sediment mobility. Other risks are addressed primarily through cable routing and avoidance rather than burial.

4.4.2. The CBRA has carried out a systematic evaluation of the risks to the cable along the proposed route. The assessment has identified and categorised threats as either natural or anthropogenic and outlined the recommended treatments and specific observations for each risk type. The main risks considered are fishing, shipping, sediment mobility, seismic activity, submarine landslides, mining/aggregate extraction, dredging, third-party infrastructure, unexploded ordnance (UXO), and dumping.

4.4.3. Table 4-4 outlines three natural risks to the cable route and their recommended treatments.

Table 4-4 – Natural risks

Risk	Description
Sediment mobility	• Sand waves and mega-ripples near the Douglas platform indicate potential for sediment movement. • CBRA recommends burial beneath non-mobile sediment; pre-sweeping or increased depth of lowering (DOL) may be required.
Seismic activity	• Minor seismic activity is present in the Liverpool Bay Area (LBA), with 712 events recorded in a 100 km radius from 2000 to 2025. • CBRA does not recommend burial as protection from seismic events; cable routing should consider seismic risk.
Submarine landslides	• A ridge with a slope of 20° between KP 32 and 32.5 is adjacent to the cable route. • Burial is not recommended as protection; routing should avoid landslide-prone areas.

4.4.4. The table outlines six anthropogenic risks to the cable route and their recommended treatments.

Table 4-5 – Anthropogenic risks

Risk	Description
Shipping	• The cable route intersects wind farms and is close to major vessel traffic lanes (Liverpool Bay TSS). • Probabilistic assessment methodology is used to evaluate anchor strike risk.
Fishing	• Typical DOL for protection from fishing gear is 0.6 m (0.3 m penetration × safety factor of 2). • Virtually no bottom trawling activity is present in the project area.
Mining/ Aggregate extraction	• Burial is not recommended as protection; cable routing should avoid these zones. • The Hilbre Swash Aggregate Extraction Zone is 3.5 km from the route but does not coincide with it.
Dredging	• CBRA recommends burial below the maximum dredged level in dredged areas. • Dredging occurs in the Dee Estuary and Mersey River, but not within the work area.
Third-party infrastructure	• There are 10 cable crossings along the route.
Aquaculture/ UXOs/dumping	• No relevant data or activity identified for aquaculture, UXOs, or dumping in the LBA.

4.4.5. The **CBRA** at **Appendix B** includes **Table 4-1** summarising each threat type, its description, general notes on treatment, and specific observations for the Point of Ayr to Douglas CCS cable route. This table provides a concise reference for the risk management strategies applied to each identified threat.

4.5. BURIAL CAPABILITY ASSESSMENT

RATIONALE FOR CABLE BURIAL DEPTHS

4.5.1. The determination of the appropriate cable burial depths has been a critical component of the subsea cable engineering and environmental risk management. The identification of burial depth has balanced multiple interacting factors, including external aggression risks (such as fishing gear and anchoring), natural seabed processes, regulatory obligations, and installation feasibility.

4.5.2. Industry-standard approaches such as the Cable Burial Risk Assessment (CBRA) methodology and supporting guidance from bodies including the Carbon Trust and DNV emphasise that burial depth should be tailored to local hazard profiles, seabed conditions, and long-term reliability expectations. In practice, this has meant selecting a depth that not only addresses the minimum technical requirement for a single risk driver, but also provides robust, multi-hazard protection across the full cable route.

4.5.3. For this project, the burial depth rationale integrates:

- quantified fishing and anchoring risks;
- analysis of historical and ongoing seabed mobility;
- requirements set by navigation and port authorities; and
- installation practicalities, including tool performance and geotechnical conditions.

4.5.4. The sections below summarise the basis for the selected burial depth, showing how each risk category has been assessed and how these considerations collectively justify a target burial depth of 2.0 m across the route, except where engineered protection (e.g., mattresses or rock placement) provides an equivalent level of safeguarding.

FISHING RISK

- Minimum Required Depth: 0.6 m (based on maximum fishing gear penetration of 0.3 m and a safety factor of 2).
- Actual Activity: Bottom trawling is virtually absent along the route, so fishing risk does not govern the burial depth selection.
- Conclusion: While 0.6 m would suffice for fishing alone, other risks require greater depth.

SHIPPING RISK (ANCHOR STRIKE)

- High-Risk Areas: Near the Douglas platform, the Liverpool Bay Traffic Separation Scheme (TSS) corridor, and the Welsh Channel.
- Probabilistic Analysis: Shows that anchor strike risk drops dramatically with increased burial depth:
  - At 0 m (surface lay): Return period ~83,718 years.
  - At 1 m: ~97,178 years.
  - At 1.5 m: ~1,050,561 years.
  - At 2.0 m: ~2,309,926 years.
  - At 3.0 m: Risk is effectively eliminated.
- Conclusion: A burial depth of 2.0 m is chosen to ensure extremely low probability of anchor strike, even in the highest-risk sections.

SEDIMENT MOBILITY

- Historical Data: Most of the route has less than 1 m seabed variation over recent years, but the first 4.5–6 km (Welsh Channel, West Hoyle Spit) has seen changes up to 2.0 m.
- Mobility Risk: Burial depth must account for the possibility of cable exposure due to shifting sands and bedforms.
- Conclusion: 2.0 m depth ensures the cable remains protected even in areas with significant historical seabed movement.

REGULATORY AND OPERATIONAL REQUIREMENTS

- Welsh Channel: Port authority requires a minimum water depth of 9 m. The 2.0 m burial depth ensures compliance while maintaining cable protection.
- Crossings and Protected Areas: Where the cable is protected by mattresses or rock berms, burial depth may be reduced, as these features provide additional physical protection.

IMPLEMENTATION PRACTICALITIES

- Simultaneous Lay and Burial (SLB) Tool: Recommended for achieving the 2.0 m depth efficiently.
- Preparatory Works: May be needed in areas with stiff sediments to facilitate burial.

Table 4-6 – Rationale for 2.0 m burial depth

Risk/Requirement	Minimum Depth Needed	Governing Depth	Rationale for 2.0 m Selection
Fishing	0.6 m	No	Minimal trawling; not governing
Shipping (Anchor Strike)	1.5–2.0 m	Yes	Anchor strike risk drops sharply at 2.0 m
Sediment Mobility	Up to 2.0 m	Yes	Historical seabed movement up to 2 m
Regulatory (Welsh Channel)	2.0 m	Yes	Ensures 9 m water depth for navigation
Crossings/Mattresses	<2.0 m (as designed)	No	Additional protection allows reduced depth

CONCLUSION

4.5.5. The **2.0 m burial depth** is a robust, risk-based recommendation that balances protection against fishing gear, anchor strikes, and seabed mobility, while also meeting regulatory requirements and practical installation constraints. This depth is applied consistently along the route except where additional protection is provided by mattresses or rock berms.

Table 4-7 – Summary of recommended burial depths

Route Section / Key Point	Recommended Burial Depth (DoC)	Notes
General Route	2.0 m	Applies to most of the route
Crossings / Mattress-Protected	As per design/protection	Depth may be reduced where additional protection is present
Welsh Channel (KP 1.5–2.5)	2.0 m	Ensures 9 m water depth, addresses high vessel traffic
TSS Corridor (KP 29–32.5)	2.0 m	High anchor strike risk
Near Douglas Platform (KP 32.5+)	2.0 m (with mattresses)	High anchor risk and seabed mobility, external protection

4.6. DEPTH OF LOWERING SPECIFICATION

4.6.1. The CBRA recommends a **consistent 2.0 m burial depth** for the Point of Ayr to Douglas CCS cable, with adjustments only at crossings or where external protection is provided. This approach balances the risks from fishing, shipping, and sediment mobility, and is supported by probabilistic risk analysis and historical seabed data.

Table 4-8 –Recommended burial depths by key points along the cable route

Key Point / Section	Burial Depth (meters)	Rationale
General Route	2.0	Applies to most of the cable route, except for crossings and locations with additional protection (e.g., concrete mattresses, rock berms). This depth is selected to mitigate risks from fishing, shipping (anchor strikes), and sediment mobility.
Welsh Channel (KP 1.5–2.5)	2.0	High vessel traffic and port authority requirement to maintain a minimum water depth of 9 meters. The 2.0 m depth ensures compliance and protection against anchor strikes and seabed mobility.
Traffic Separation Scheme (TSS) Corridor (KP 29–32.5)	2.0	High density of cargo and tanker vessel crossings, increased anchor strike risk. The probabilistic risk assessment supports the 2.0 m depth for long-term protection.
Near Douglas Platform (KP 32.5-33.5)	2.0 (with mattresses)	Increased anchor strike risk due to slower-moving oil and gas vessels, and higher seabed mobility. This section will also be protected by concrete mattresses, further reducing risk of cable exposure.
Crossings and mattress-protected locations	<2.0 (as designed)	Where the cable crosses other infrastructure or is protected by mattresses/rock berms, the burial depth may be reduced, as these features provide additional physical protection.

Key Point / Section	Burial Depth (meters)	Rationale
Areas with high historical seabed mobility (First 4.5–6 km)	2.0	Historical data shows seabed changes up to 2 meters, especially near the West Hoyle Spit. The 2.0 m depth is chosen to ensure the cable remains buried even with ongoing seabed movement.

Additional Notes:

- **Minimum Depth for Fishing Risk:** 0.6 meters (not governing, as trawling is minimal).
- **Probabilistic Risk Analysis:** At 2.0 m, anchor strike risk is extremely low (return period >2.3 million years).
- **Implementation:** Simultaneous Lay and Burial (SLB) tool recommended; preparatory works may be needed in stiff sediment areas.

Table 4-9 –Burial depths by kilometre point (KP)

Kilometre Point (KP)	Recommended Burial Depth (meters)	Notes
0 – 4.5	2.0	High historical seabed mobility; depth selected to ensure long-term cover
4.5 – 6	2.0	Continued seabed mobility; West Hoyle Spit migration area
1.5 – 2.5	2.0	Welsh Channel; high vessel traffic and port authority requirement
6 – 29	2.0	General route; standard depth for fishing, shipping, and sediment mobility
29 – 32.5	2.0	Liverpool Bay TSS corridor; high anchor strike risk
32.5 – 33.5	2.0 (with mattresses)	Near Douglas platform; increased anchor risk and seabed mobility, external protection
Crossings / Mattress-Protected	<2.0 (as designed)	Depth may be reduced where additional protection is present

Additional Notes

- Throughout the route, the recommended burial depth is 2.0 meters at every kilometre point unless the cable crosses other infrastructure or is protected by mattresses/rock berms, in which case the depth may be reduced as per design.
- Special attention is given to the Welsh Channel (KP 1.5–2.5), the TSS corridor (KP 29–32.5), and near the Douglas platform (KP 32.5–33.5), where risks are elevated and the 2.0 m depth is confirmed.

4.7. MITIGATION MEASURES

ENGINEERING CONTROLS

4.7.1. **Optimised Depth of Lowering:** Specify burial depth based on risk assessment, ensuring adequate protection from fishing gear and anchors.

4.7.2. **Tapered Transitions/Ramps:** Use gradual transitions at the ends of mattresses, berms, or rock protection to reduce snag points and local scour.

4.7.3. Mattress Fringing/Overlap: Overlap or fringe mattresses to avoid abrupt steps and minimise snagging risk.

4.7.4. Micro-routing: Adjust cable route to avoid seabed features or high-risk areas (e.g., sandwaves, obstructions).

SURVEY AND MONITORING

4.7.5. Pre- and Post-Lay Surveys: Conduct high-resolution bathymetric and geophysical surveys before and after installation to confirm burial depth and detect hazards.

4.7.6. Routine O&M Monitoring: Schedule regular inspections to identify exposure, scour, or changes in seabed conditions.

4.7.7. Remedial Actions: Implement targeted re-burial or additional protection if surveys reveal increased risk.

OPERATIONAL AND THIRD-PARTY CONTROLS

4.7.8. Notices to Mariners (NtMs): Issue notifications to alert mariners of cable locations and crossings.

4.7.9. Kingfisher Bulletins: Use fisheries liaison bulletins to inform fishing communities about cable routes and protection.

4.7.10. Aids to Navigation (AtoNs): Deploy temporary or permanent markers if required.

4.7.11. Exclusion Zones: Establish and enforce zones to restrict anchoring or fishing near cables.

STAKEHOLDER ENGAGEMENT

4.7.12. Fisheries Liaison: Engage with local fisheries to communicate risks and coordinate activities.

DESIGN ADAPTATIONS

4.7.13. Rock Bag Feathering: Add rock bags or similar materials to smooth transitions and reduce turbulence.

4.7.14. Sympathetic Routing: Route cables to avoid dredging areas, dumping grounds, or other high-risk zones.

4.8. CONCLUSIONS AND RECOMMENDATIONS

CONCLUSION

4.8.1. The risk assessment for the cable route indicates that the key risks for the lifetime of the cable are fishing, shipping and sediment mobility.

<u>Fishing</u>

4.8.2. A minimum Depth of Lowering of 0.6 m is required along the route to mitigate the risk from bottom trawling.

Shipping

4.8.3. Anchor strike risk is highest near the Douglas platform and Liverpool Bay Traffic Separation Scheme (TSS) corridor.

4.8.4. Vessel traffic analysis shows:

- High vessel density near KP 1.5 - 2.5 (Welsh channel) and KP 29- 32.5 (TSS corridor).
- Increased risk near Douglas platform due to slower vessel speeds despite lower traffic volume.

4.8.5. Probabilistic analysis indicates that for a surface lay (0 m): PStrike = 1.19×10^{-5} (return period ~83,718 years). Therefore, depth of lowering will be governed by fishing and seabed mobility risk.

Sediment Mobility

4.8.6. There is a high level of seabed mobility along the route indicated by areas of sandwaves and bedforms. Assessment of historical data from 2019 to date suggest that seabed mobility is limited to the top 1m along most of the route except for the Welsh Channel and the area around the West Hoyle Spit whether higher variations have been noted over the last 80 years.

RECOMMENDATIONS

4.8.7. It is recommended that a Depth of Cover of 2.0m as shown in Figure 4-1, be adopted along the entire route except for crossings and locations that are protected by concrete mattresses or rock berms.

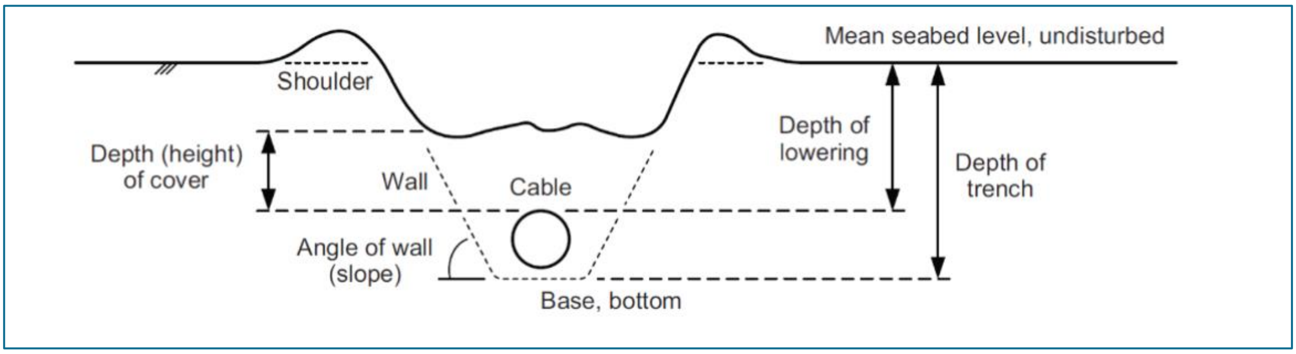


Figure 4-1: Depth of Burial definitions for electrical and fibre-optic cable

4.8.8. Due to issues regarding on-bottom stability it is recommended to bury the cable using a Simultaneous Lay and Burial Tool. The Depth of Cover of 2.0m should be achievable with this tooling. However, due to sediment type and depth along the route it is recommended to perform some preparatory works to reduce the stiffness of the seabed along the proposed route for ease of burial with an SLB tool later.

5. CABLE LAYING AND INSTALLATION

5.1. INTRODUCTION

5.1.1. The following section describes the anticipated method, equipment and vessels to be used for the laying and installation of the following cables:

- PoA to Douglas CCS.
- Douglas CCS to Hamilton Main.
- Douglas CCS to Hamilton North.
- Douglas CCS to Lennox.

5.1.2. The work shall be performed in a phased approach, with the sequence of cable installation and route preparation works being determined by both engineering analysis and scheduling criteria. Per cable, the work can be broken down into the following stages:

- Pre-construction surveys.
- Route Preparation.
- Cable Lay and Burial.
- Post-Lay Intervention.

5.1.3. This section describes the timeline for the proposed works for the PoA to Douglas CCS cable routes and associated inter-platform connections, which are scheduled over 2026 and 2027. The programme has been developed to avoid activity between 01 November and 31 March inclusive (CML2365 Condition 3.18).

5.1.4. The programme details comprehensive survey and seabed preparation, cable laying and burial, as well as the installation of mattresses and rock protection at various crossings. Operations are carefully phased to ensure efficient vessel use and to accommodate weather and tidal windows, with specific activities allocated to dedicated support vessels. This approach demonstrates robust planning to support navigational safety, environmental considerations, and the timely delivery of the Liverpool Bay CCS Project cable infrastructure.

5.1.5. Cable installation will be undertaken using Simultaneous Lay and Burial (SLB), free lay, and post-lay burial techniques, with trenching, jetting and ploughing methods applied depending on seabed conditions.

5.2. VESSEL AND CREW STANDARDS AND REQUIREMENTS

5.2.1. Vessel crews will be required to meet recognised standards and comply with the international maritime rules (as adopted by the relevant flag state) and regulations for their class and area of operation. Liverpool Bay CCS Limited will conduct independent vessel audits on construction vessels, as necessary, to check that they meet these standards and are appropriate for the purpose of their desired role(s).

5.2.2. Vessel crews will be required to meet the requirements for the size, type, and area of operation in line with Standard for Training, Certification and Watchkeeping as set out by the IMO, and any site-specific requirements implemented by Liverpool Bay CCS Limited above the minimum standards outlined above.

5.2.3. All vessels involved in the construction of the Liverpool Bay CCS Project will be marked in accordance with the International Regulations for Preventing Collisions at Sea, 1972. Offshore platforms, and jack up vessels when jacked up, will be marked in accordance with the UK Standard Marking Schedule for Offshore Installations (Department of Energy & Climate Change (DECC), 2011). All construction vessels will be equipped with AIS receivers and transmitters.

5.2.4. Liverpool Bay CCS Limited will require that all construction vessels comply with the procedures and requirements set out in this VMP as well as other relevant project plans such as, but not limited to, the Offshore CEMP.

5.3. VESSEL REGISTER

5.3.1. Liverpool Bay CCS Limited will maintain a register of all project vessels that will include:

- Vessel name, IMO / MMSI number, and call sign.
- Type and function (e.g. cable lay vessel, crew transfer).
- Flag state and classification details.
- Evidence of certification (e.g. MARPOL compliance, oil spill response equipment).
- Details of dynamic positioning (DP) systems or anchoring requirements.

5.4. PRE-CONSTRUCTION SURVEYS

5.4.1. Pre-construction surveys have been and will be performed along and in proximity to the cable routes to determine the locations of constraints such as:

- Route debris
- Boulders
- Archaeological features
- Magnetometer anomalies
- UXO presence
- Seabed features
- Sediment depth
- Specific nature of seabed

5.4.2. The pre-construction survey is anticipated to be executed in the following phases:

- Pre-Engineering Survey
- Pre-lay survey
- Pre-installation survey

5.4.3. A work boat or suitable alternative, equipped with towed, hull mounted or ROV mounted survey sensors, will be employed to undertake the Pre-construction Surveys.

5.4.4. The survey shall be performed using the following survey methods (but not limited to):

- Multibeam Echo Sounder
- Side Scan Sonar
- Magnetometer
- Sub-bottom Profiling
- Gradiometer array

5.4.5. The surveys will be conducted along the cable routes, including sections of 3rd party assets, seabed features in the proximity of the cable routes, and other assets and infrastructure. The characteristics of potential vessels that could be used for seabed surveys are set out in Table 5-1.

Table 5-1 – Seabed Survey Vessel

Vessel characteristics	Details
Vessel name	Titan Discovery 
Vessel function	Survey vessel
Vessel type	Shallow drafted DP Vessel
IMO number	-
Call Sign	2HCR3
MMSI	235102534
Vessel owner	
Vessel key characteristics	Length: 13m, Breadth: 5m, and Draught: 1.5m

5.5. SEABED PREPARATION

5.5.1. Prior to the execution of cable lay and installation, the cable routes shall be prepared by means of the following activities:

- Boulder relocation
- Pre-Lay Grapnel operations
- Pre-lay mattress installation
- Dredging
- Pre-trenching

BOULDER RELOCATION

5.5.2. A light construction vessel equipped with a UTROV positioned tine grab, or suitable alternative spread, will be employed to undertake the relocation of boulders, up to approximately 2m in size.

5.5.3. The boulders will be relocated to a position on the seabed which is clear of the cables route and required installation corridor.

5.5.4. The size and number of boulders to be relocated shall be determined based upon the selected burial tool, cable route and required installation corridor.

5.5.5. The identification of the boulders to be relocated shall be determined through a review of the obtained survey data.

PRE-LAY GRAPNEL RUN

5.5.6. A shallow draft service vessel, equipped with grapnel train, will be employed to perform the pre-lay grapnel run.

5.5.7. The grapnel train shall be deployed to the seabed and dragged along the cable route for the purpose of relocating, beyond the cable installation corridor, debris which may obstruct the cable installation.

5.5.8. For debris recovered to the deck of the service vessel, by the grapnel train, shall be removed and disposed of. All other debris shall be relocated outside of the installation corridor.

PRE-LAY MATTRESS INSTALLATION

5.5.9. A light construction vessel equipped with a UTROV positioned mattress frame, or suitable alternative spread, will be employed to install the pre-lay mattresses.

5.5.10. The pre-lay mattresses will be installed at the crossing points with the 3rd party assets identified in Section Error! Reference source not found. and provide a physical s eparation between existing assets and installed cable.

DREDGING

5.5.11. A combination of backhoe dredger (BHD), trailing suction hopper dredger (TSHD), and water injection dredger (WID) or suitable alternatives will be employed to perform seabed preparation works along the PoA to Douglas CCS cable route. (see LB CCS-CEMP#3 for CML2365 Condition 3.25-DRAFT-RevA-For APPROVAL).

5.5.12. The dredging works will be conducted to achieve the following:

- Flattening of seabed in shallow water locations at the West Hoyle Spit to enable beaching of cable lay vessel.
- Lowering of seabed in shallow water locations at the West Hoyle Spit to allow safe passage of the cable lay vessel.
- Lowering of seabed along cable route to enable cable burial tool to reach required cable burial depth.

PRE-TRENCHING PREPARATION FOR CABLE BURIAL

5.5.13. The pre-trenching activities will be conducted along the PoA to Douglas CCS cable route in the locations identified in Table 5-3 to reduce the risk of cable burial refusal during the simultaneous lay and burial. The pre-trenching will be performed by a trenching support vessel equipped with a tracked trencher with, jetting, cutting and/or jetting and cutting capabilities. The trench, created by during the pre-trenching, will be back filled through both the collapse of the trench, following departure of the trencher, and natural seabed movement.

Table 5.2 Coordinates of pre-trenching for PoA to Douglas CCS cable

KP	Easting WGS84 (DDMMSS)	Northing WGS84 (DDMMSS)	KP	Easting WGS84 (DDMMSS)	Northing WGS84 (DDMMSS)
11.3	03 47 12.47	53 39 54.95	34	03 58 29.34	53 53 87.49
6	3.39409199	53 38 37.12	9	03 43 77.15	53 39 05.70
1	3.33905182	53 35 95.23	2.5	03 34 70.22	53 37 21.36

WORKS PROGRAMME

5.5.14. The anticipated programme for the pre-lay mattresses installation, survey and seabed preparation works along routes for the Point of Ayr (PoA) to Douglas CCS, and Douglas CCS to satellites cables, planned for 2026, is presented in Error! Reference source not found.. The programme has been developed to avoid activity between 01 November and 31 March inclusive (CML2365 Condition 3.18).

5.5.15. This operation will utilise three primary vessel types: the multi-purpose support vessel (MPSV) for boulder relocation and mattress installation, pre-lay grapnel run (PLGR) vessel, and the post-lay survey (PLS) vessel.

Table 5-3 – 2026 programme for survey and seabed preparation and pre-lay mattress installation for the PoA to Douglas CCS, and Douglas CCS to satellites cables

Activity	Key dates
MPSV transit to site	7-8 April 2026
MPSV Boulder removal	9-19 April 2026
MPSV Mattress pre-lay at crossings PoA to Douglas CCS	19 April 2026
MPSV transit to port and demobilisation	20-25 April 2026
MPSV transit to site	24-25 August 2026
MPSV Mattress pre-lay at crossings Douglas CCS Hamilton Main	26-28 August 2026
MPSV Mattress pre-lay at crossings Douglas CCS to Hamilton North	29-31 August 2026
MPSV Mattress installation at crossings Douglas CCS Lennox	01-03 September 2026
MPSV transit to port and demobilisation	04-05 September 2026
PLGR transit to site	9-16 April 2026
PLGR PoA to Douglas	17-20 April 2026
PLGR transit to port	20-24 April 2026
PLGR offload debris	24-25 April 2026
PLGR demobilisation	25-27 April 2026
PLS transit to site	21-22 April 2026
PLS pre-lay survey from PoA to Douglas	22 April-8 June 2026
PLS transit to port	8-9 June 2026
PLS demobilisation	9-10 June 2026

VESSELS AND EQUIPMENT

5.5.16. The subsequent sections provide examples of vessel types anticipated for use during pre-construction activities to prepare the seabed ahead of cable installation and burial. While the exact vessels have yet to be determined, indicative specifications are presented based on currently available information. Any vessel names mentioned serve solely as examples to illustrate typical vessels of each type and should not be construed as an assurance that those specific vessels will be utilised. The characteristics of vessels required for seabed preparation are set out in Table 5-4.

Table 5-4 – Seabed Preparation Vessels

Vessel characteristics	Details
Vessel name	Glomar Worker
Vessel function	Boulder relocating and Mattress installation
Vessel type	MPSV
IMO number Callsign MMSI	9344227 3EKK8 352110000
Vessel owner/operating company	Glomar
Vessel key characteristics	Multipurpose vessel. Length: 60m, Breadth: 15,6m, and Draught: 3.5m/5.0m
Propulsion/ Mooring/station keeping	DP2

Vessel characteristics	Details
Vessel name	Causeway
Vessel function	Trailer suction Hopper dredger
Vessel type	Hopper dredger
IMO number Call Sign MMSI	9653197 5BVB3 210523000
Vessel owner	Boskalis
Vessel key characteristics	Length: 92m, Breadth: 19m, Draught: 7.2m
Propulsion/ Mooring/station keeping	2x 1,491 kW

Vessel characteristics	Details
Vessel name	Voe Vanguard
Vessel function	Pre Lay Grapnel Run Vessel
Vessel type	Damen Renewables Service Vessel 3315
IMO number Call Sign MMSI	9809693 MBEN9 232008636
Vessel owner	Jiff Mar
Vessel key characteristics	Shallow drafted DP Vessel. Length: 33m, Breadth: 14m, and Draught: 2.6m/4.95m
Propulsion	39t Bollard Pull
Mooring/station keeping	DP 2 – thrusters and Azimuths

SUMMARY OF SEABED PREPARATION ACTIVITIES AND TIMETABLE

5.5.17. The proposed programmes for the pre-lay boulder relocation, pre-lay grapnel run seabed preparation works along the cable route for the PoA to Douglas CCS cable, planned for April 2026, are presented in **Figure 5-1**, and **Figure 5-2**.

5.5.18. The proposed programme for the pre-trenching run along the cable route for the PoA to Douglas CCS cable, planned for April 2026, is presented in **Figure 5-3**.

5.5.19. The proposed programme for the installation of pre-lay mattresses along the cable routes for the PoA to Douglas CCS, and Douglas CCS to satellites cables, planned for 2026, is presented in **Figure 5-4.**, **Figure 5-5**, and **Figure 5-6**.

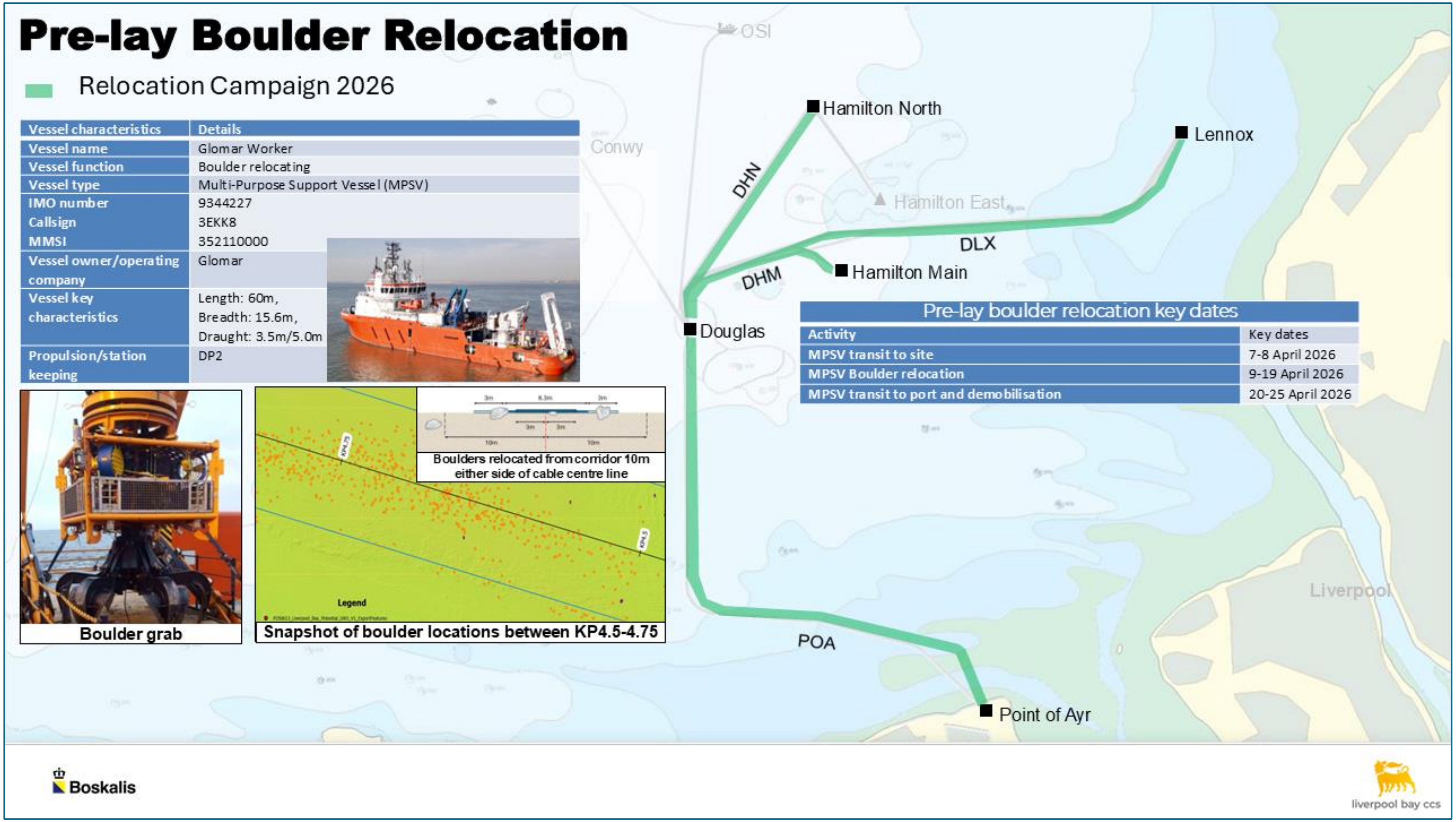


Figure 5-1: Location, method, and programme for pre-lay boulder relocation

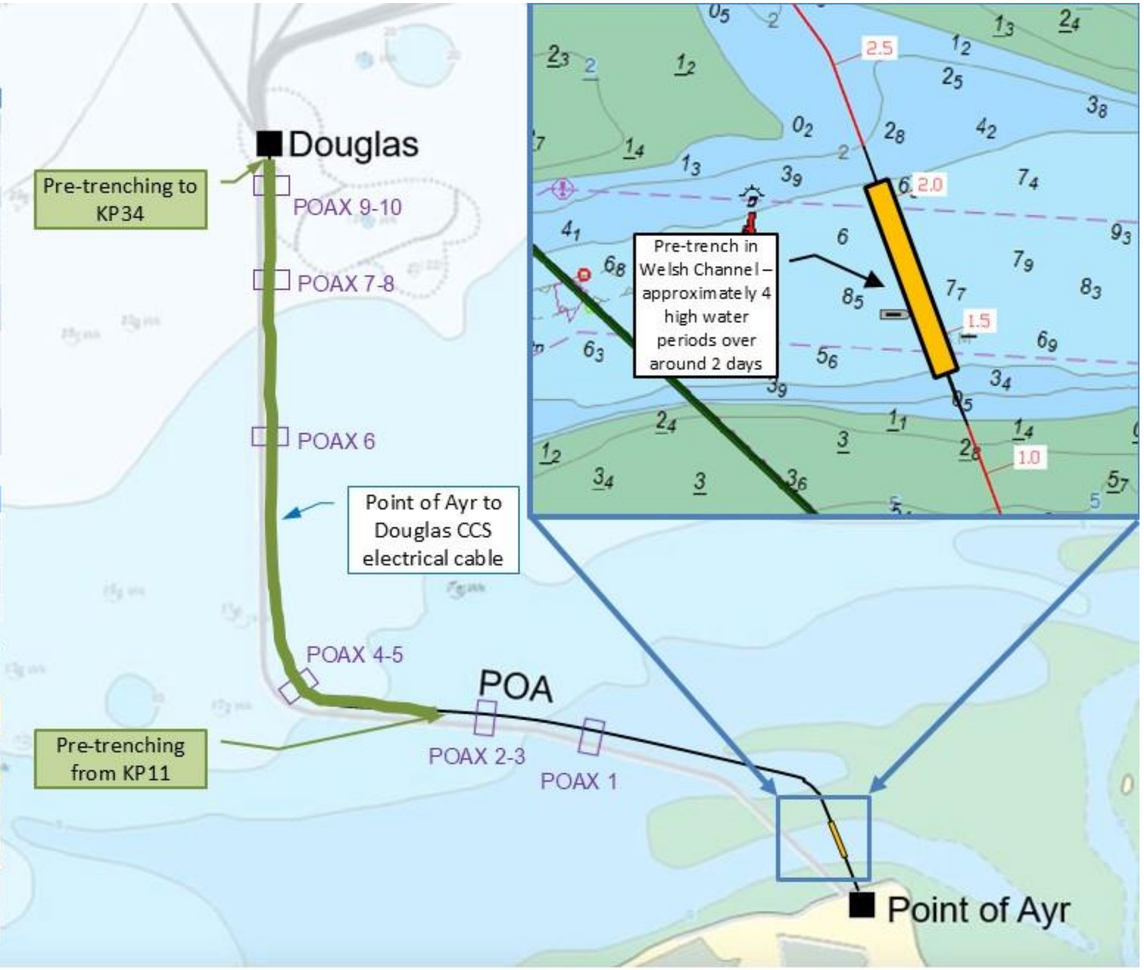
Figure 5-2: Location, method, and programme for pre-lay grapnel run

Pre-trenching

Vessel characteristics	Details
Vessel name	Ndeavor
Vessel function	Pre-trenching and cable burial
Vessel type	Cable burial
IMO number	9650212
Callsign	5BVG3
MMSI	209852000
Vessel owner/operating company	Boskalis
Vessel key characteristics	Length: 99m, Breadth: 30m, Draught: 4.8m/7.0m
Propulsion/station keeping	DP2 2x 1,250kW + 2x 1,000kW Azimuth Thrusters & 1x 550kW Bow Thruster

Pre-trenching key dates	
Activity	Key dates
Ndeavor transit to site	13-18 April 2026
Ndeavor pre-trenching	18 April-03 May 2026
Ndeavor transit to port and demobilisation	04-09 May 2026

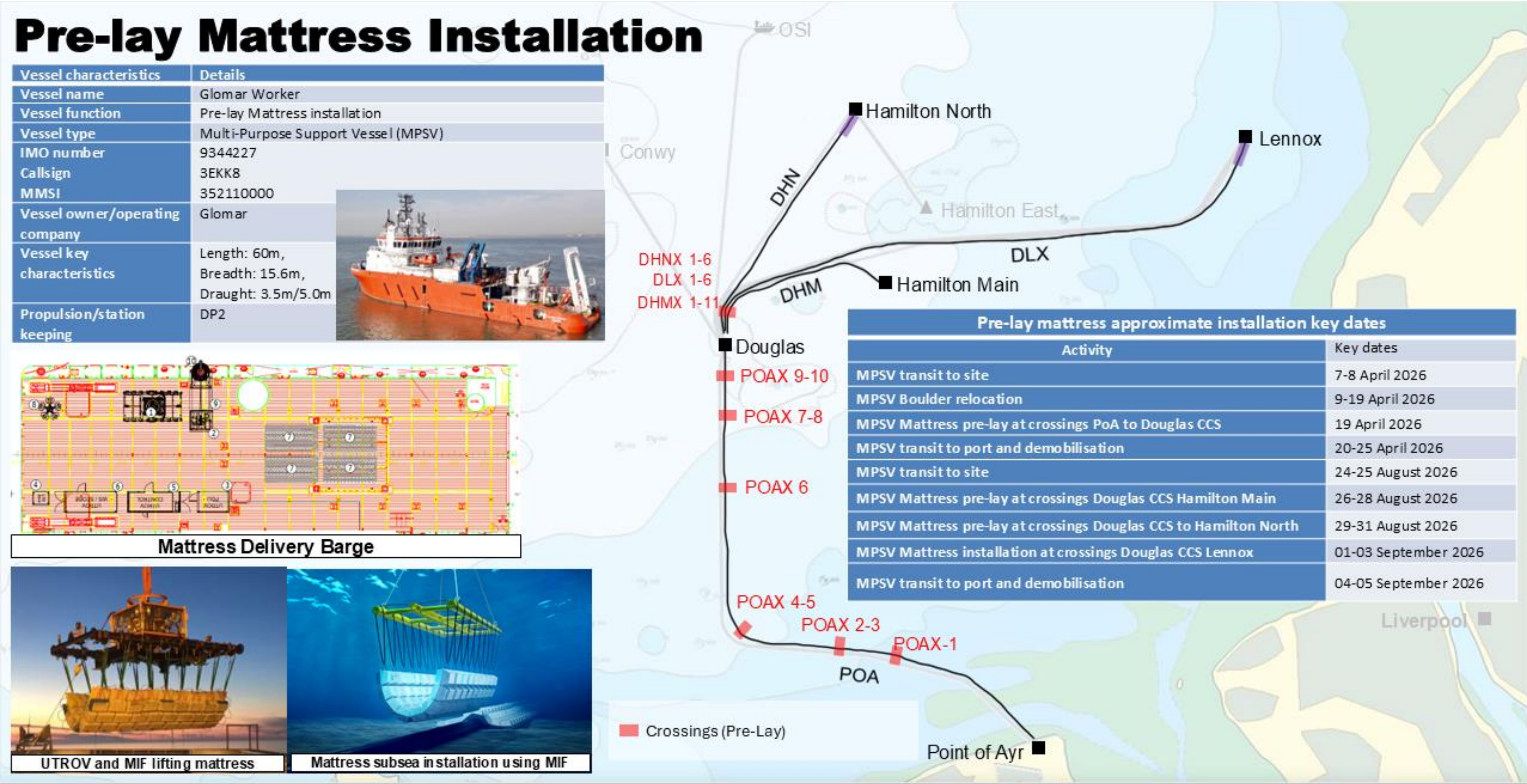
Equipment Characteristics	Details
Equipment name	CBT 2400
Equipment function	Cable Burial
Key characteristics	Depth rating: 4-1000m Length: 8.5m Width: 8.3m Height: 6.4m Trench Depth: 3.3m Cable Diameter: up to 500mm (depending on configuration)
Trenching Method	Jetting, Cutting or hybrid



Boskalis

2

Figure 5-3: Location, method, and programme for pre-trenching



Boskalis

liverpool bay ccs

Figure 5-4: Location, method, and programme for pre-lay mattress installation

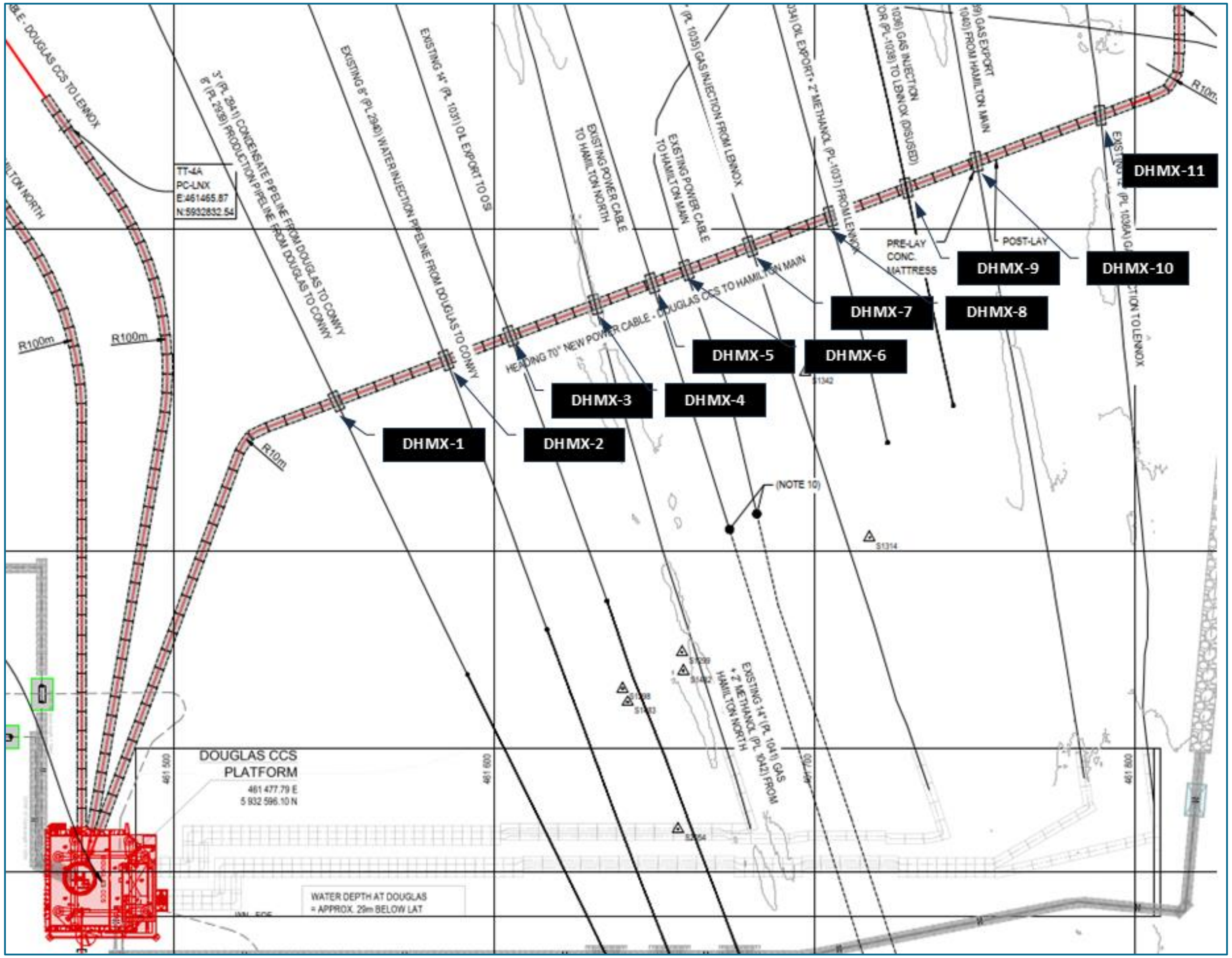


Figure 5-5: Locations for pre-lay mattress installation along Douglas CCS to Hamilton Main Cable

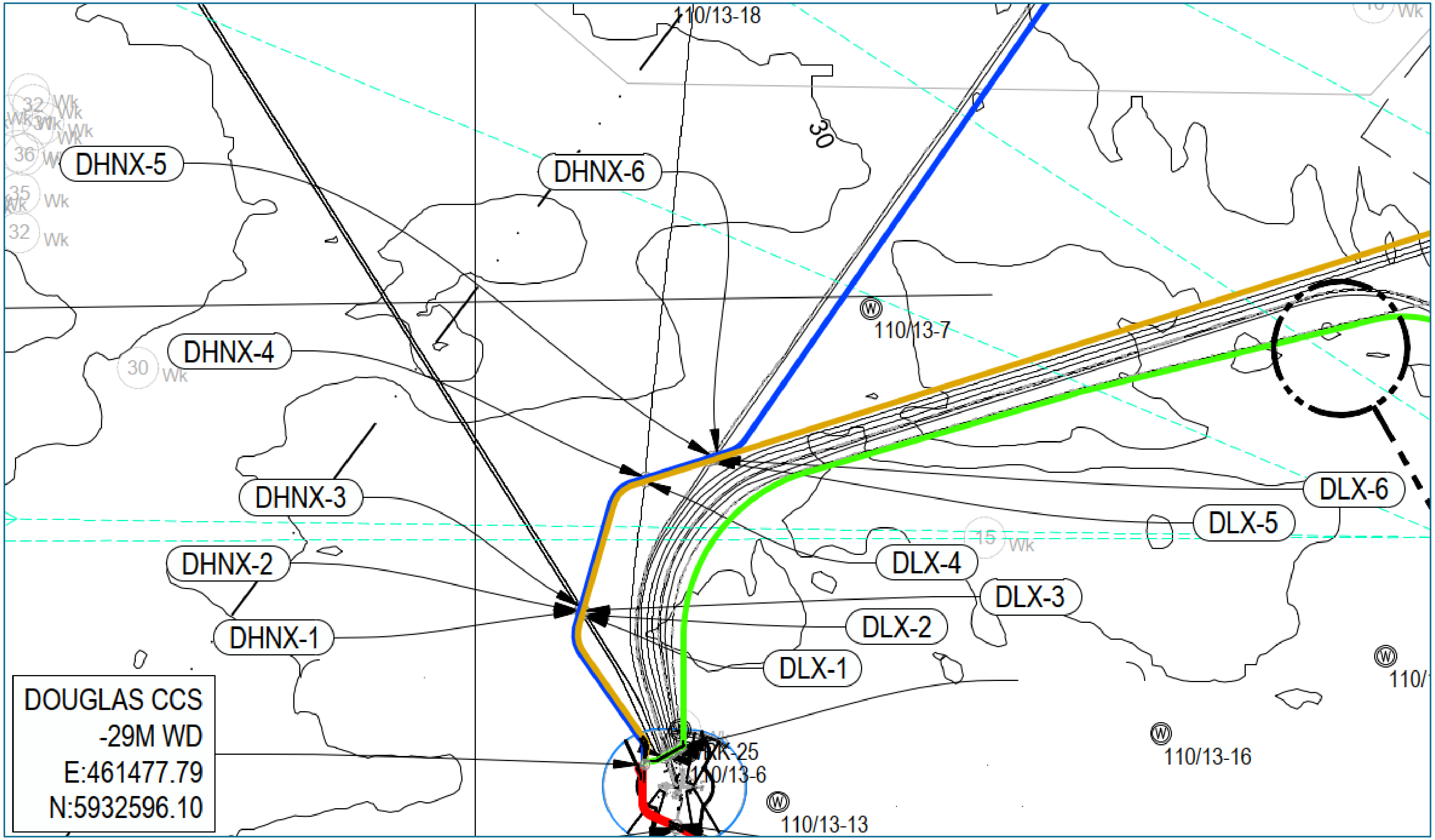


Figure 5-6: Locations for pre-lay mattress installation along Douglas CCS to Hamilton North (DHNX), and Lennox (DLX) Cables

5.6. CABLE LAYING AND BURIAL

5.6.1. Due to the varying geological and topological conditions across the Liverpool Bay area. The methodology of cable installation varies by cable route. The following provides a summary of the planned methods of cable installation, per cable.

- Point of Ayr to Douglas CCS
  - Nearshore (shallow water) Simultaneous Cable Lay and Burial
  - Offshore (deeper waters) Cable Free Lay
  - Offshore (deeper waters) Post Lay Burial
- Douglas CCS to Hamilton Main
  - Cable Free Lay
  - Post Lay Burial
- Douglas CCS to Hamilton North
  - Cable Free Lay
  - Post Lay Burial
- Douglas CCS to Lennox
  - Cable Free Lay
  - Post Lay Burial

CABLE LAY AND BURIAL

5.6.2. The anticipated programme during 2026 for the cable lay vessel (CLV) to be used for the cable simultaneous laying and burial works is presented in Error! Reference s ource not found.. The programme has been developed to avoid activity between 01 November and 31 March inclusive (CML2365 Condition 3.18).

Table 5-5 – Programme for PoA to Douglas CCS cable simultaneous laying and burial

Activity	Key dates
CLV transit to Blythe for cable load out	29 June-1July 2026
CLV loading cable in Blythe	1-8 July 2026
CLV transit from Blythe to Liverpool Bay	8-14 July 2026
CLV waiting on weather window	15-22 July 2026
CLV shore pull in PoA	22-25 July 2026
CLV simultaneous lay and burial from PoA to Douglas CCS	26 July-3 August 2026
CLV free lay from PoA to Douglas CCS	3-12 August 2026
CLV wet store cable at Douglas CCS	12-13 August 2026
CLV transit to port	13 August 2026
CLV rearrange deck and load HD3	13-14 Auust 2026
CLV transit to site	14-15 August 2026
CLV pull-in cable at Douglas CCS	15-16 August 2026
CLV transit to port	16-17 August 2026
CLV rearrange deck and load HD3	17-18 August 2026
CLV transit back to Rotterdam	18-22 August 2026

SIMULTANEOUS LAY AND BURIAL

5.6.3. A cable lay vessel, with 7-point anchor mooring system, beaching classification notation and equipped with cable lay system and plough, will be employed to execute the cable installation along the shallow portion of the PoA – Douglas CCS cable route.

5.6.4. For shallow water operations the vessel will be positioned and manoeuvred by a 7-point anchor mooring system.

5.6.5. Anchor placement, relocation and removal shall be achieved using shallow draft anchor handling tugs.

5.6.6. For the onshore landing, the vessel will be positioned close to or within the intertidal region of the shore and will supply the cable to the onshore landing location through use of its cable lay system.

5.6.7. The vessel's cable lay system, and plough shall be used to simultaneously lay and bury the cable from the intertidal region, throughout the shallow waters, until deeper waters.

5.6.8. During the simultaneous lay and burial of the cable in the shallow water section, the vessel will be beached during the low water portion of the tidal cycle. During this process, the simultaneous lay and burial process will be stopped. The process will be restarted once sufficient water depth returns.

5.6.9. When the vessel reaches sufficiently deep water, positioning and manoeuvring shall be achieved through by use of the cable lay vessel's dynamic positioning system. Which may be operated both in combination and not in combination with the anchor mooring system.

5.6.10. The trench, created by the plough during simultaneous lay and burial, shall be back filled through both the collapse of the trench, following departure of the plough, and natural seabed movement.

CABLE FREE LAY

5.6.11. A cable lay vessel, with dynamic positioning system, and equipped with cable lay system, will be employed to execute the cable lay along the cable deeper part of the PoA – Douglas CCS cable route and the interconnector routes.

5.6.12. The cable will be free-laid along the pre-determined cable route with sufficient installation accuracy to remain within the pre-determined installation corridor.

5.6.13. On approaching the platform, depending on the determined approach, the cable shall be either pulled into the platform or wet stored for future pull-in.

5.6.14. For the platform pull-in the vessel will supply the cable to the platform pull-in location through use of its cable lay system. A winch system, mounted on the platform, shall perform the platform pull-in.

5.6.15. Temporary stabilisation of the cable may be applied either; through the installation of rock bags (or suitable equivalent) on to the cable on the seabed, or shallow cable burial by the means of controlled flow or jetting.

5.6.16. The temporary stabilisation will either be: removed, prior to cable burial; relocated to a position outside of the cable installation corridor; or determined to be permanent stabilisation and left in place.

CABLE WET STORAGE

5.6.17. The PoA to Douglas CCS cable will be wet-stored until it can be pulled-into the Douglas CCS platform.

5.6.18. Figure 5-7 presents the sequential steps for the wet storage and burial process in the PoA to Douglas CCS subsea cable installation, 'Option A'. The procedure starts with pre-trenching and grading, followed by free-lay and shallow burial of the cable from KP 32.5 to the wet storage site. After burial, post-lay mattresses are installed at crossings for protection. The following year, the cable is recovered, tested, re-laid, and platform pull-in is completed, with further burial and mattress installations to secure the route. Figure 5-7 shows the cable path, key locations, and protection areas.

5.6.19. Figure 5-8 also details Option B, beginning with pre-trenching and grading along the route, then laying and shallow burial of the cable from KP 32.5 to the wet storage point. Post-lay mattresses are installed from KP 32.5 to KP 33.2. In the next year, the cable is recovered, tested, and pulled into the platform between KP 33.2 and KP 33.4, followed by additional mattresses at the platform. Figure 5-8 shows the cable route, key points, and mattress locations.

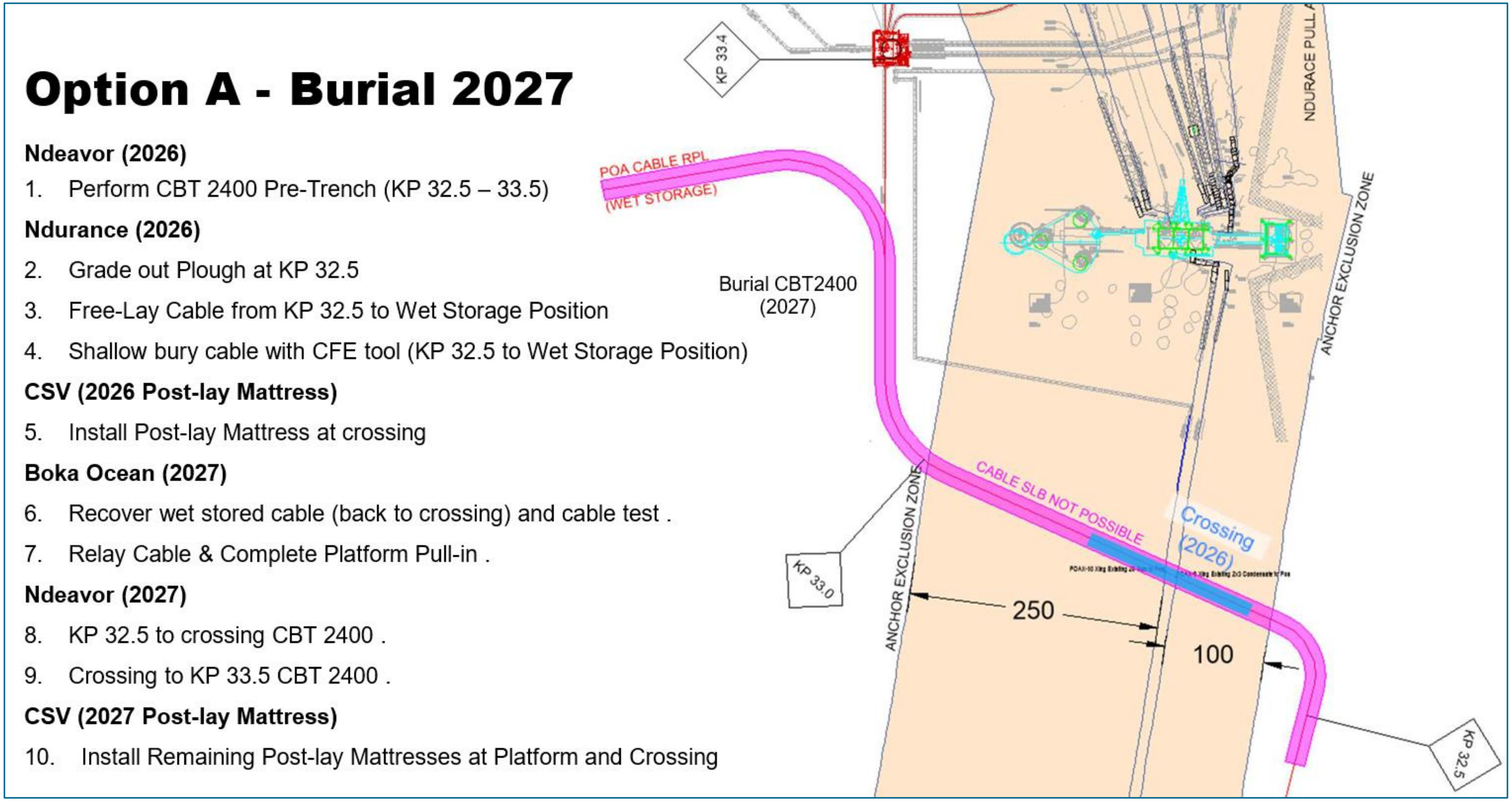


Figure 5-7: Cable Wet Storage Option A

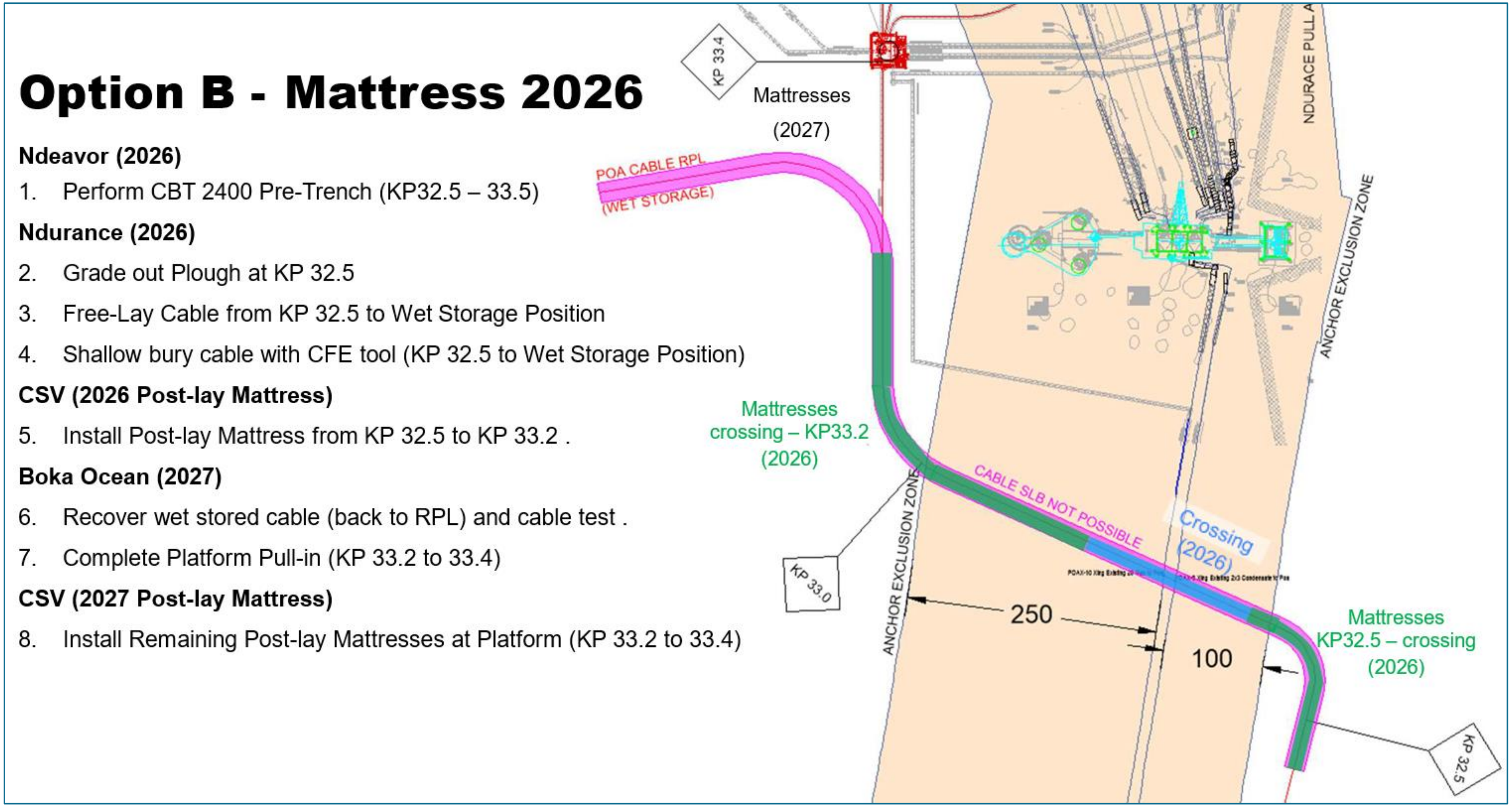


Figure 5-8: Cable Wet Storage Option B

POST LAY BURIAL

5.6.20. A trenching support vessel equipped with cable trenching tool, shall be employed to execute the post lay burial.

5.6.21. The post lay burial shall be performed using a tracked trencher with, jetting, cutting and/or jetting and cutting capabilities.

5.6.22. The trench, created by the trenching tool during post lay burial, shall be back filled through both the collapse of the trench, following departure of the trenching tool, and natural seabed movement.

VESSELS AND EQUIPMENT

<u>Overview</u>

5.6.23. The following sections present examples of the vessel types that are likely to be used during the construction works. Precise vessels to be used are not currently known, however indicative specifications are given based on the information available at the time. Any vessel names quoted are to be considered indicative only, are provided for the purposes of illustrating a typical vessel of that type and should not be interpreted as a commitment that vessel will be used.

5.6.24. This section provides estimates for vessel numbers and types in the cable laying and burial phase:

- Up to a total of 9 construction vessels on site at any one time (including main installation/support vessels, tug/anchor handlers, cable lay vessels, guard vessels, survey vessels, seabed preparation vessels, CTVs, scour protection installation vessels and cable protection installation vessels).
- Up to 50 installation vessel movements (return trips) during construction (including main installation/support vessels, tug/anchor handlers, cable lay vessels, guard vessels, survey vessels, seabed preparation vessels, CTVs, scour protection installation vessels and cable protection installation vessels).

5.6.25. The confirmed individual vessel details will be notified to NRW in writing no later than 14 days prior to the commencement of the development, and thereafter, any changes to the details supplied will be notified, as soon as practicable, prior to any such change being implemented in the construction or operation of the Liverpool Bay CCS Project.

5.6.26. Liverpool Bay CCS Limited will ensure that for any vessel appointed to engage in the works, the following details are available (where applicable) in the Vessel Report at least five days prior to its engagement in the construction phase of the Development, which will be made available on the Liverpool Bay CCS webpage:

- Vessel name;
- Vessel function;
- Vessel type;
- IMO Number; and
- Vessel owner or operating company.

5.6.27. The following sections provide the details of the vessels proposed for the laying and burial of the cables, and the installation of the mattresses, and rock protection.

Cable laying vessels

5.6.28. The characteristics of vessels required for seabed preparation are set out in Error! Reference source not found..

Table 5-6 – Vessels for cable laying

Vessel characteristics	Details
Vessel name	Ndurance
Vessel function	Cable Lay Vessel
Vessel type	Cable Layer
IMO number Call sign MMSI	9632466 5BVH3 209851000
Vessel owner	Boskalis
Vessel key characteristics	Cable layer with beaching capabilities. Length 99m, Breadth 30m, and Draught 4.8m/7.0m
Propulsion Mooring/station keeping	DP2 and 7 point mooring system

Vessel characteristics	Details
Vessel name	Boka Ocean
Vessel function	Cable Lay Vessel
Vessel type	Cable Layer
IMO number Call sign MMSI	9397951 C6ZS2 311064500
Vessel owner	Boskalis
Vessel key characteristics	Cable layer. Length 120m, Breadth 27m, and Draught 7.0m
Propulsion Mooring/station keeping	DP2 mooring system

Support vessels for cable pull-in to shore

5.6.29. During the Pull-in of the cable to shore, support vessels are required assist in the shallow water operations. During the works Ndurance will be on anchors, and two anchor handling tugs will be used to place the anchors. Multicat Odin is a possible anchor handler to assist in the works.

Vessel characteristics	Details
Vessel name	Odin
Vessel function	Anchor handling
Vessel type	Multicat
IMO number Call sign MMSI	9572824 PCCQ 245307000
Vessel owner	Herman Senior
Vessel key characteristics	Shallow draft anchor handler. Length 29.9m, Breadth: 13.5m, and Draught 2.6/2.8m
Propulsion Mooring/station keeping	3x Promarin fixed propellers in Optima nozzles

Vessel characteristics	Details
Vessel name	CRC Gladiator
Vessel function	Crew Transfer vessel
Vessel type	
IMO number Call sign MMSI	9572824 2IUR3 235112943
Vessel owner	Commercial Rib Charter
Vessel key characteristics	CTV – 12 pax. Length: 13m, Breadth: 5.4m, Draught: 0.8m
Propulsion Mooring/station keeping	2 x Iveco FPT Cursor C90 620 2 x MJP. Ultrajet 377 waterjets

Vessel characteristics	Details
Vessel name	Ndeavor
Vessel function	Cable burial Vessel
Vessel type	Cable burial
IMO number Call sign MMSI	9650212 5BVG3 209852000
Vessel owner	Boskalis
Vessel key characteristics	Cable layer with beaching capabilities Length: 99m, Breadth: 30m, Draught: 4.8m/7.0m
Propulsion Mooring/station keeping	DP2 2x 1,250kW + 2x 1,000kW Azimuth Thrusters & 1x 550kW Bow Thruster

Vessel characteristics	Details
Vessel name	Causeway
Vessel function	Trailer suction Hopper dredger
Vessel type	Hopper dredger
IMO number Call Sign MMSI	9653197 5BVB3 210523000
Vessel owner	Boskalis
Vessel key characteristics	Length: 92m, Breadth: 19m, Draught: 7.2m
Propulsion/ Mooring/station keeping	2x 1,491 kW

Vessel characteristics	Details
Vessel name	GV Haulbowline
Vessel function	Guard vessel
Vessel type	Monohull
IMO number Call Sign MMSI	8847179 MEZW9 232021354
Vessel owner	Boskalis
Vessel key characteristics	Length: 23m, Breadth: 7m, Draught: 3.6m

Cable burial equipment

5.6.30. A subsea plough or cable trencher would be used to bury sections of the new electrical cable where seabed conditions are suitable and where burial is required to provide protection from external interactions. The burial tool, either a towed plough or a tracked or ROV-operated jetting trencher, would be deployed from the installation vessel and guided along the predetermined route. The equipment creates a narrow trench by cutting or fluidising seabed sediments, allowing the cable to be placed at the required depth either during the same operation or during a subsequent burial pass.

5.6.31. The choice of tool depends on sediment type, required burial depth, and the need to minimise disturbance to the surrounding seabed. Ploughs are typically used in softer, more homogeneous sediments, while trenchers are employed in more variable or compacted ground conditions. Trenching activities would be planned to limit seabed disturbance to the smallest practicable footprint, with sediment expected to naturally backfill the trench over time as part of the normal seabed recovery process. The process ensures controlled and consistent burial to provide mechanical protection and long-term stability for the subsea cable.

5.6.32. The characteristics of equipment required for cable burial are set out in **Table 5-7**.

Table 5-7 – Equipment for cable burial

Equipment Characteristics	Details
Equipment name	HD3 Plough
Equipment function	Cable Burial
Key characteristics	Depth rating: 500m Length: 16m Width: 6.5m Height: 7.m Trench Depth: 2.75m Cable Diameter: 30 – 300mm
Trenching Method	Plough share and Jetting (optional)

Equipment Characteristics	Details
Equipment name	CBT 2400
Equipment function	Cable Burial
Key characteristics	Depth rating: 4-1000m Length: 8.5m Width: 8.3m Height: 6.4m Trench Depth: 3.3m Cable Diameter: up to 500mm (depending on configuration)
Trenching Method	Jetting, Cutting or hybrid

5.7. POST LAY MATTRESSES AND ROCK PROTECTION AT CABLE CROSSINGS

OVERVIEW AND PROGRAMME

5.7.1. Following the execution of cable lay and burial, the cable installation shall be completed by means of the following activities:

- Post-lay mattress installation.
- Rock installation.

5.7.2. The installation of concrete mattresses and subsea rock protection at the cable crossings would be carried out using specialist marine construction vessels. Pre lay concrete mattresses would typically be deployed on a dedicated mattress installation vessel or a multipurpose offshore construction vessel equipped with a crane or A-frame, mattress deployment chute, and dynamic positioning (DP) capability to ensure accurate placement.

5.7.3. Rock protection would be installed using a purpose-built fallpipe vessel capable of placing graded rock with high precision via controlled fallpipe system or fallpipe ROV, depending on water depths and accuracy requirements. These vessels allow for safe and efficient installation activities around existing seabed infrastructure and ensure the required stability and separation between the new electrical cable and the crossed assets. Further details are provided in the following sections.

5.7.4. The planned schedule for the installation of post-lay mattresses and rock protection on third-party assets along the PoA to Douglas CCS cable only, is detailed in Error! Reference source not found.. The programme has been developed to **avoid activity between 01 November and 31 March inclusive** (**CML2365 Condition 3.18**).

5.7.5. This operation will utilise two primary vessel types: the Offshore Support Vessel (OSV) will be responsible for mattress deployment, followed by the Fall Pipe Vessel (FPV), which will install rock protection at cable crossings.

Table 5-8 – Programme for PoA to Douglas CCS cable post-lay mattresses and rock protection at crossings

Activity	Key dates
Mattress Installation	
OSV transit to port	26-31 August 2026
OSV load mattresses (approx. 95 pieces)	1-2 September 2026
OSV lay mattresses PoA to Douglas CCS cable (approx. 95 pieces)	2-4 September 2026
OSV transit to home port (Netherlands)	4-7 September 2026
Rock Protection	
FPV mobilisation to site	4-8 September 2026
FPV install rock protection	8-18 September 2026
FPV waiting on weather	18-19 September 2026
FPV to home port (Netherlands)	19-22 September 2026

POST LAY MATTRESS INSTALLATION

5.7.6. A light construction vessel equipped with a UTROV positioned mattress frame, or suitable alternative spread, will be employed to install the post-lay mattresses. The post-lay mattresses will be installed on the seabed at the predetermined crossing locations, along the cables approach to the platforms.

Table 7-9 – Vessel proposed for mattress laying

Vessel characteristics	Details	
Vessel name	Geoquip Elena	
Vessel function	Post lay mattress campaign / crossings	
Vessel type	OSV	
IMO number Callsign MMSI	9249439 YJVL7 576431000	
Vessel owner	Benemare Shipping	
Vessel key characteristics	DP vessel Length: 91m Breadth: 20m Draught: 5m	
Propulsion / Mooring/station keeping	2 x 2200 kW Aquamaster Contaz15 CRP DP	

5.7.7. Additional, post-lay mattresses may be installed along the cable route, in locations where the cable is identified to be at an insufficient depth of lowering.

5.7.8. Additional, post-lay mattresses (or equivalent) may be installed along the cables approach to the platforms, to stabilise the cable catenary between the platform J-Tube and seabed.

ROCK INSTALLATION

5.7.9. A rock installation vessel with fall pipe shall be employed to execute the rock installation. The rock shall be installed on the seabed at the predetermined crossing locations.

5.7.10. Additional, rock may be installed along the cable route, in locations where the cable is identified to be at an insufficient depth of lowering. Or along the cables approach to the platforms, to stabilise the cable catenary between the platform J-Tube and seabed.

Table 7-10 – Vessel proposed for placement of rock protection

Vessel characteristics	Details
Vessel name	Rockpiper
Vessel function	Subsea rock Installation vessel
Vessel type	Rock installation
IMO number Callsign MMSI	9583861 5BML3 209449000
Vessel owner	Boskalis
Vessel key characteristics	Dp vessel Length: 158,6m Breadth: 36m Draught: 9,4m
Propulsion / Mooring/station keeping	DP-2 - 2x 4,500 kW (2 x azimuth thrusters)

AS-BUILT SURVEY

5.7.11. As-built surveys can be performed along and in proximity to the cable routes to determine the following: seabed topography, associated depth of burial of the cable and locations of constraints such as:

- Seabed topography;
- Depth of burial and position of cable;
- Position of installed subsea items

5.7.12. A work boat or suitable alternative, equipped with towed, hull mounted or ROV mounted survey sensor, will be employed to undertake the As-built surveys.

5.7.13. The survey shall be performed using the following equipment (but not limited to):

- Multibeam Echo Sounder;
- Pipe tracker

5.7.14. The surveys will be conducted along the cable routes, including sections of 3rd party assets, seabed features in the proximity of the cable routes, and other assets and infrastructure.

5.8. INTER-PLATFORM CABLES

SURVEY AND SEABED PREPARATION

5.8.1. The anticipated programme for the survey and seabed preparation works along the Douglas CCS to satellite platforms cables planned for 2027 is presented in Error! Reference source not found.. The programme has been developed to avoid activity between 01 November and 31 March inclusive (CML2365 Condition 3.18). This operation will utilise two primary vessel types: the pre-lay grapnel run (PLGR) vessel, and the post-lay survey (PLS) vessel.

Table 5-11 – Programme for Douglas CSS to satellite platforms cable routes survey and seabed preparation

Activity	Key dates
Pre-lay Grapnel Run	
PLGR transit to site	9-13 May 2027
PLGR Douglas CCS to Hamilton Main	13-15 May 2027
PLGR Douglas CCS to Hamilton North	15-16 May 2027
PLGR Douglas CCS to Lennox	16-20 May 2027
PLGR transit to port	20-24 May 2027
PLGR offload debris	24-25 May 2027
PLGR demobilisation	25-27 May 2027
Post-lay Survey	
PLS transit to site	20-22 May 2027
PLS Douglas CCS to Hamilton Main	22-23 May 2027
PLS Douglas CCS to Hamilton North	23-24 May 2027
PLS Douglas CCS to Lennox	24-28 May 2027
PLS transit to port	28-29 May 2027
PLS demobilisation	29-30 May 2027

CABLE LAY AND BURIAL

5.8.2. The anticipated programme during 2027 for the CLV to be used for the free-lay of the cables from Douglas CCS to the three satellite platforms is presented in Error! Reference source not found.. The programme has been developed to avoid activity between 01 November and 31 March inclusive (CML2365 Condition 3.18).

Table 5-12 – Programme for cable free-lay from Douglas CCS to satellite platforms

Activity	Key dates
CLV transit to Blythe for cable load out	14-16 June 2027
CLV loading cable in Blythe	16-26 June 2027
CLV transit from Blythe to Liverpool Bay	26-30 June 2027
CLV – cable pull-in Douglas CCS	1 July 2027
CLV free-lay Douglas CCS to Hamilton Main	1-3 July 2027
CLV – cable pull-in Hamilton Main	3-4 July 2027
CLV in-field transit	4 July 2027
CLV – cable pull-in Douglas CCS	4-5 July 2027
CLV free-lay Douglas CCS to Hamilton North	5-6 July 2027
CLV cable pull-in Hamilton North	6-8 July 2027
CLV – in-field transit	8 July 2027
CLV tidal delay at Lennox	8 July 2027
CLV weather downtime at Lennox	8-9 July 2027

Activity	Key dates
CLV – cable pull-in Douglas CCS	9-10 July 2027
CLV free-lay Douglas CCS to Lennox	10-14 July 2027
CLV – cable pull-in Lennox	14-15 July 2027
CLV transit to Rotterdam	15-18 July 2027

CABLE CROSSINGS

5.8.3. The anticipated programme during **2027** for the installation of post-lay mattresses and rock protection on third-party assets along the Douglas CCS to satellite cables is detailed in Error! Reference source not found.. The programme has been d eveloped to **avoid activity between 01 November and 31 March inclusive** (**CML2365 Condition 3.18**).

5.8.4. This operation will utilise two primary vessel types: the Offshore Support Vessel (OSV) will be responsible for mattress deployment, followed by the Fall Pipe Vessel (FPV), which will install rock protection at cable crossings.

Table 5-13 – Programme for Douglas CCS to satellite platforms cables post-lay mattresses and rock protection at crossings

Activity	Key dates
OSV transit to loading port	02-06 August 2027
OSV load mattresses (approx. 96 pieces)	06-08 August 2027
OSV transit to site	08 August 2027
OSV lay mattresses Douglas CCS to Hamilton Main cable (96 pieces)	08-11 August 2027
Transit to loading port	11 August 2027
OSV load mattresses (approx. 96 pieces)	11-13 August 2027
OSV transit to site	13 August 2027
OSV lay mattresses Douglas CCS to Hamilton Main cable (10 pieces)	14 August 2027
OSV lay mattresses Douglas CCS to Hamilton North cable (61 pieces)	14-15 August 2027
OSV lay mattresses Douglas CCS to Lennox cable (25 pieces)	15-16 August 2027
Transit to loading port	16 August 2027
OSV load mattresses (approx. 35 pieces)	16-17 August 2027
OSV transit to site	17-18 August 2027
OSV lay mattresses Douglas CCS to Lennox cable (35 pieces)	18-19 August 2027
OSV transit to home port (Netherlands)	19-22 August 2027
FPV mobilisation to site	19-23 August 2027
FPV install rock protection	23 August-02 September 2027
FPV waiting on weather	02-03 September 2027
FPV to home port (Netherlands)	03-06 September 2027

6. CONTINGENCY PLAN

6.1. CONTINGENCY MEASURES

STATION KEEPING / PROPULSION FAILURE

6.1.1. In case of a station keeping/propulsion failure, the vessel shall immediately change to manual control, vessel operations shall be brought to a controlled stop, with equipment and product made safe.

6.1.2. In case of a complete engine failure the vessel shall deploys an anchor to prevent drifting in an undesired direction.

6.1.3. Should the vessel, already be on anchors, then assistance in station keeping shall be requested from either the anchor handling tugs, or using the vessels own propulsion system.

EQUIPMENT FAILURE

6.1.4. In the event of equipment failure, operations shall be brought to a controlled stop, made safe and investigated. If possible, the current operation will be completed. Otherwise, the operation shall be halted and the failed equipment repaired onboard.

6.1.5. Should an onboard repair not be possible, either the equipment will be returned to shore and repaired there, or replacement equipment will be arranged.

6.1.6. In the event of installation machinery failure (including cable lay vessel systems, trenching tools, ploughs or ROV equipment), alternative installation methods or replacement equipment will be mobilised where required. The range of installation techniques defined in this CSIP (including simultaneous lay and burial, free lay and post-lay burial) provides inherent contingency to ensure safe and continued installation within the assessed design envelope.

6.2. EMERGENCY RESPONSE

6.2.1. A Bronze-Silver-Gold (BSG) command structure is used to manage emergency situations in a clear and scalable hierarchy. This model, adopted from UK emergency services and widely used in offshore operations, provides a consistent framework for operational control, tactical coordination and strategic oversight. For the Liverpool Bay CCS Project, this structure is applied as follows:

6.2.2. BRONZE (Operational): First responder and vessel-level management coordination direct actions on site

6.2.3. SILVER (Tactical): OCM and Project SHE-Q Advisor managing tactical decisions, resource allocation and coordination across vessel or sites

6.2.4. GOLD (Strategic): project Manager and Liverpool Bay CCS Limited representatives making high-level decisions including external notifications, stakeholder liaison and business continuity considerations

6.2.5. Some practitioners use the term Operational-Tactical-Strategic Operational Command instead, but the three categories are functionally equivalent.

6.2.6. The three roles are not restricted to any rank, though invariably the chain of command will be the same as the order of rank. Whilst the Bronze-Silver-Gold command structure was designed for responding to sudden major incidents, it has also been used for planned operations.

6.2.7. This structure underpins all coordination efforts during emergency events and is reinforced through the roles and responsibilities defined in this Emergency Response Plan.

BRONZE OPERATIONAL EMERGENCY RESPONSE

6.2.8. The Bronze (Operational) level is responsible for implementing the immediate response to an emergency at the site of the incident. Personnel at this level operate within the offshore project area – including onboard vessels and offshore support assets – and execute direct control over the situation using available resources.

6.2.9. Typical roles at this level include the Vessel Master, Deck Foreman and First Responders. They carry out initial rescue, fire-fighting, first aid or containment actions in accordance with the ERP and vessel-specific procedures (e.g. SOPEP, muster list, rescue protocols).

6.2.10. Personnel at the Bronze level may coordinate with other on-site responders but retain accountability to the OCM and MCC for all tactical and escalation communication.

SILVER TACTICAL EMERGENCY RESPONSE

6.2.11. The Silver (Tactical) level is activated to coordinate the tactical response to an emergency, supporting operational personnel (Bronze) and implementing strategic direction from Gold-level decision-makers. This includes resource management, coordination across vessels and sites and support with external communications.

6.2.12. In this Project, the OCM, in coordination with the Project SHE-Q Advisor and MCC, typically assumes the Silver role. These personnel may be located offshore or onshore, depending on the scenario.

6.2.13. Silver-level responsibilities include:

- Assessing the evolving situation and determining required support;
- Managing resource allocation (e.g. vessel reassignments, first aid coordination);
- Facilitating internal and external communication, including support to Liverpool Bay CCS Limited and liaison with HM Coastguard when appropriate;
- Ensuring that Bronze-level teams have the guidance and means to execute their tasks.

GOLD STRATEGIC EMERGENCY RESPONSE

6.2.14. Once a Silver-level is initiated, communication with the Gold-level strategic team shall also be established. The Gold level provides high-level oversight, resource authorisation, external stakeholders coordination and strategic guidance for managing the emergency.

6.2.15. In Liverpool Bay CCS Project, the Project Manager acts as the Emergency Coordinator (EC) and is responsible for the strategic management of emergencies within the CONTRACTOR's organisation. The Liverpool Bay CCS Limited also designates its own senior representative(s) at the Gold level to provide direction and coordination in line with contractual escalation procedures.

6.2.16. Gold-responsibilities include:

- Setting the overall response strategy;
- Managing Liverpool Bay CCS Limited -level stakeholder liaison and public/media communications (via Liverpool Bay CCS Limited ERT);
- Ensuring sufficient resources and support are available to the Silver and Bronze levels;
- Maintaining communication with Liverpool Bay CCS Limited, CGOC, emergency services and other third parties as required.

6.2.17. The Gold Commander will typically operate from a remote location (e.g. Project Site Office or Boskalis Head Office in Papendrecht), not at the scene of the incident.

6.2.18. To ensure an effective strategic response:

- One person must be designated with decision-making authority during an emergency – for CONTRACTOR, this is the Project Manager / Emergency Coordinator;
- Communication with external emergency services (including HM Coastguard) shall be supported via the Marine Control Centre (MCC) and Silver-level roles;
- All roles and responsibilities across the command structure must be clearly defined, understood and delegated as required;
- Appropriate contingency planning must be in place to ensure continuity during personnel absence;
- All emergency response personnel must be trained and demonstrably competent in their roles.

6.3. NOTIFICATION PROCEDURES

6.3.1. For each emergency, notification of the Project Team is required as per the flowchart on the Emergency Notification Chart (Appendix D)

6.3.2. Boskalis Subsea Cables (BSC) will follow normal practice and contact the Papendrecht Head Office Security Officer, who provides 24hrs coverage, 7 days a week and coordinates the emergency notification cascade through the BSC Emergency Response Team (ERT) or other relevant parties.

6.3.3. Contacting the Security Officer initiates the information cascade, which must include:

- Notification of the Liverpool Bay CCS Limited Incident Management Team as per the Project Emergency Response Plan (ERP).

- Notification of the Marine Coordination Centre (MCC) by telephone at the earliest opportunity, but no later than 60 minutes from incident occurrence. The time of the call shall be recorded in Daily Progress Report (DPR).
- Notification of statutory authorities, when applicable, in compliance with UK regulations.

6.3.4. For any environmental incident, including any release of substances into the water, air or ground that could harm the environment – whether planned or unplanned – immediate notification by telephone must also be made to MCC, the Liverpool Bay CCS Limited Incident Management Team and statutory bodies as specified in the ERP.

6.3.5. In addition, the vessel's own Emergency Response Procedures and ERP shall be followed, and the Master or Offshore Manager shall ensure timely reporting to both shore-based contacts and regulatory agencies.

7. VESSEL MANAGEMENT

7.1. LOCATION OF PORTS

PORT OF ORIGIN

7.1.1. Port of Rotterdam will be used for Mobilisation of the Dutch oriented vessels. The cable lay vessel Ndurance will be mobilised in the port of Rotterdam and transit to Port of Blyth for the loading of the project.

7.1.2. For the larger vessels (cable lay vessel, cable burial vessel, rock installation vessel) no port calls during the operations are planned, when there is a necessity to go to port sufficient ports (drafts >5m) are available around the Liverpool Bay/Irish Sea.

Figure 7-1: Location of cables and crossings for pre-lay activities

CONSTRUCTION PORT

7.1.3. Port of Mostyn will be the operational port for the smaller vessels (draft < 5m) such as PLGR Vessel and the Boulder relocating and Pre lay mattress vessel. For the CTV and Survey vessel it will be the operational port and a dedicated pontoon will be available.

7.1.4. The smaller vessel, such as CTV and survey vessel will be allocated to a pontoon. The other vessels are planned to be berthed alongside the quay wall.

Figure 7-2: Location of cables and crossings for pre-lay activities

TRANSIT ROUTES

7.1.5. Below overview shows possible route from Operation port of Mostyn to the worksites In green the indicative transit route from Port of Mostyn to the cable installation corridor is given, the red corridor marks the approximate location of the installation works.

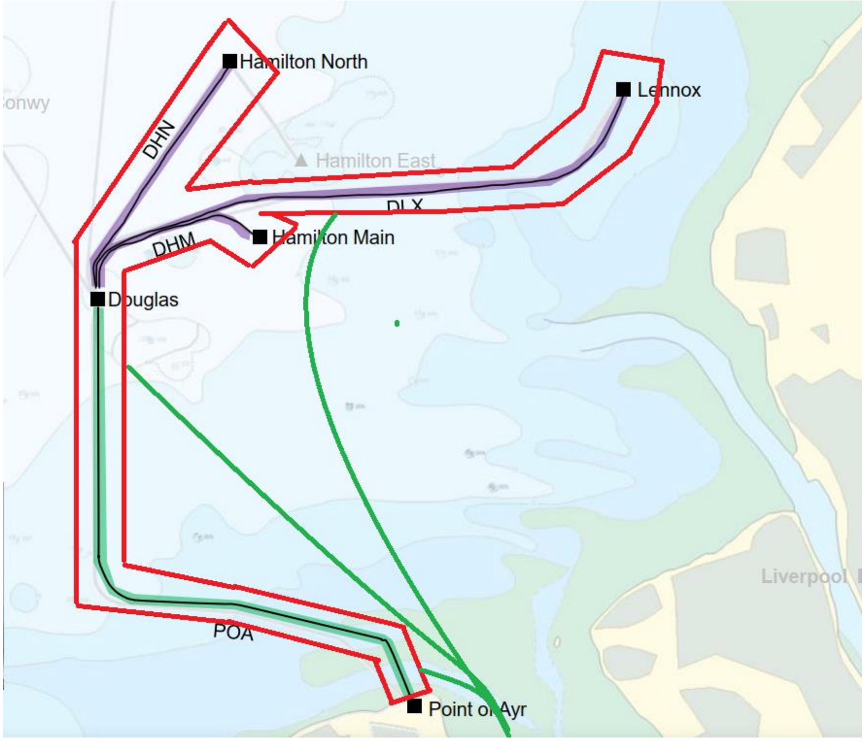


Figure 7-3: Location of cables and crossings for pre-lay activities

7.1.6. The Ndurance needs to be mobilised at Port of Rotterdam, when after she will collect cable in Blyth. When loaded, she transits to Liverpool Bay.

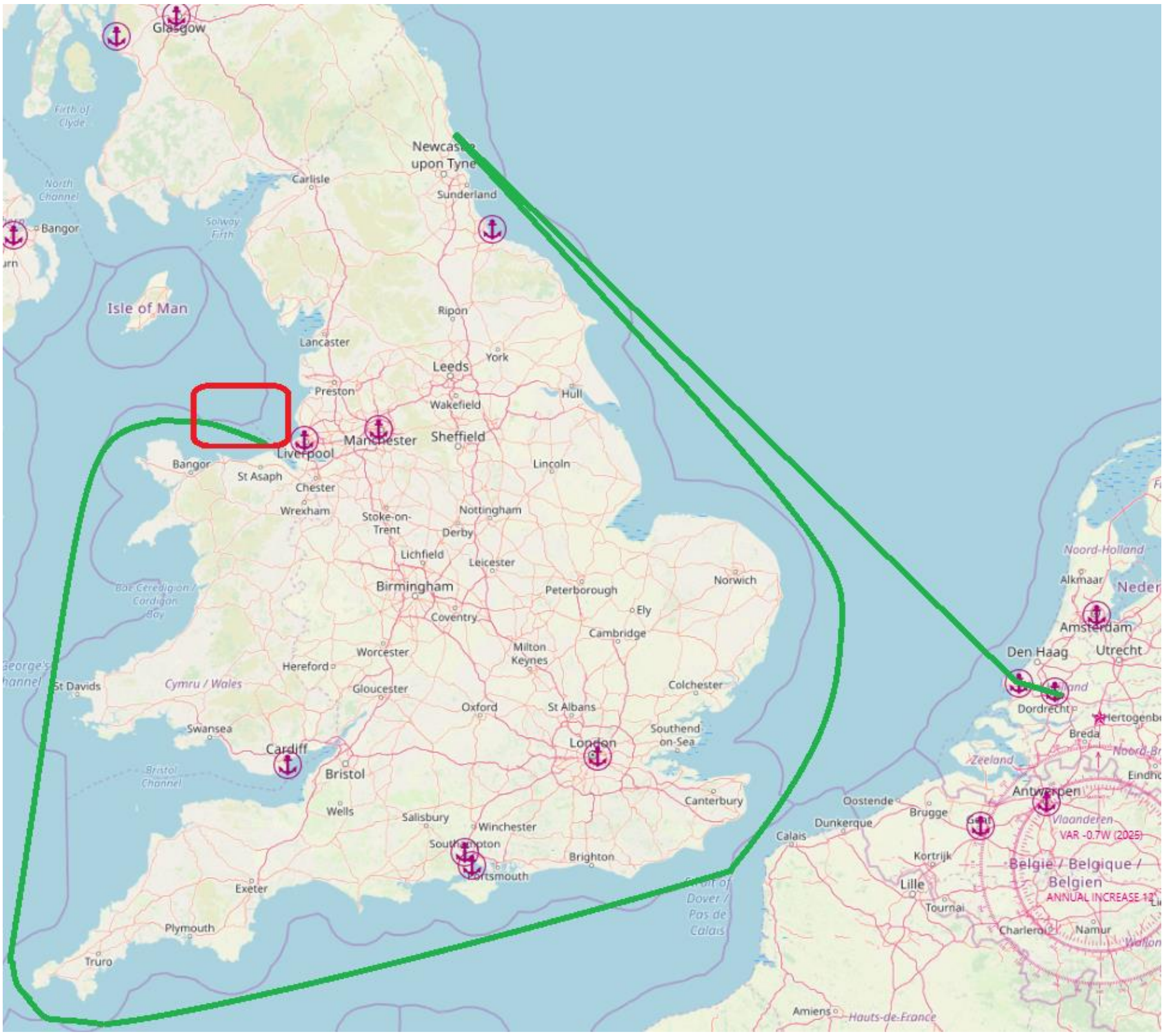


Figure 7-4: Location of cables and crossings for pre-lay activities

7.2. MANAGEMENT AND COORDINATION OF VESSELS

7.2.1. All vessels will be coordinated by Boskalis personnel. The allocated site office will be in Port of Mostyn, this to ensure close contact with all vessels. Most steps will be discussed daily with the captain and Offshore Construction manager onboard. In more detail this will be explained in Vessel Management plan.

7.2.2. The **Combined Vessel Management Plan (VMP) and Navigation and Safety Plan (NSP)** for the Liverpool Bay Carbon Capture and Storage (CCS) Project has been prepared to satisfy **Marine Licence CML2365 conditions 3.27 and 3.29**. It sets the framework for safe, environmentally responsible, and coordinated vessel operations throughout the project phases, including construction, operation, maintenance, and decommissioning in both Welsh and English waters. Full details of the vessel management can be found in the Combined VMP & NSP, however, a summary of its key elements is, for completeness, presented in the following sections.

7.3. INTRODUCTION, PURPOSE, AND SCOPE

7.3.1. The Combined VMP & NSP is based on international maritime safety conventions, particularly SOLAS Chapter V and UK-specific Marine Guidance Note 610, aiming to secure control measures from the Offshore Environmental Statement and Navigation Risk Assessment. It covers vessel management aspects such as ports used, coordination of vessel activities, passage planning, minimum passing distances, reporting, anchoring, and restricted visibility operations.

7.4. PROJECT LOCATION AND ACTIVITIES

7.4.1. Situated in the Eastern Irish Sea, the project involves new and reused infrastructure. Construction is divided into five activities: cable laying and protection (Activity 1), pipeline spool laying and protection (Activity 2), clearance of unexploded ordnance (Activity 3, unlikely needed), installation of the Douglas CCS platform and pipeline repurposing (Activity 4), and removal of dropped objects (Activity 5, managed separately). Detailed vessel types, numbers, and schedules for these activities are provided in various tables within the document.

CONSTRUCTION AND OPERATION PHASES

- Activity 1 involves laying four combined electrical and fiber-optic cables with multiple phases scheduled between February 2026 and August 2027.
- Activity 2 covers installation of pipeline spools connecting the Douglas CCS platform to existing pipelines, scheduled for June-July 2027.
- Activity 4 includes installation of the new Douglas CCS platform and satellite platform topsides with specified vessel programs in 2026 and 2027.
- Operation phase spans 25 years, with about 21 vessels onsite at any time and approximately 850 vessel movements annually.
- Decommissioning is expected to last up to four years, gradually reducing vessel activity.

7.5. REGULATORY CONTEXT AND COMPLIANCE

7.5.1. All vessels will comply with international conventions (IMO, SOLAS, MARPOL, COLREGs), UK Maritime and Coastguard Agency (MCA) guidance, local fisheries regulations, and project-specific marine licence conditions. A Vessel Assurance Checklist and Vessel Assurance Matrix support verifying compliance before vessel mobilisation. Environmental protection measures include fuel management, ballast water control, waste management, noise reduction, pollution prevention, and fisheries liaison protocols.

Topic	Measures
Fuel Management	Use of low sulphur fuels, spill prevention during bunkering, daily fuel logs
Ballast Water Management	Compliance with IMO convention, ballast exchange in approved areas, record keeping
Waste Management	Segregation, no plastic discharge, use of port reception facilities
Noise Reduction	Minimizing thruster use and engine idling, noise monitoring during installation

Topic	Measures
Pollution Prevention	SOPEP onboard, spill drills, immediate spill reporting, coordinated Oil Pollution Emergency Plan (OPEP)
Fisheries Liaison	FLO appointed, early notification, gear interaction protocol

7.6. ROLES AND RESPONSIBILITIES

LIVERPOOL BAY CCS LIMITED

7.6.1. Liverpool Bay CCS Limited, as the licence holder holds ultimate legal accountability for vessel operations, ensuring compliance with marine licences, environmental management plans, and regulatory requirements. It has appointed the Marine Coordinator (MC) to oversee audits, stakeholder engagement, emergency responses, and continuous improvement of vessel management.

MARINE COORDINATOR (MC)

7.6.2. The MC manages real-time vessel movements, communication with vessels and authorities, enforcement of exclusion zones, incident coordination, environmental compliance, and interfaces with the Fisheries Liaison Officer (FLO).

VESSEL OWNERS AND OPERATORS

7.6.3. Liverpool Bay CCS Limited ensures vessels are certified, crewed by trained personnel, operated safely per international laws, and comply with environmental protection measures. They also maintain vessel maintenance, emergency preparedness, and reporting to the MC.

FISHERIES LIAISON OFFICER (FLO)

7.6.4. ERM is appointed as FLO to manage communication between the project and fishing communities, facilitate notifications, mitigate conflicts, manage fishing gear interactions, and maintain stakeholder engagement.

RESPONSIBILITY MATRIX

7.6.5. A RACI matrix in Appendix D of the Combined VMP & NSP clarifies the roles of principal contractor, developer, vessel owners/operators, MC, and FLO in vessel management tasks such as vessel register maintenance, assurance, mobilisation, compliance, notifications, incident reporting, and emergency response.

7.7. PORT OF MOSTYN AND PEEL PORTS COORDINATION

7.7.1. The Port of Mostyn is a key operational port with a Memorandum of Understanding (MoU) with Liverpool Bay CCS Limited to coordinate cable laying across the Welsh Channel, minimizing disruption to port traffic and maintenance dredging. Continuous communication and scheduling coordination are established. Peel Ports oversees Liverpool Bay Traffic Separation Scheme (TSS) areas, requiring coordination for cable laying vessels operating under Restricted Ability to Manoeuvre (RAM) status.

7.8. VESSEL REGISTER AND SPECIFICATIONS

7.8.1. All vessels comply with International Regulations for Preventing Collisions at Sea, be equipped with AIS, and meet crew certification standards. Detailed vessel information including name, function, type, IMO number, and owner is maintained and communicated. Specific vessels for activities such as cable laying, survey, grapnel run, dredging, pipeline spool laying, and platform installation are listed with their specifications and schedules.

7.9. NAVIGATIONAL RISK ASSESSMENT (NRA)

7.9.1. An NRA conducted using Formal Safety Assessment methodology found navigational risks to be broadly acceptable or tolerable with mitigation. Key risks like vessel displacement, collision, allision, anchor and fishing gear interaction, and under keel clearance are managed via exclusion zones, vessel coordination, cable burial, and safety zones. Mitigations include Notices to Mariners, marking per Trinity House, liaison with ports, and implementation of the VMP.

7.10. SAFETY AND MITIGATION MEASURES

EXCLUSION AND ADVISORY ZONES

7.10.1. Defined zones include:

- Construction Exclusion Zone (500 m radius around platforms)
- Diver Exclusion Zone (500 m radius during diving)
- Cable and Pipeline Laying Corridors (500 m width advisory zones)
- Anchor Spread Areas (temporary, as required)

7.10.2. These zones are enforced by guard vessels and communicated via Notices to Mariners.

GUARD VESSEL ARRANGEMENTS

7.10.3. Guard vessels patrol exclusion zones to prevent unauthorized vessel entry, maintain safe distances, and provide early warnings. They operate under the Marine Coordinator's direction with AIS, radar, and VHF communications.

LIGHTING AND MARKING

7.10.4. All structures are marked and lit according to approved plans to ensure visibility and safety.

7.11. COMMUNICATION PROTOCOL

PRE-OPERATION AND STANDARD CHANNELS

7.11.1. Communication is established via Notices to Mariners, toolbox talks, VHF radio channels, AIS tracking, and direct communication lines. Daily and shift reports maintain situational awareness.

SAFETY AND MITIGATION COMMUNICATIONS

7.11.2. Includes monitoring exclusion zones, DP system alerts, diving and ROV operational communication, weather updates, and anchor handling notifications.

REPORTING AND EMERGENCY ESCALATION

7.11.3. Regular vessel position reporting, guard vessel reports, daily coordination calls, and an escalation pathway for incidents involving the Marine Coordinator, HM Coastguard, and emergency services ensure rapid response and safety.

7.12. MANAGEMENT AND COORDINATION OF VESSELS

7.12.1. The Marine Coordinator manages vessel permissions, routeing, monitoring for conflicts, defining safety zones, weather information, and emergency contacts. Navigational safety is assured by AIS monitoring, COLREGs compliance, guard vessels, exclusion zones, and communication with authorities.

VESSELS RESTRICTED IN ABILITY TO MANOEUVRE (RAM)

7.12.2. Vessels engaged in cable installation or heavy lifts are designated as RAM, displaying appropriate signals and maintaining communication with the Marine Coordinator.

PASSAGE PLANNING AND ANCHORING

7.12.3. Vessels follow SOLAS requirements for passage planning, considering weather, hazards, and instructions. Anchoring requires Marine Coordinator permission and consideration of seabed conditions, other vessels, and operational zones.

VESSEL MOVEMENT PLANNING AND NOTIFICATIONS

7.12.4. Vessels provide advance notifications, daily position reports, and comply with Notices to Mariners and Kingfisher Bulletins. Coordination with fisheries and navigation stakeholders is maintained.

7.13. CHARTING PROCEDURES

7.13.1. Post-construction surveying and data collection enable accurate charting of infrastructure on official nautical charts. Hydrographic notes and submissions to the UK Hydrographic Office ensure mariners are informed of new structures and safety zones. Notifications are made to regulators, coastguard, fishing industry, and adjacent operators. Interim Notices to Mariners are issued until permanent chart updates are published.

7.14. COMMUNICATION AND REPORTING FRAMEWORK

7.14.1. A dedicated Marine Coordinator maintains continuous communication, tracks vessel positions, issues instructions, and manages emergency communications. Reporting templates for daily, weekly, and monthly vessel activity and compliance are utilized. Incident and near-miss reporting protocols are established with escalation to contractors, developers, and regulators.

7.15. EMERGENCY RESPONSE AND CONTINGENCY PLANNING

7.15.1. Vessels maintain Shipboard Oil Pollution Emergency Plans (SOPEP) and participate in a unified Offshore Pollution Emergency Plan (OPEP). Spill response equipment and trained crews are mandatory. Search and Rescue (SAR) procedures comply with international conventions, with coordination through the Marine Coordinator and HM Coastguard. Procedures for fire, collision, grounding, and major incidents are defined, with clear escalation and notification requirements.

7.16. COMPLIANCE MONITORING AND AUDITING

7.16.1. Regular internal audits verify compliance with marine licences, international regulations, and project procedures. The Licence Holder facilitates regulator inspections. Non-conformances are tracked with root cause analysis and corrective actions. The VMP & NSP is a live document subject to annual review, updates from lessons learned, and stakeholder consultation.

7.17. COMBINED VMP & NSP APPENDICES OVERVIEW

- Appendix A: Vessel Assurance Checklist to be completed before vessel mobilisation, covering vessel details, certification, compliance with IMO and MARPOL, navigation safety, emergency preparedness, environmental and fisheries liaison, and project-specific documentation.
- Appendix B: Vessel Assurance Matrix summarizing certification requirements across vessel types such as Cable Lay Vessels, Heavy Lift Vessels, Crew Transfer Vessels, Guard Vessels, and Survey Vessels.
- Appendix C: Crew Briefing Sheet highlighting key environmental protection measures including fuel management, ballast water, waste management, noise reduction, and spill response.
- Appendix D: RACI matrix clarifying roles and responsibilities in vessel management among Principal Contractor, Developer, Vessel Owners/Operators, Marine Coordinator, and Fisheries Liaison Officer.

7.17.1. This comprehensive VMP & NSP ensures that the Liverpool Bay CCS Project's vessel activities are conducted safely, in compliance with regulatory frameworks, and with minimal environmental impact, supporting the successful delivery of offshore construction, operation, and decommissioning phases.

8. MONITORING AND MAINTENANCE AND CONCLUSIONS

8.1. MONITORING AND MAINTENANCE

8.1.1. Post-lay inspections, ongoing burial depth surveys, and risk-based monitoring strategies are planned to maintain cable integrity throughout the operational life. Maintenance and repair strategies include reporting protocols to regulators to ensure compliance and adaptive management.

8.1.2. A risk-based monitoring and maintenance strategy will be implemented throughout the full lifecycle of the cables, including post-installation, operational, and decommissioning phases. This approach is consistent with the Project Design Envelope assessed in the Environmental Statement (ES) and ensures that all monitoring activities remain proportionate, non-intrusive, and within the assessed envelope. The monitoring strategy has been developed to verify cable integrity, confirm burial performance, and identify any changes in seabed conditions over time, while minimising unnecessary intervention and environmental disturbance.

8.1.3. Post-installation monitoring will include the completion of as-built surveys to confirm the position of the cables, burial depth, and the condition of cable protection measures. During the operational phase, monitoring will be undertaken through a combination of periodic seabed surveys, including geophysical and/or ROV-based inspections where appropriate, and continuous remote performance monitoring via the control system (Centralised Control and Safety Platform, ICSS at PoA (e.g. continuity, signal performance, resistance). Where practicable, physical inspection surveys will be aligned with existing offshore inspection programmes, such as pipeline surveys, to minimise additional vessel activity and associated environmental effects.

8.1.4. Routine active seabed maintenance is not anticipated during normal operation of the cables. Intervention activities will be undertaken only if monitoring identifies a requirement, such as reduced burial depth or cable exposure. Any intervention will be localised and temporary in nature and may include re-burial of the cable, placement of additional protection such as mattresses or rock, or other appropriate remedial measures. All such activities will be carried out in accordance with the environmental management measures defined within the project documentation and will remain within the limits assessed in the ES.

8.1.5. The nature and duration of monitoring and maintenance activities have been designed to minimise environmental disturbance. Installation activities are short-term and sequential, while monitoring surveys are temporary and non-intrusive. Any repair or intervention works, if required, will be localised and limited in duration. At any one location, disturbance will therefore be intermittent and short-term, allowing natural recovery of seabed habitats in line with the characteristics described in the ES.

8.1.6. The results of all monitoring activities, including any identified issues and subsequent remedial actions, will be recorded and reported to the relevant regulatory authorities in accordance with the requirements of Marine Licence

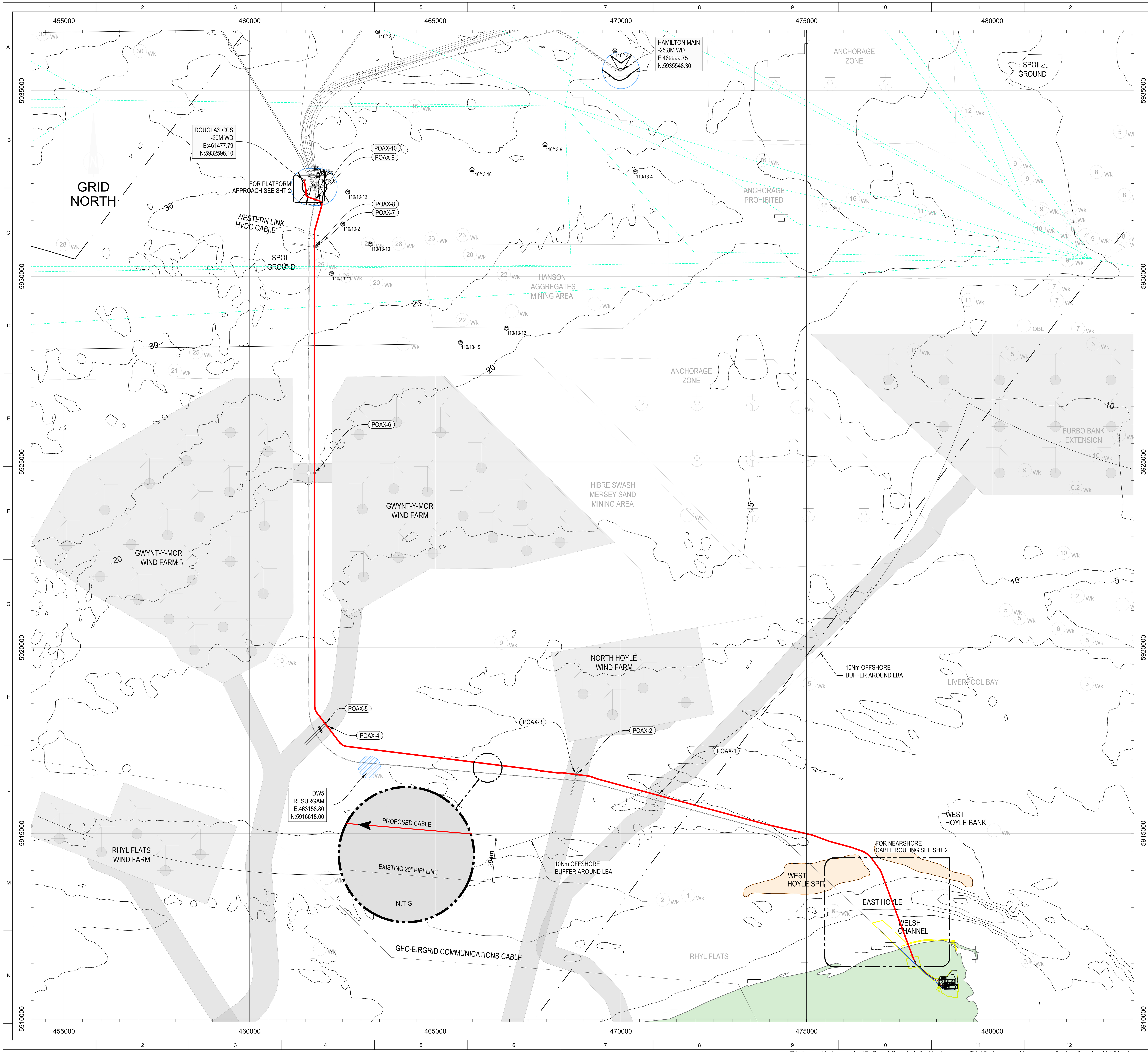
CML2365. This will ensure transparency and demonstrate continued compliance with consent conditions and environmental commitments.

8.1.7. The monitoring and maintenance strategy confirms that all lifecycle activities associated with the cables, including inspection and any potential intervention, remain within the Worst-Case Scenario assessed in the Environmental Statement and do not result in any new or materially different environmental effects. All activities will be undertaken in accordance with the embedded mitigation measures and environmental controls defined within the project documentation, including the CEMP.

8.2. CONCLUSIONS

8.2.1. The CSIP confirms compliance with Marine Licence CML2365 conditions, applying ALARP principles to risk management. It commits to ongoing monitoring, stakeholder engagement, and adaptive management to support the safe, effective, and environmentally responsible installation and operation of the Liverpool Bay CCS Project's subsea cables.

APPENDIX A: NEW OFFSHORE POWER CABLE AND FIBRE OPTIC FIELD LAYOUT (OFFSHORE SECTION)



REFERENCE DOCUMENTS

NUMBER	TITLE

KEY PLAN

GENERAL NOTES

1. ALL DIMENSIONS AND COORDINATES ARE IN METRES UNLESS NOTED OTHERWISE.
2. GLOBAL COORDINATE REFERENCE SYSTEM: European Datum 1950 UTM Zone 30N (EPSG: 23030)

PROJECTED COORDINATE SYSTEM	European Datum 1950 UTM Zone 30N
PROJECTION	TRANSVERSE MERCATOR
LINEAR UNIT	METERS (1.0)
FALSE EASTING	500000.0
FALSE NORTHING	0.0
CENTRAL MERIDIAN	-3.0
SCALE FACTOR	0.9996
LATITUDE OF ORIGIN	0.0
GEOGRAPHIC COORDINATE SYSTEM	European Datum 1950
ANGULAR UNIT	DEGREE (0.0174532925199433)
PRIME MERIDIAN	GREENWICH (0.0)
DATUM	European 1950
SPHEROID	Iternational 1924
SEMIMAJOR AXIS	6378388.0
SEMIMINOR AXIS	6356911.946127946
INVERSE FLATTENING	297

3. CABLE ROUTING AND CROSSINGS ARE PRELIMINARY AND SUBJECT TO CHANGE BASED ON SURVEY INFORMATION.
4. WATER DEPTHS AND SHIPWRECKS (Wk) ARE GIVEN FOR INFORMATION ONLY.
5. LAYOUT IS COMPILED FROM VARIOUS SOURCES AND THEREFORE IS SUBJECT TO CONFIRMATION.
6. PRELIMINARY ROUTING BASED ON EXISTING SEABED ARCHITECTURE AROUND EACH PLATFORM.
7. CABLE APPROACH TO EACH PLATFORM TO BE CONFIRMED.
8. FIELD LAYOUT BASED ON THE PRELIMINARY LOCATION OF NEW J-TUBES AT EXISTING PLATFORMS (HAMILTON MAIN, HAMILTON NORTH, LENNOX) AND DOUGLAS CCS PLATFORM.
9. FINAL LOCATION OF J-TUBES AT DOUGLAS CCS PLATFORM TO BE CONFIRMED.
10. DRILLING JACK-UP CORRIDOR AND FOOTPRINT AROUND PLATFORMS TO BE CONFIRMED.
11. FIELD LAYOUT TO BE REVIEWED AGAINST THE DECOMMISSIONING SCOPE FOR THE PROJECT.

LEGEND

- PROPOSED BOSKALIS CABLE ROUTE (POINT OF AYR - DOUGLAS CCS)
- MARINE TRAFFIC (SHIPPING LANES)
- EXISTING POWER CABLES
- EXISTING PIPELINES / UMBILICALS / POWER CABLES
- AREA LIMITS
- XX Wk — SHIPWRECK LOCATION
- 110/XX-XX — ABANDONED WELL LOCATION AND IDENT
- WIND TURBINE (NOT INDICATIVE OF LOCATION)
- OFFSHORE WIND FARM POWER CABLE CORRIDORS
- RESURGAM EXCLUSION ZONE

Validity Status	Rev. Number	Date	Description	Prepared	Checked	Approved	Approved Eni UK
CD-FE	00	10.02.2026	ISSUED FOR INFORMATION	R.D	M.R	S.G	

Revision index

Company logo and business name: eni uk, eni progetti

Company Document ID: 102700DSDD0014I

Job. N. JA0614

Facility and Sub Facility Name: POINT OF AYR GAS PLANT - GENERAL

Project Name: LBA CCS Transport and Storage

Scale: 1:50k @A1

Sheet of Sheets: 1 / 2

Document Title: **NEW OFFSHORE POWER CABLE AND FIBRE OPTIC FIELD LAYOUT (OFFSHORE SECTION)**

Supersedes N.

Superseded by N.

Plant Area: N/A

Plant Unit: N/A

A1 (841 x 594)

Software:AutoCad

Filename.102700DSDD0014I _CDFE00_01_02.DWG

REFERENCE DOCUMENTS

NUMBER	TITLE

KEY PLAN

GENERAL NOTES

1. FOR GENERAL NOTES SEE SHEET 1.

LEGEND

(red line)	PROPOSED BOSKALIS CABLE ROUTE (POINT OF AYR - DOUGLAS CCS)
(yellow dashed line)	TCPA BOUNDARY FOR CONSULTATION
	EXISTING 20" (PL 1030) GAS DOUGLAS TO POINT OF AYR
	5m BATHYMETRY CONTOURS
XX Wk	SHIPWRECK LOCATION

Validity Status	Rev. Number	Date	Description	Prepared	Checked	Approved	Approved Eni UK
CD-FE	00	11.02.2026	ISSUED FOR INFORMATION	R.D	M.R	S.G	

Revision index

Company logo and business name: eni uk / eni progetti

Company Document ID: 102700DSDD0014I

Job. N. JA0614

Facility and Sub Facility Name: POINT OF AYR GAS PLANT - GENERAL

Project Name: LBA CCS Transport and Storage

Scale: 1:8k @A1

Sheet of Sheets: 2 / 2

Document Title:

NEW OFFSHORE POWER CABLE AND FIBRE OPTIC FIELD LAYOUT (OFFSHORE SECTION)

Supersedes N.

Superseded by N.

Plant Area: N/A

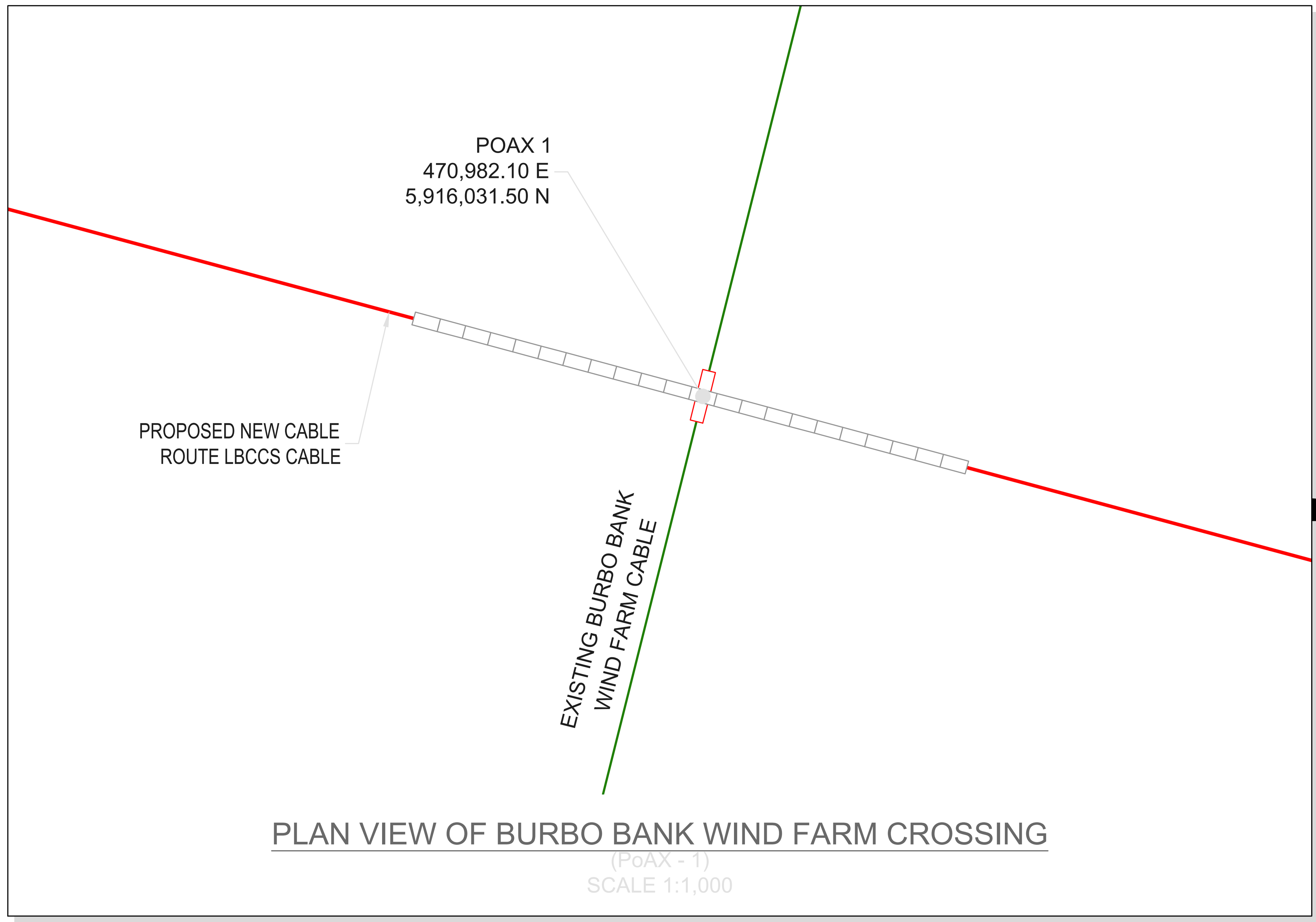
Plant Unit: N/A

A1 (841 x 594)

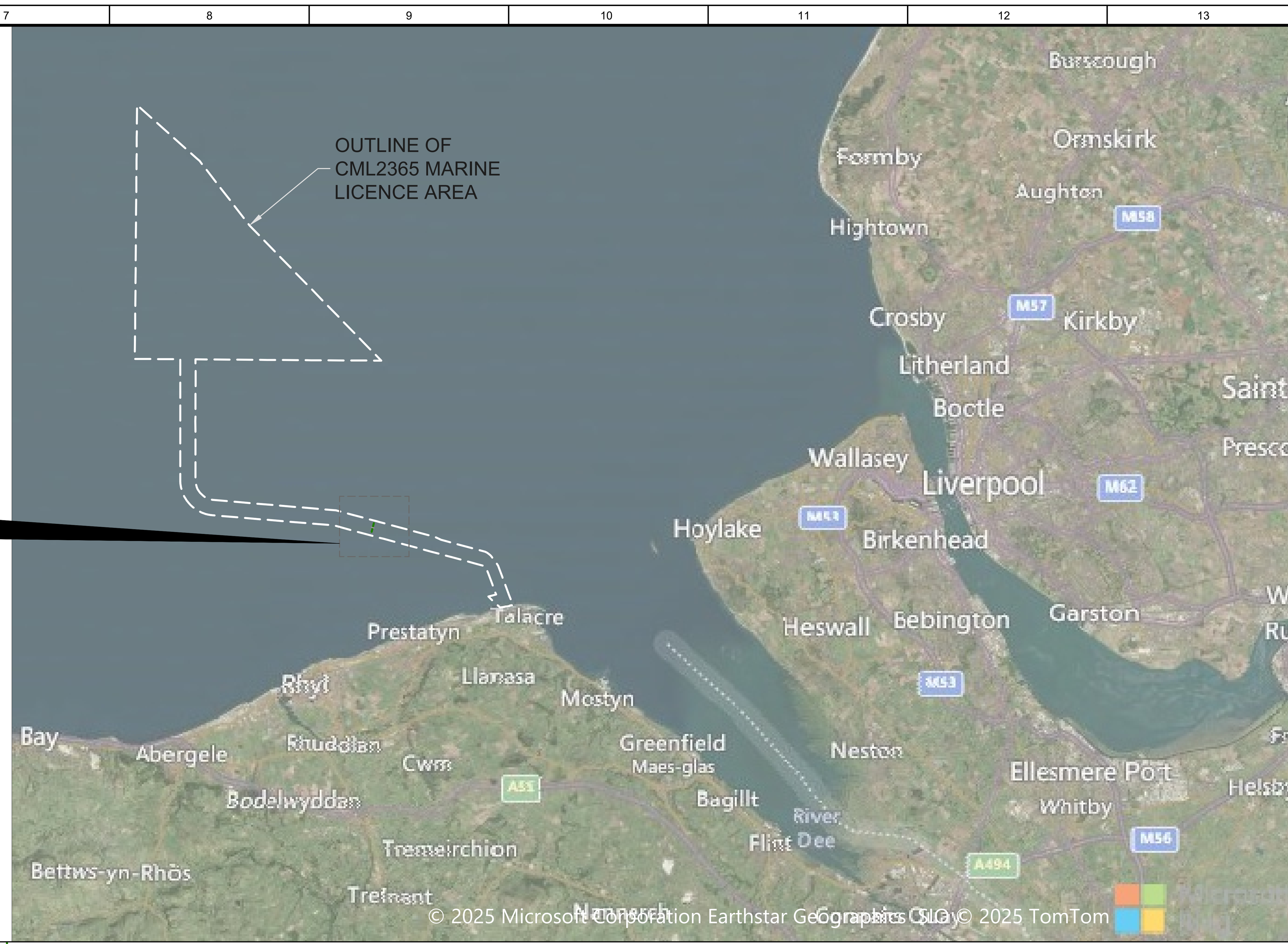
Software:AutoCad

Filename.102700DSDD0014I _CDFE00_01_02.DWG

APPENDIX B: CABLE CROSSING DESIGN DRAWINGS



PLAN VIEW OF BURBO BANK WIND FARM CROSSING
(PoAX - 1)
SCALE 1:1,000

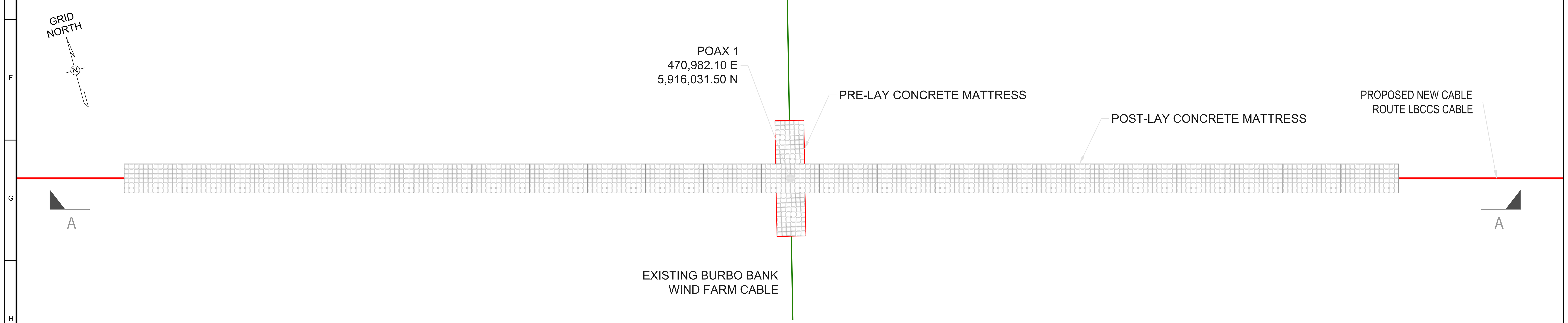


NOTES:

1. THE CABLE MINIMUM BENDING RADIUS IS ASSUMED TO BE 2.4m DURING INSTALLATION AND OPERATION.
2. MODULAR MATTRESS PROPERTIES FOR THE PROPOSED PRE-LAY AND POST-LAY MATTRESSES SHALL BE AS PER10562701DSRH1039W, CABLE CROSSING DESIGN REPORT - POINT OF AYR TO DOUGLAS CCS.
3. ALL COORDINATES ARE IN EUROPEAN DATUM 1950 UTM ZONE 30N.
4. EXTENT OF MATTRESS PROTECTION SHALL BE CONFIRMED BASED ON SITE-SPECIFIC GROUND SLOPE CONDITIONS.

REFERENCE DOCUMENTS

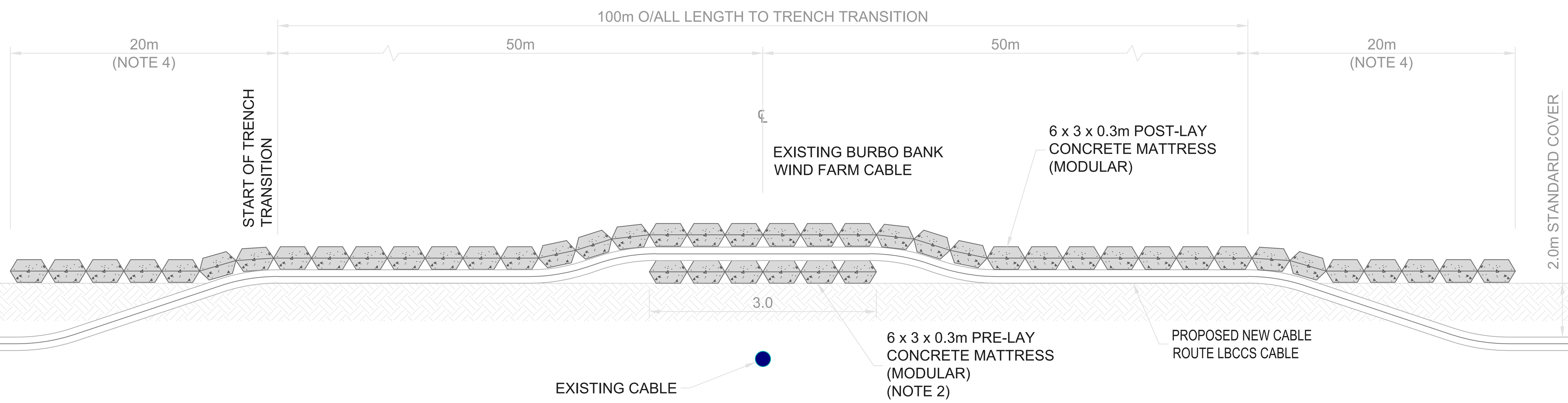
NUMBER	TITLE



PLAN VIEW ON BURBO BANK WIND FARM CABLE CROSING (PoAX-1)
SCALE 1:250

ABBREVIATIONS:

GYM	GWYNT-Y-MOR
LBCCS	LIVERPOOL BAY CARBON CAPTURE & STORAGE PROJECT
POA	POINT OF AYR
TYP.	TYPICAL
WD	WATER DEPTH



SECTION A-A
NOT TO SCALE

Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approval	Company Approval
EX-DE	00	13.02.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC

Revision index

Company logo and business name: liverpool bay ccs

LCI Activity Code GB20250014

Contract Code 000593

Company Document ID: 10562701DSDN1049W

Job. N. JA1351

Contractor logo and business name: wood.

Contractor Document ID: OP271234-GN-GAS-0012

Contractor N.

Vendor logo and business name: NOT APPLICABLE

Vendor Document ID: NOT APPLICABLE

Purchase Order N.

Facility and Sub Facility Description: SEALINE DOUGLAS CCS - POINT OF AYR GAS PLANT OFFSHORE CABLES

Project and SoW Description: LBA CCS PROJECT Engineering for Cable Laying

Scale: AS SHOWN

Sheet of Sheets: 1 of 1

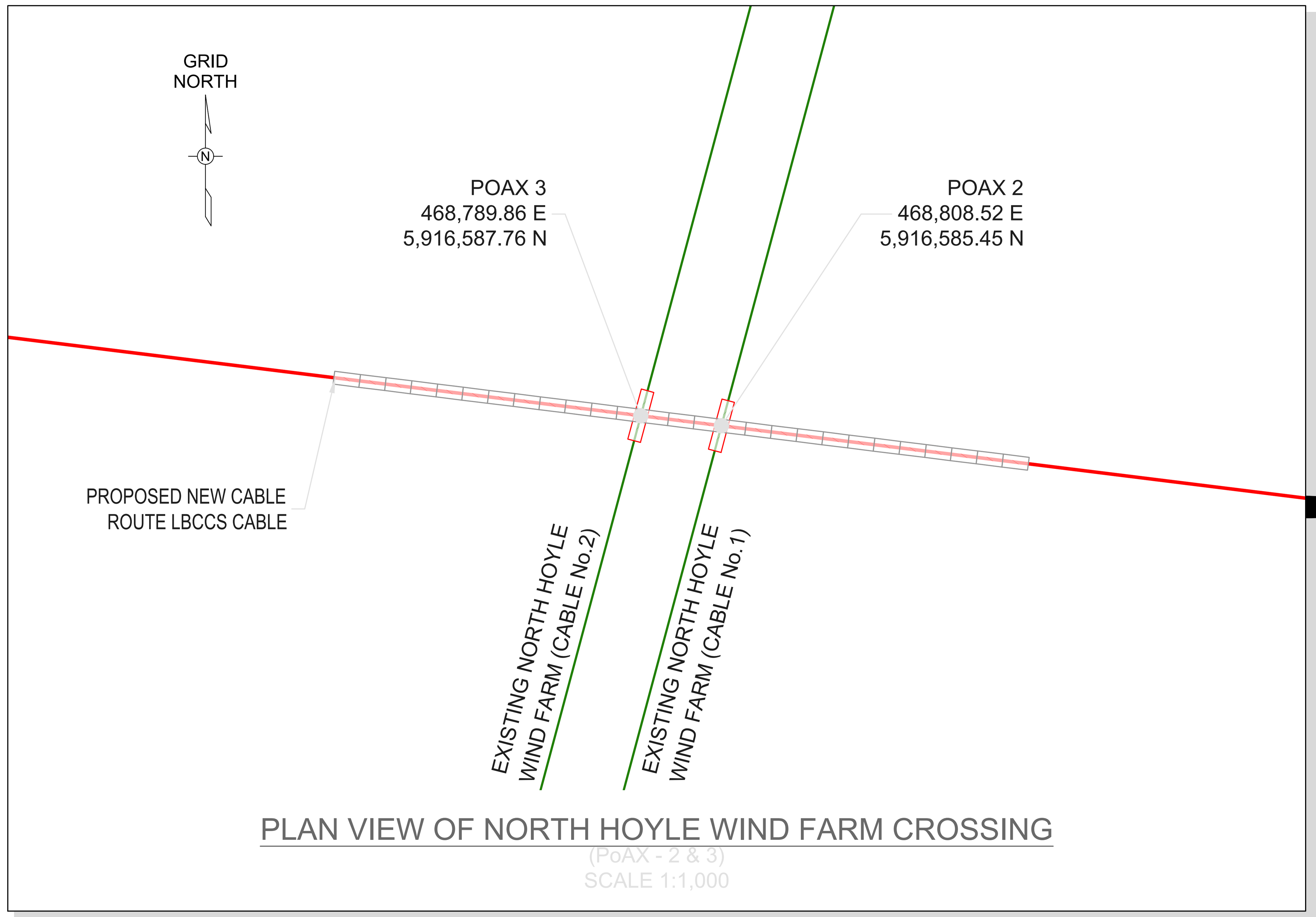
Document Title: PROPOSED BURBO BANK CROSSING SKETCH

Supersedes N. NOT APPLICABLE

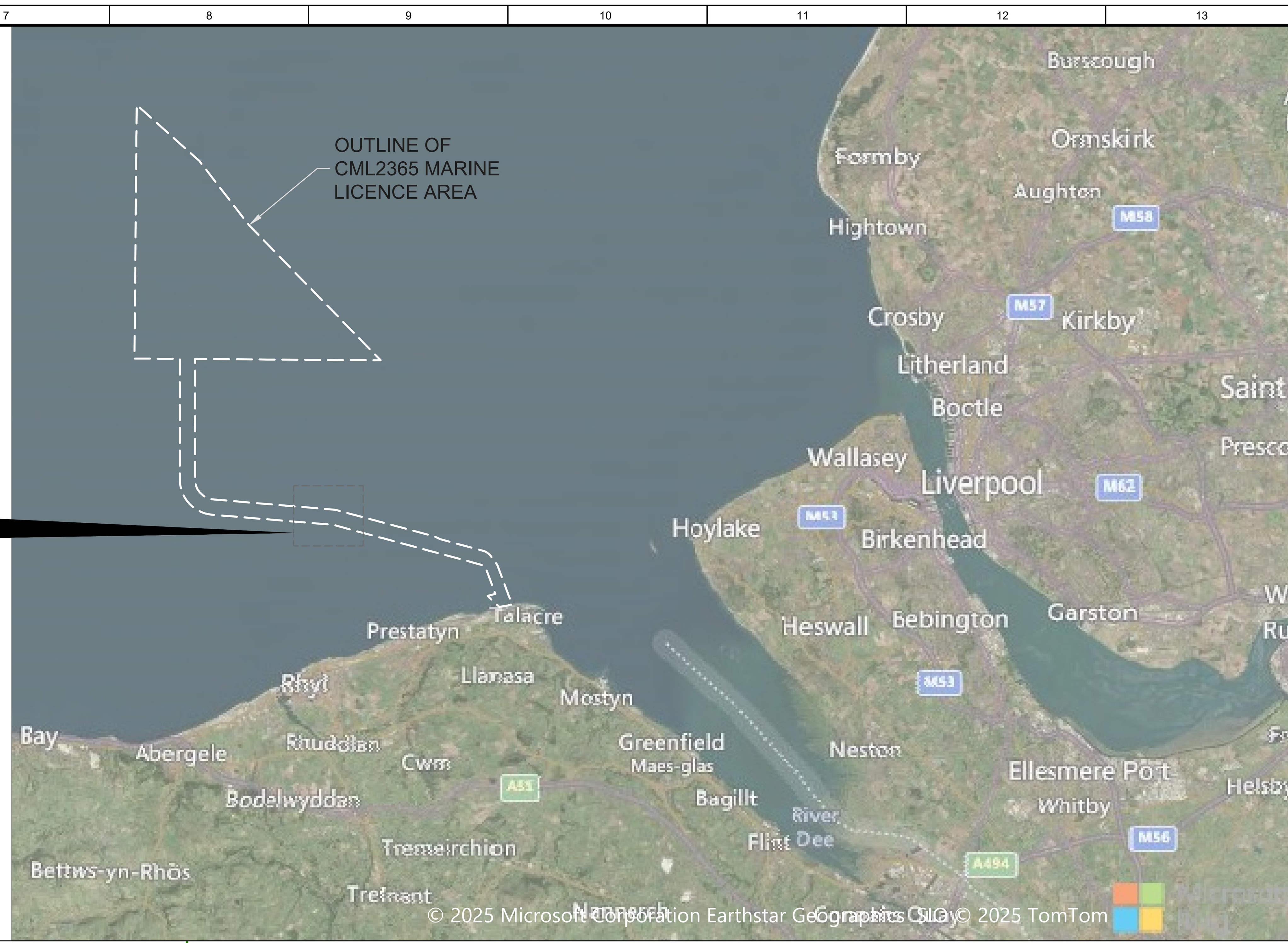
Superseded by N.

Plant Area: 1

Functional Unit: 0



PLAN VIEW OF NORTH HOYLE WIND FARM CROSSING
(PoAX - 2 & 3)
SCALE 1:1,000

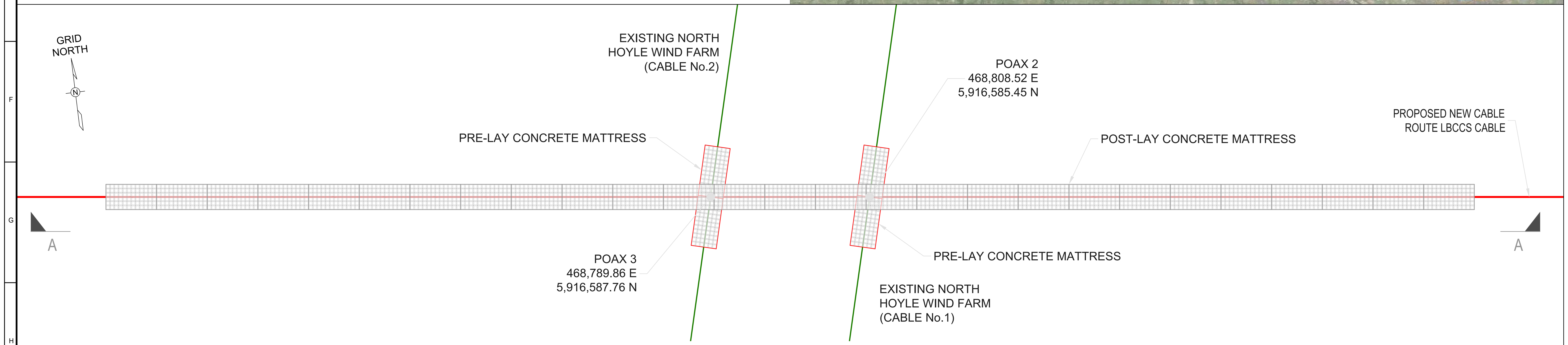


REFERENCE DOCUMENTS

NUMBER	TITLE

NOTES:

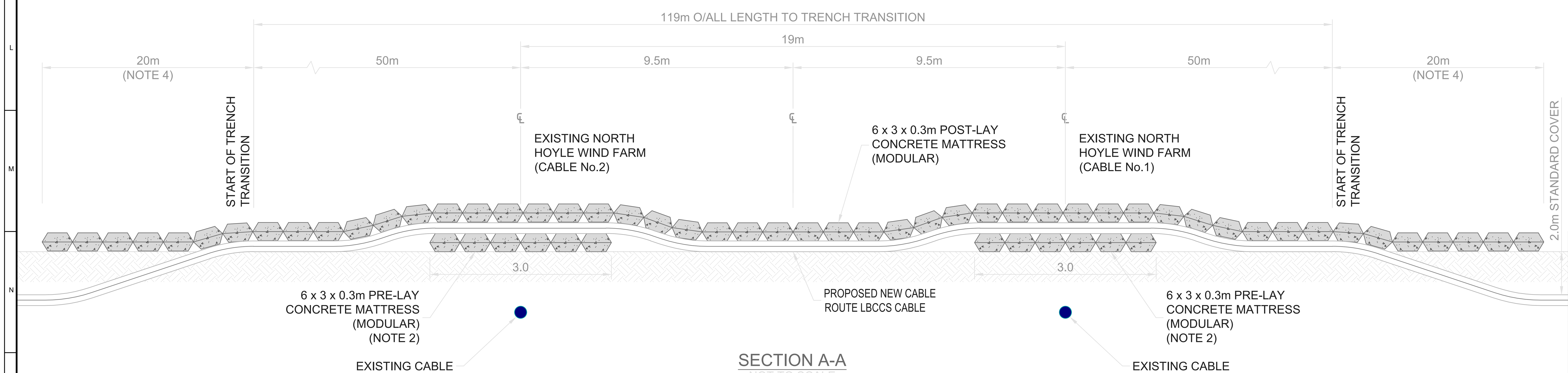
1. THE CABLE MINIMUM BENDING RADIUS IS ASSUMED TO BE 2.4m DURING INSTALLATION AND OPERATION.
2. MODULAR MATTRESS PROPERTIES FOR THE PROPOSED PRE-LAY AND POST-LAY MATTRESSES SHALL BE AS PER10562701DSRH1039W, CABLE CROSSING DESIGN REPORT - POINT OF AYR TO DOUGLAS CCS.
3. ALL COORDINATES ARE IN EUROPEAN DATUM 1950 UTM ZONE 30N.
4. EXTENT OF MATTRESS PROTECTION SHALL BE CONFIRMED BASED ON SITE-SPECIFIC GROUND SLOPE CONDITIONS.



PLAN VIEW ON NORTH HOYLE WIND FARM CABLE CROSSING (PoAX-2 & PoAX-3)
NOT TO SCALE

ABBREVIATIONS:

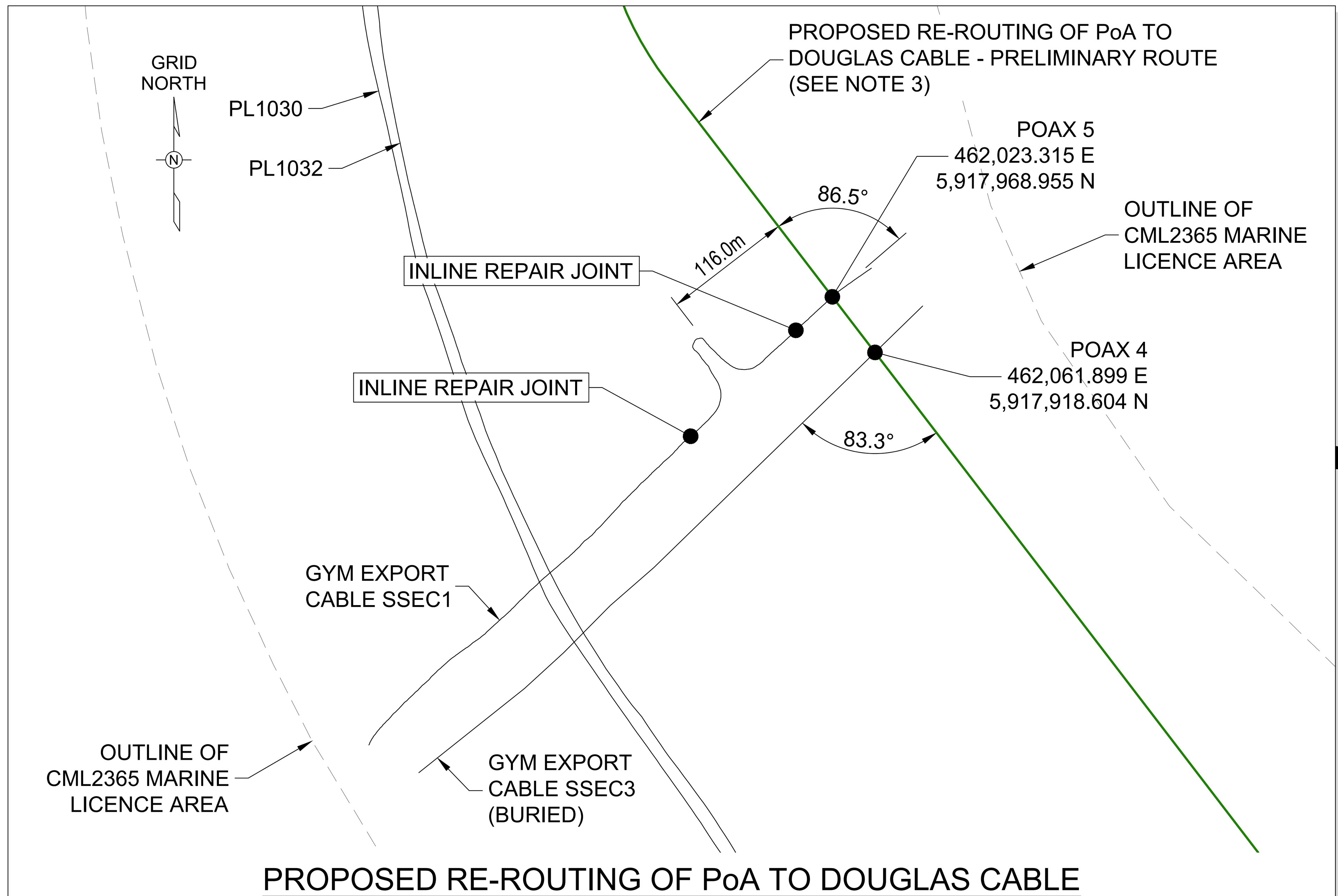
GYM	GWYNT-Y-MOR
LBCCS	LIVERPOOL BAY CARBON CAPTURE & STORAGE PROJECT
POA	POINT OF AYR
TYP.	TYPICAL
WD	WATER DEPTH



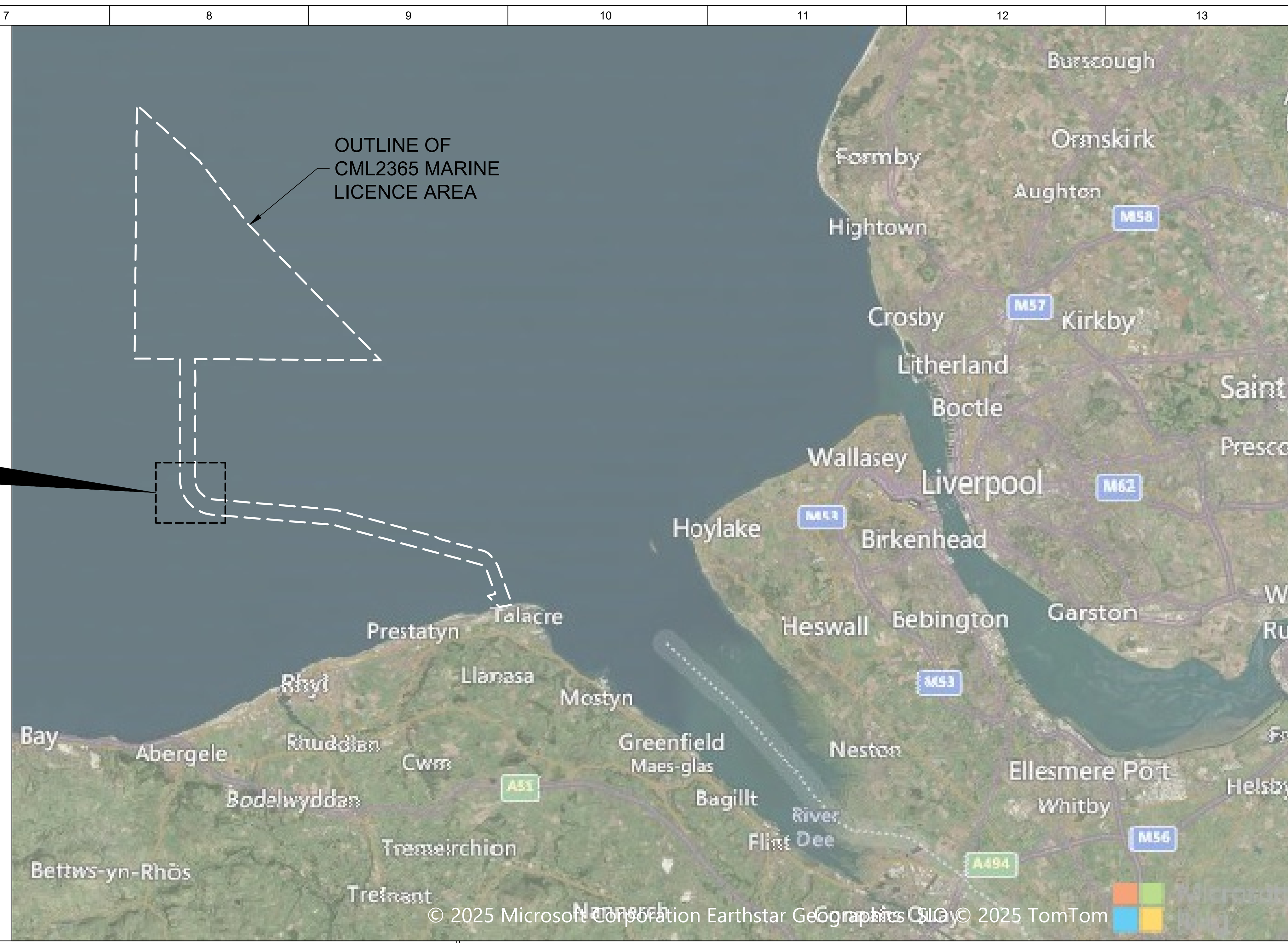
SECTION A-A
NOT TO SCALE

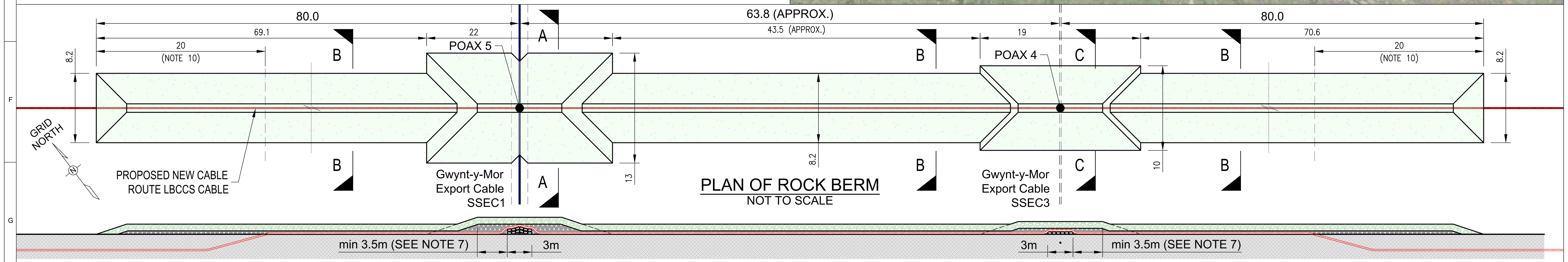
EX-DE	00	13.02.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC
Validity Status / Revision Number — Revision index		Date	Description	Prepared by	Checked by	Approved by	Contractor Approval	Company Approval

Company logo and business name: liverpool bay ccs	LCI Activity Code GB20250014; Contract Code 000593
Company Document ID: 10562701DSDN1050W	Job. N. JA1351
Contractor logo and business name: wood.	Contractor Document ID: OP271234-GN-GAS-0013; Contractor N.
Vendor logo and business name: NOT APPLICABLE	Vendor Document ID: NOT APPLICABLE; Purchase Order N.
Facility and Sub Facility Description: SEALINE DOUGLAS CCS - POINT OF AYR GAS PLANT OFFSHORE CABLES	Project and SoW Description: LBA CCS PROJECT Engineering for Cable Laying
Scale: AS SHOWN	Sheet of Sheets: 1 of 1
Document Title: PROPOSED NORTH HOYLE CROSSING SKETCH	Supersedes N. / Superseded by N.: NOT APPLICABLE
Plant Area: 1	Functional Unit: 0

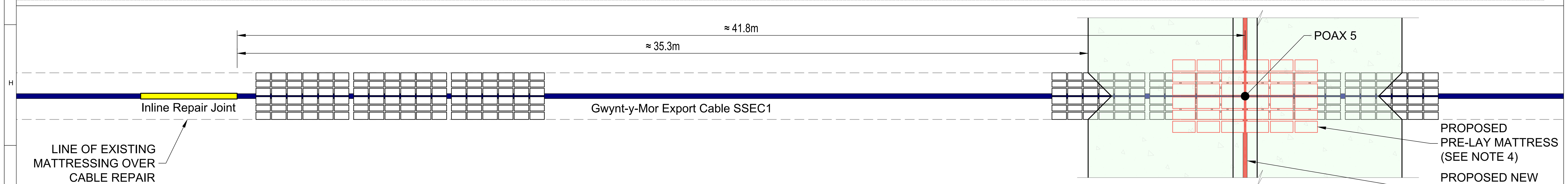


PROPOSED RE-ROUTING OF PoA TO DOUGLAS CABLE
SCALE 1:4,000

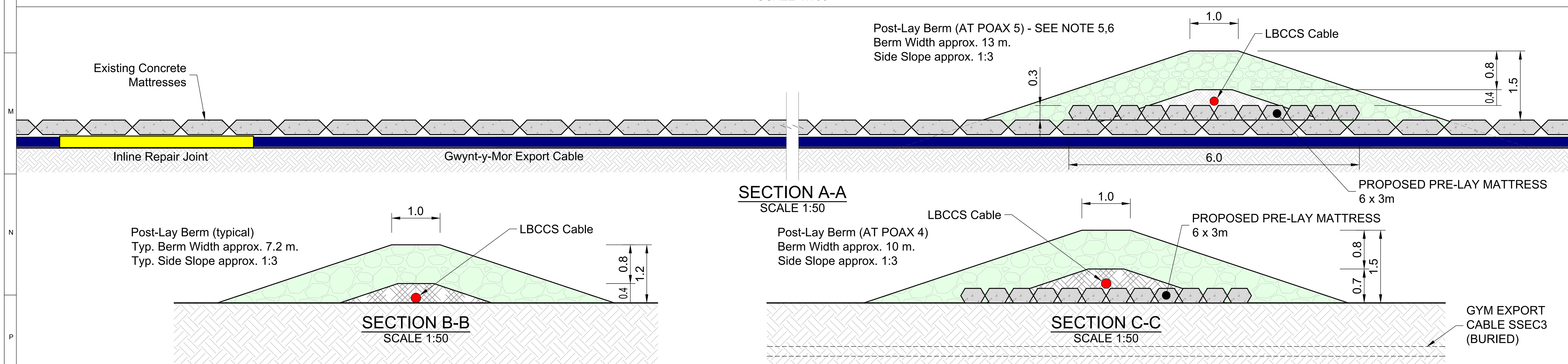




PLAN OF ROCK BERM
NOT TO SCALE



PLAN OF CROSSING OF GWYNT-Y-MOR EXPORT CABLE SSEC1 AND PoA TO DOUGLAS CABLE
SCALE 1:100



SECTION A-A
SCALE 1:50

SECTION B-B
SCALE 1:50

SECTION C-C
SCALE 1:50

REFERENCE DOCUMENTS

NUMBER	TITLE

NOTES:

1. THE ORIGINAL ROUTING FOR THE LBCCS CABLE PASSES BETWEEN THE WESTERN INLINE REPAIR JOINT AND THE CABLE REPAIR BIGHT ON GYM EXPORT CABLE SSEC1.
2. THE PROPOSED RE-ROUTING OF THE LBCCS CABLE IS TO 3 x WD FROM THE EASTERN REPAIR JOINT ON GYM EXPORT CABLE SSEC1. THIS ALSO MAINTAINS >50m CLEARANCE WITH PARALLEL CABLE IN THE BIGHT.
3. PRELIMINARY ROUTE. THE PROPOSED RE-ROUTING OF THE POA TO DOUGLAS CABLE MAY BE REFINED TO IMPROVE INSTALLABILITY.
4. PROPERTIES OF THE PROPOSED PRE-LAY MATTRESS AND THE POST-LAY ROCK BERM SHALL BE AS PER 10562701DSRH1039W CABLE CROSSING DESIGN REPORT-POINT OF AYR TO DOUGLAS CCS.
5. THE DETAILS OF THE PROPOSED ROCK BERM ARE SHOWN FROM THE BOTTOM OF THE PROPOSED PRE-LAY MATTRESS AT THE CROSSING LOCATIONS POAX 4 AND 5.
6. AT CROSSING POAX 5, IT IS ASSUMED THAT THE EXISTING PIPELINE AND MATRESS ARE EXPOSED ON THE SEA-BED. THIS MUST BE CONFIRMED BASED ON INSPECTION OF SITE-SPECIFIC CONDITIONS. THE FOOTPRINT OF THE ROCK BERM SHOWN IS CONTINGENT ON THIS ASSUMPTION.
7. THE PROPOSED INCREASE IN HEIGHT OF THE ROCK BERM AT THE CROSSINGS SHOULD START AND EXTEND UPTO A MINIMUM OF 3.5m BEFORE AND AFTER THE EDGE OF THE PROPOSED PRE-LAY MATTRESS.
8. ALL DIMENSIONS ARE MINIMUM AND THE ROCK BERM MAY EXTEND BEYOND THE STATED DIMENSIONS.
9. ALL COORDINATES ARE IN EUROPEAN DATUM 1950 UTM ZONE 30N.
10. ROCK BERM PROTECTION EXTENTS TO BE CONFIRMED BASED ON EXISTING GROUND SLOPE. PROTECTION SHOULD BE EXTENDED UNTIL CABLE REACHES A BURIAL DEPTH OF 2.0m.

ABBREVIATIONS:

GYM	GWYNT-Y-MOR
LBCCS	LIVERPOOL BAY CARBON CAPTURE & STORAGE PROJECT
POA	POINT OF AYR
TYP.	TYPICAL
WD	WATER DEPTH

Crossing ID	Pre-Lay Protection		Post-Lay Protection			Total Quantity / Volume (Nos. / m³)
	Type	Quantity	Type	Total Length (m)	Quantity	
PoAX-4 & PoAX-5	Concrete Mattress (high density edge blocks)	2 Nos.	Rock Berm	224.000	275 m3 (Underlayer), 1150 m3 (Armour Layer)	2 Nos., 1515 m3

Note: 10% design/placing tolerance has been assumed for rock volume estimation.

Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approval	Company Approval
EX-DE	02	05.03.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	01	06.02.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	00	09.12.25	ISSUED FOR DESIGN	BCA	LSU	CKI	BOK	GC

Revision index

Company logo and business name: liverpool bay ccs
LCI Activity Code GB20250014
Contract Code 000593
Company Document ID: 10562701DSDN1047W
Job. N. JA1351

Contractor logo and business name: wood.
Contractor Document ID: OP271234-GN-GAS-0010
Contractor N.

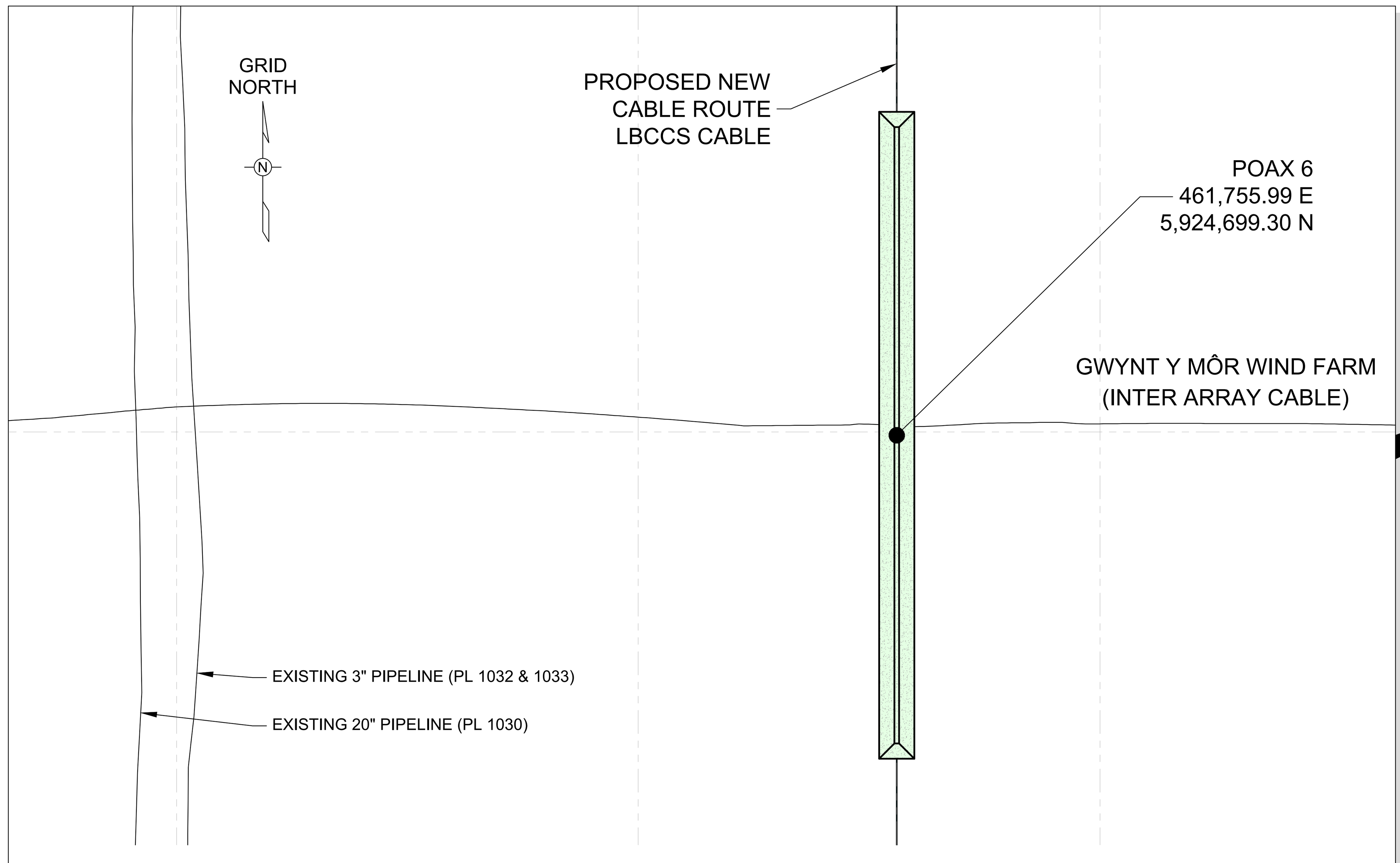
Vendor logo and business name: NOT APPLICABLE
Vendor Document ID: NOT APPLICABLE
Purchase Order N.

Facility and Sub Facility Description: SEALINE DOUGLAS CCS - POINT OF AYR GAS PLANT OFFSHORE CABLES
Project and SoW Description: LBA CCS PROJECT Engineering for Cable Laying
Scale: AS SHOWN
Sheet of Sheets: 1 of 1

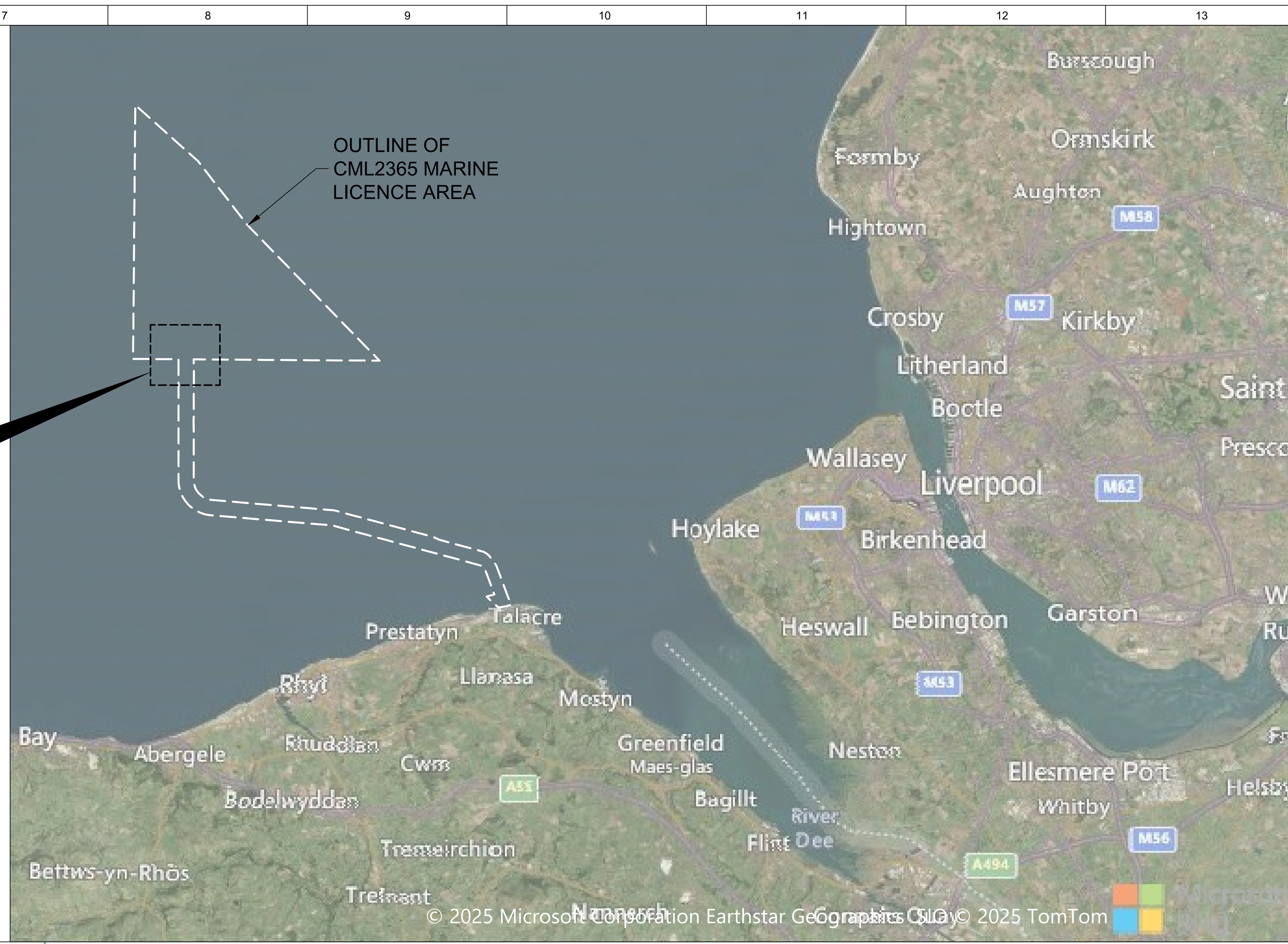
Document Title: Proposed Gwynt-y-Mor Crossing Sketch
Supersedes N. NOT APPLICABLE
Superseded by N.
Plant Area: 1
Functional Unit: 0

Software: Autocad

File Name OP271234-GN-GAS-0010.DWG



PLAN VIEW OF GWYNT Y MÔR WIND FARM (INTER ARRAY CABLE)
(PoAX - 6)
SCALE 1:1,000

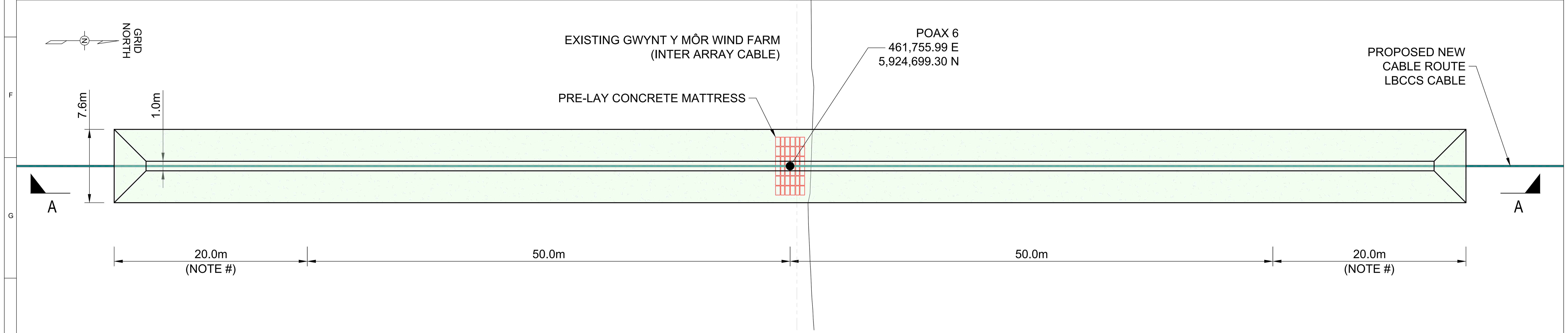


REFERENCE DOCUMENTS

NUMBER	TITLE

NOTES:

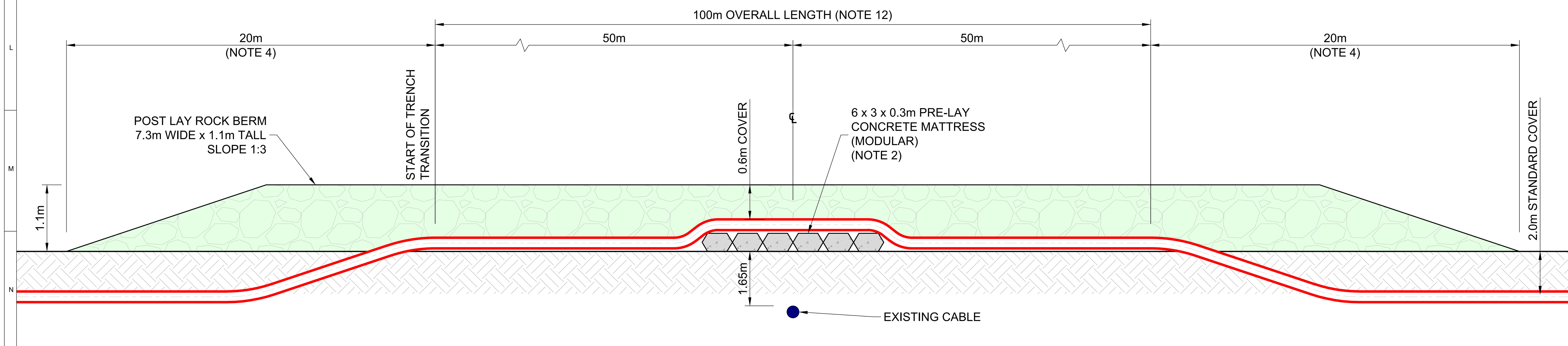
1. ALL DIMENSIONS AND COORDINATES ARE IN METRES UNLESS NOTED OTHERWISE.
2. THE CABLE MINIMUM BENDING RADIUS IS ASSUMED TO BE 2.4m DURING INSTALLATION AND OPERATION.
3. MODULAR MATTRESS PROPERTIES FOR THE PROPOSED PRE-LAY AND ROCK PROPERTIES FOR THE POST-LAY ROCK BERM SHALL BE AS PER10562701DSRH1039W, CABLE CROSSING DESIGN REPORT -POINT OF AYR TO DOUGLAS CCS.
4. ALL COORDINATES ARE IN EUROPEAN DATUM 1950 UTM ZONE 30N.
5. EXTENT OF ROCK-BERM PROTECTION SHALL BE CONFIRMED BASED ON SITE-SPECIFIC GROUND SLOPE CONDITIONS. ROCK DUMP PROTECTION TO BE EXTENDED UNTIL CABLE REACHES 2m BURIAL DEPTH OF COVER.
6. EXISTING CABLES CROSSED ASSUMED BURIED TO A DEPTH OF 1.65m, TO BE CONFIRMED BY EPC CONTRACTOR.
7. THE POSITIONING OF THE CONCRETE MATTRESS WILL BE BASED ON THE ACTUAL SITE CONDITION DURING INSTALLATION. THE EPC CONTRACTOR SHALL ESTABLISH EXACT LOCATION OF CROSSINGS AND REPORT FINDINGS.
8. ALL DIMENSIONS ARE MINIMUM AND THE ROCK BERM MAY EXTEND BEYOND THE STATED DIMENSIONS.



PLAN VIEW OF GWYNT Y MÔR WIND FARM (INTER ARRAY CABLE)
(PoAX - 6)
SCALE 1:1,000

ABBREVIATIONS:

GYM	GWYNT-Y-MOR
LBCCS	LIVERPOOL BAY CARBON CAPTURE & STORAGE PROJECT
POA	POINT OF AYR
TYP.	TYPICAL
WD	WATER DEPTH



SECTION A-A
NOT TO SCALE

Crossing ID	Pre-Lay Protection		Post-Lay Protection			Total Quantity / Volume (Nos. / m³)
	Type	Quantity	Type	Total Length (m)	Quantity	
PoAX-6	Standard Concrete Mattress	1 No.	Rock Berm	140.00	675 m3	1 No., 675 m3

Note: 10% design/placing tolerance has been assumed for rock volume estimation.

Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approval	Company Approval
EX-DE	03	15.04.26	APPROVED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	02	07.04.26	APPROVED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	01	05.02.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	00	19.02.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC

Revision index

Company logo and business name: liverpool bay ccs EX-DE

LCI Activity Code GB20250014

Contract Code 000593

Company Document ID: 10562701DSDN1052W

Job. N. JA1351

Contractor logo and business name: wood.

Contractor Document ID: OP271234-GN-GAS-0014

Contractor N.

Vendor logo and business name: NOT APPLICABLE

Vendor Document ID: NOT APPLICABLE

Purchase Order N.

Facility and Sub Facility Description: SEALINE DOUGLAS CCS - POINT OF AYR GAS PLANT OFFSHORE CABLES

Project and SoW Description: LBA CCS PROJECT Engineering for Cable Laying

Scale: AS SHOWN | Sheet of Sheets: 1 of 1

Document Title: PROPOSED GWYNT-V-MOR INTERLINK CROSSING SKETCH

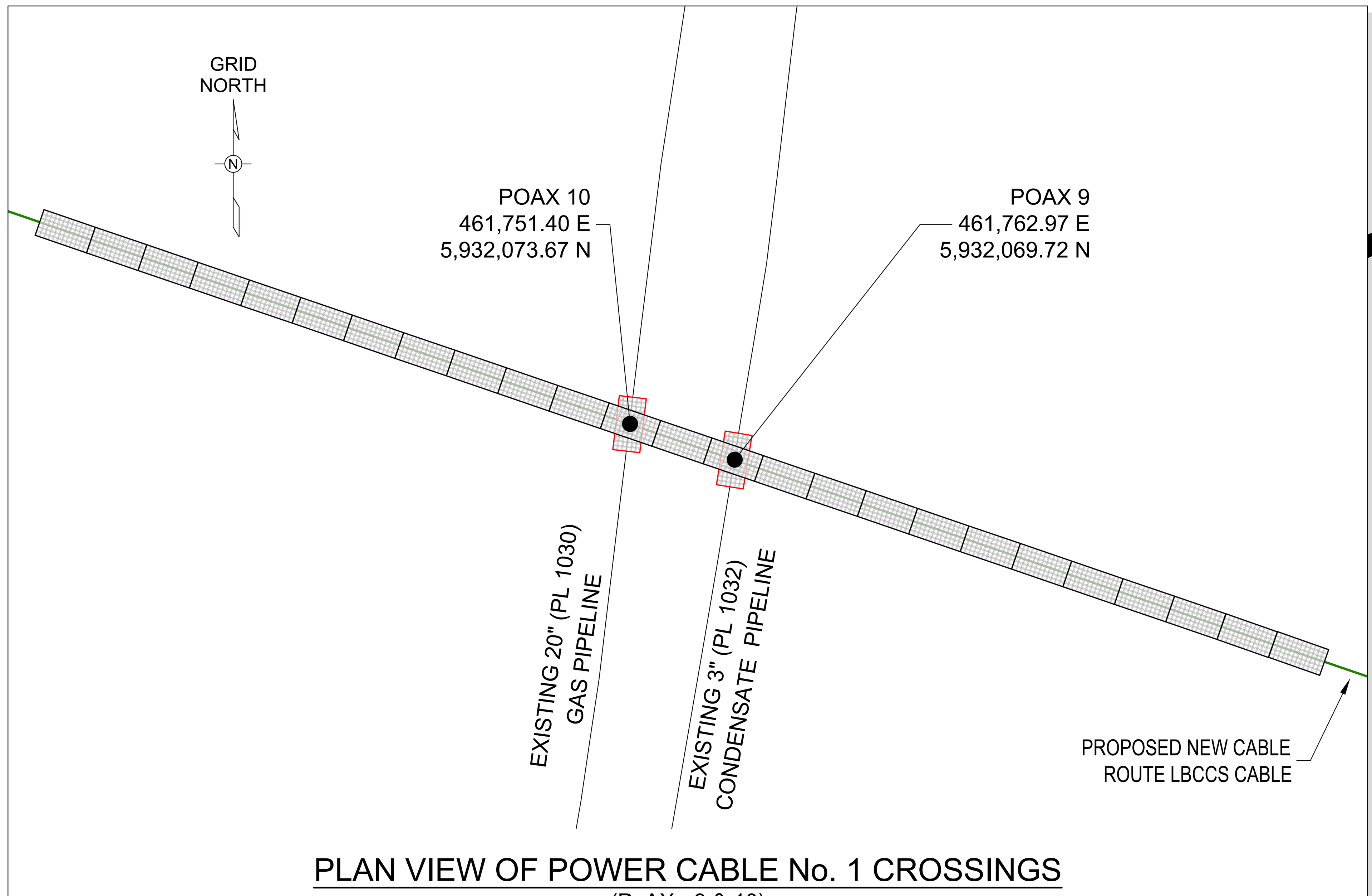
Supersedes N. NOT APPLICABLE

Superseded by N.

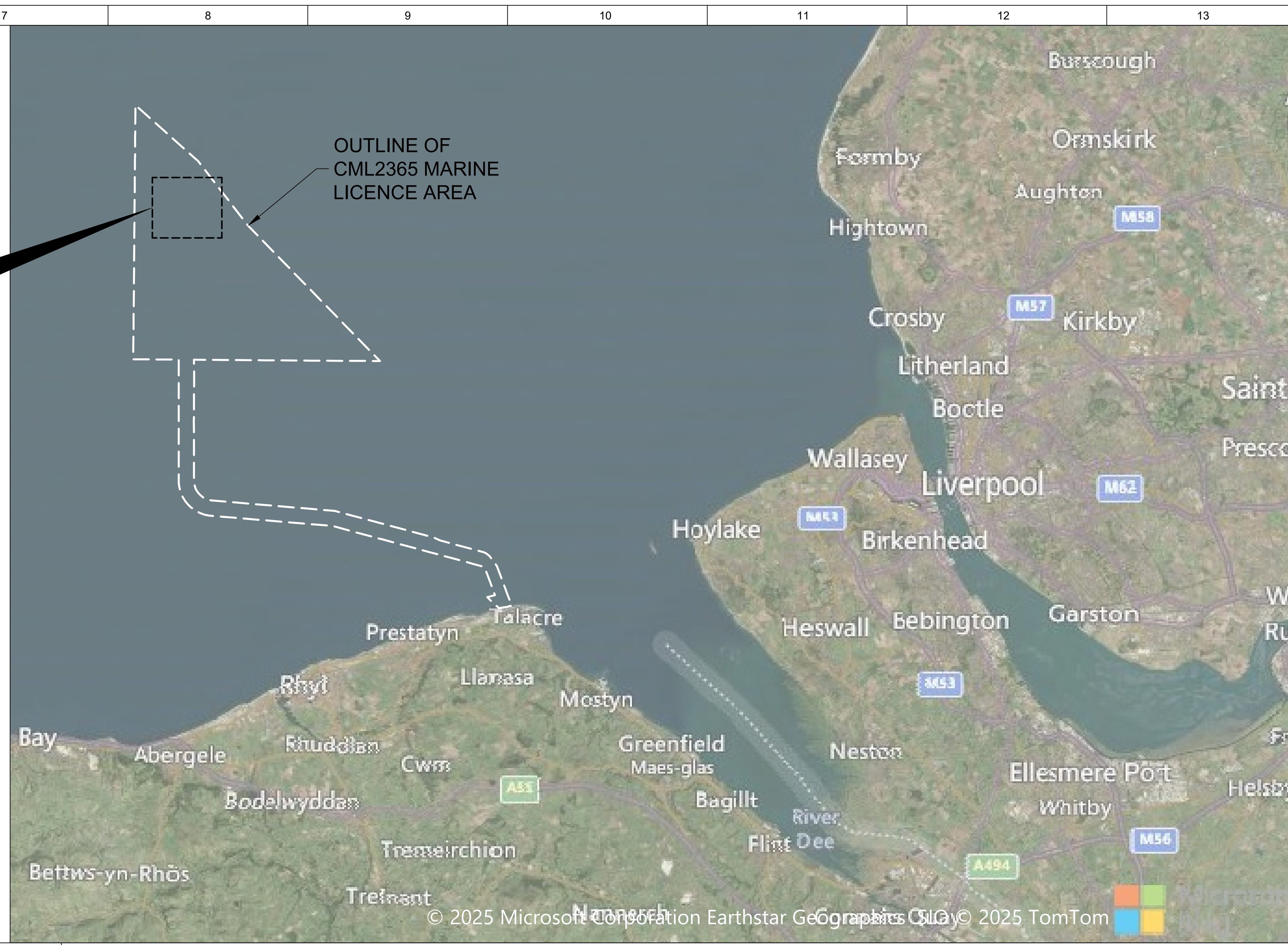
Plant Area: 1 | Functional Unit: 0

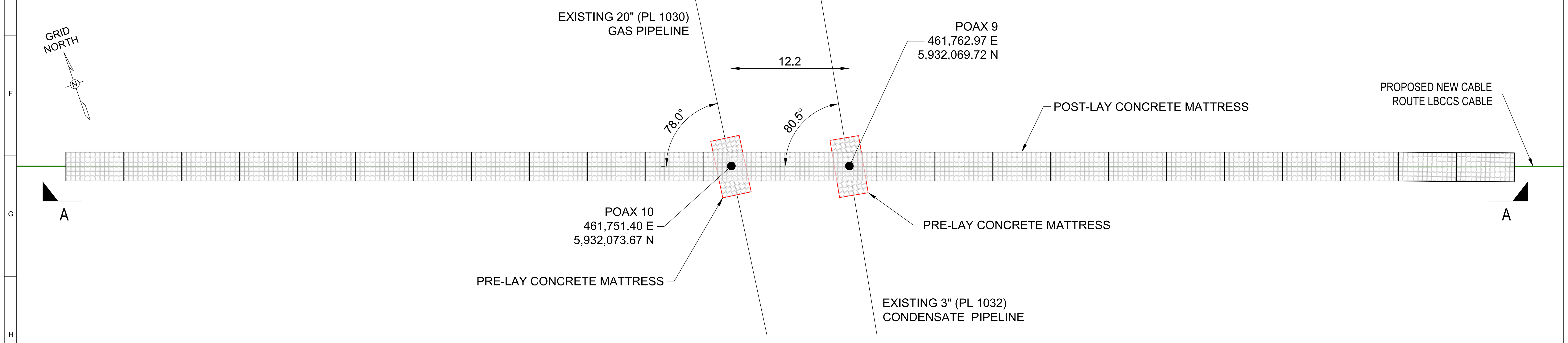
Software: Autocad

File Name OP271234-GN-GAS-0014.DWG

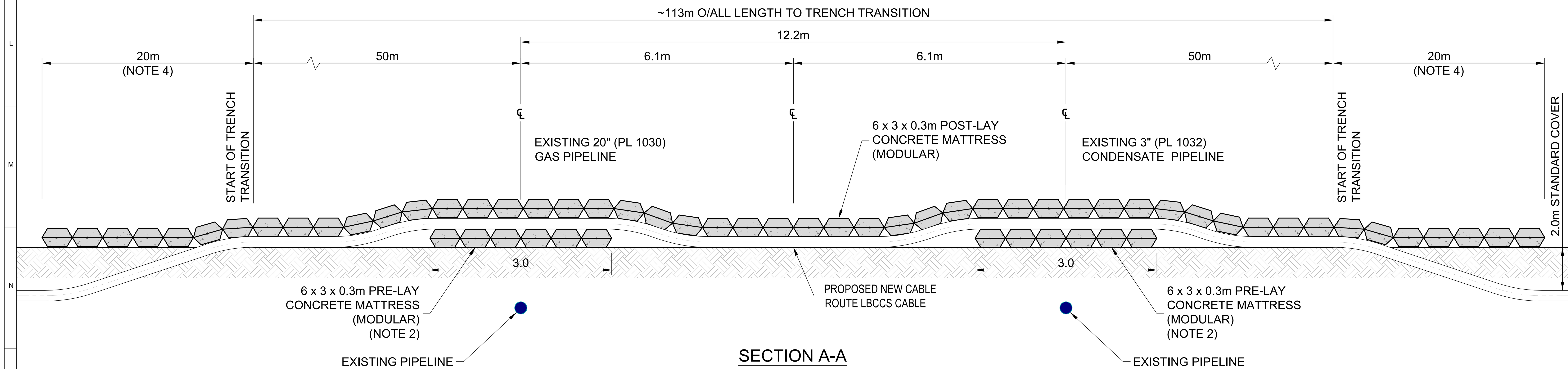


PLAN VIEW OF POWER CABLE No. 1 CROSSINGS
(PoAX - 9 & 10)
SCALE 1:500





PLAN VIEW OF POWER CABLE No. 1 CROSSINGS (PoAX-9 & PoAX-10)
SCALE 1:250



SECTION A-A
NOT TO SCALE

REFERENCE DOCUMENTS

NUMBER	TITLE

NOTES:

1. THE CABLE MINIMUM BENDING RADIUS IS ASSUMED TO BE 2.4m DURING INSTALLATION AND OPERATION.
2. MODULAR MATTRESS PROPERTIES FOR THE PROPOSED PRE-LAY AND POST-LAY MATTRESSES SHALL BE AS PER10562701DSRH1039W, CABLE CROSSING DESIGN REPORT - POINT OF AYR TO DOUGLAS CCS.
3. ALL COORDINATES ARE IN EUROPEAN DATUM 1950 UTM ZONE 30N.
4. ROCK BERM PROTECTION EXTENTS TO BE CONFIRMED BASED ON EXISTING GROUND SLOPE. PROTECTION SHOULD BE EXTENDED UNTIL CABLE REACHES A BURIAL DEPTH OF 2.0m.

ABBREVIATIONS:

GYM	GWYNT-Y-MOR
LBCCS	LIVERPOOL BAY CARBON CAPTURE & STORAGE PROJECT
POA	POINT OF AYR
TYP.	TYPICAL
WD	WATER DEPTH

Crossing ID	Pre-Lay Protection		Post-Lay Protection			Total Quantity / Volume (Nos. / m³)
	Type	Quantity	Type	Total Length (m)	Quantity	
PaAX-9 & PoAX-10	Standard Concrete Mattress	2 Nos.	Standard Concrete Mattress	153	25 Nos.	27 Nos.

Note: 10% design/placing tolerance has been assumed for rock volume estimation.

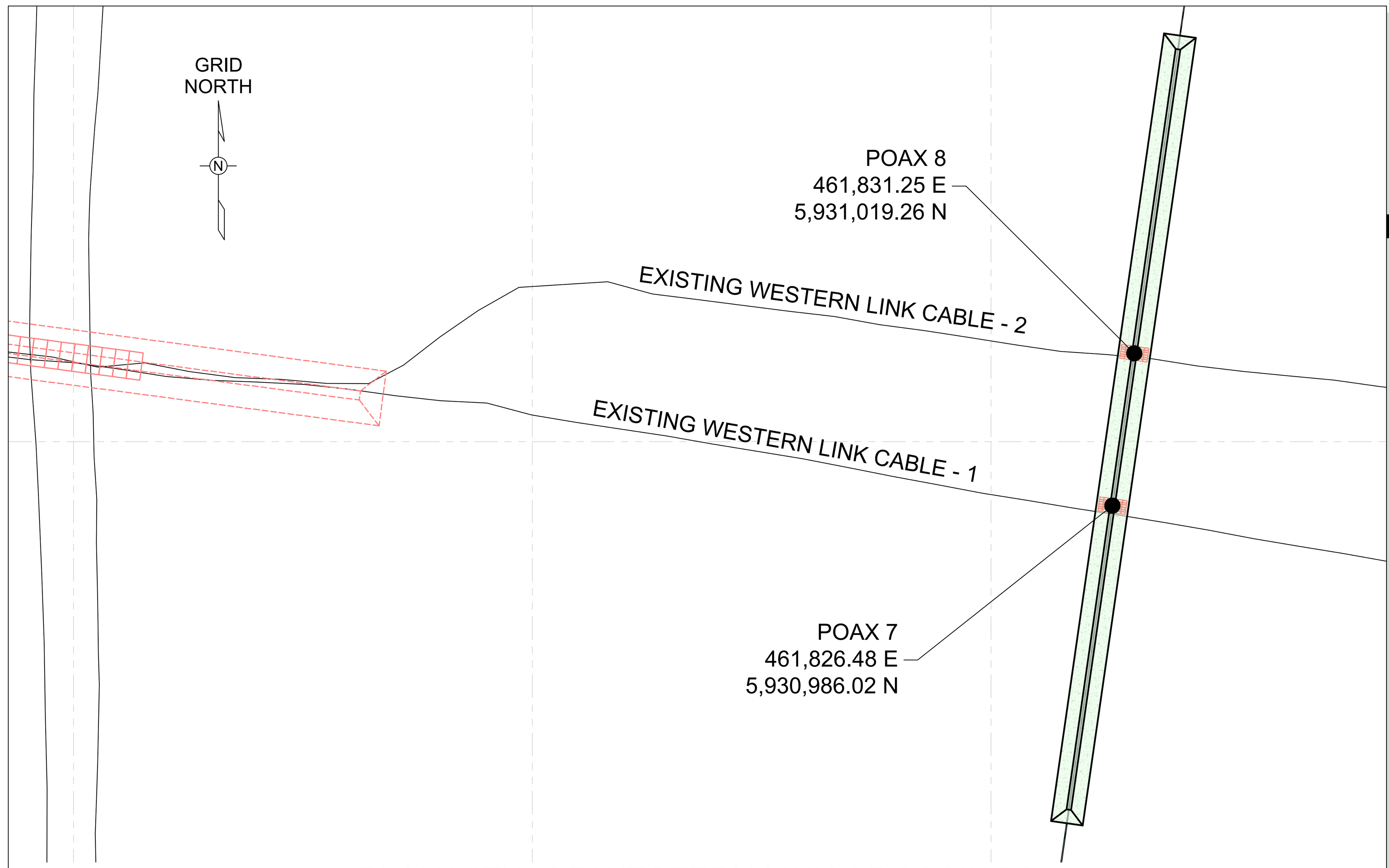
Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approval	Company Approval
EX-DE	02	28.04.26	APPROVED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	01	07.04.26	APPROVED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	00	24.02.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC

Revision index

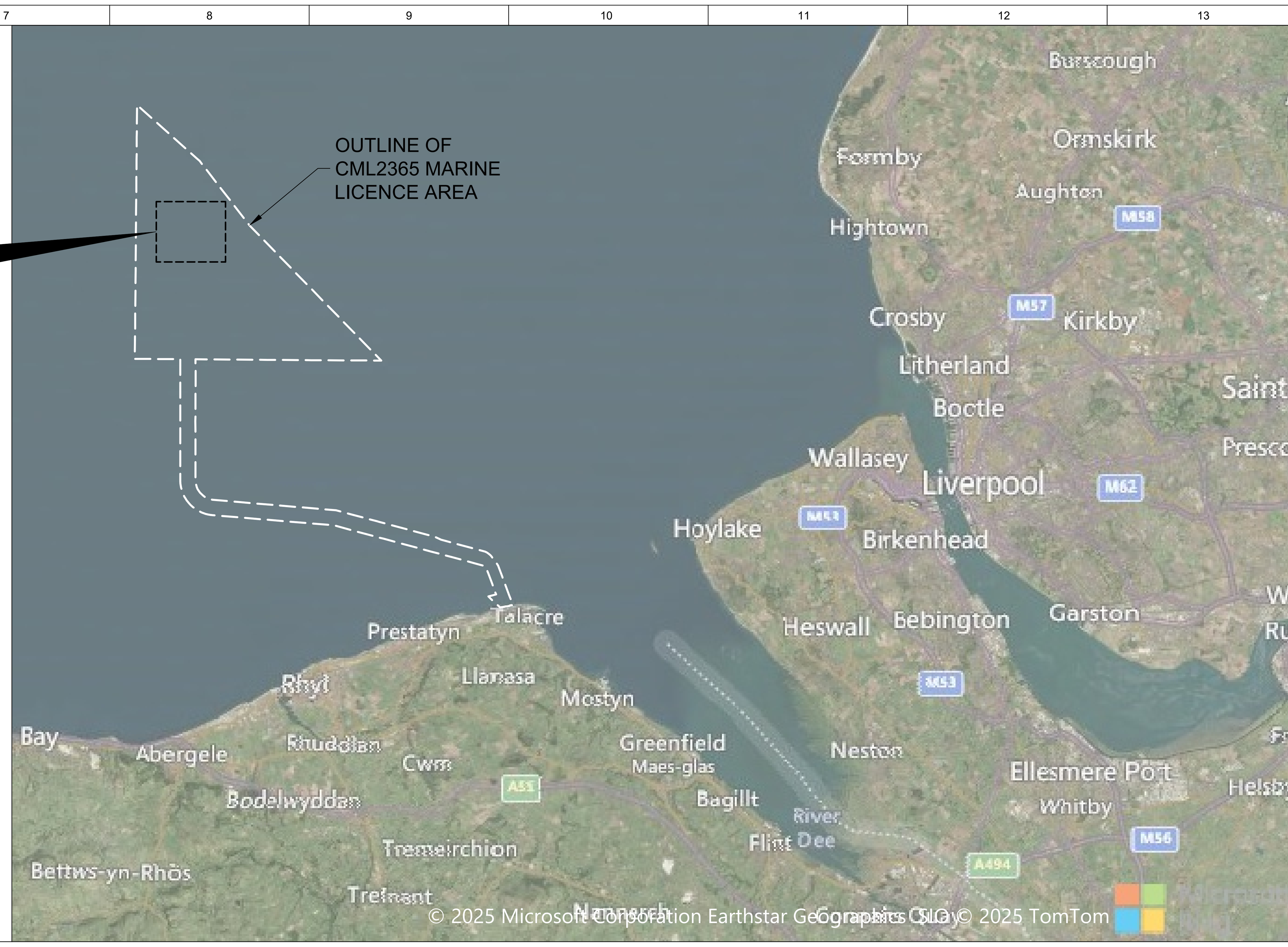
Company logo and business name: liverpool bay ccs
LCI Activity Code: GB20250014
Contract Code: 000593
Company Document ID: 10562701DSDN1051W
Job. N. JA1351
Contractor logo and business name: wood.
Contractor Document ID: OP271234-GN-GAS-0015
Contractor N.
Vendor logo and business name: NOT APPLICABLE
Vendor Document ID: NOT APPLICABLE
Purchase Order N.
Facility and Sub Facility Description: SEALINE DOUGLAS CCS - POINT OF AYR GAS PLANT OFFSHORE CABLES
Project and SoW Description: LBA CCS PROJECT Engineering for Cable Laying
Scale: AS SHOWN
Sheet of Sheets: 1 of 1
Document Title: PROPOSED CROSSING SKETCH OF PIPELINES PL1032 AND PL1030
Supersedes N. NOT APPLICABLE
Superseded by N.
Plant Area: 1
Functional Unit: 0

Software: Autocad

File Name OP271234-GN-GAS-0015.DWG



PLAN VIEW OF WESTERN LINK CROSSINGS
(PoAX - 7 & PoAX - 8)
SCALE 1:1,000



REFERENCE DOCUMENTS

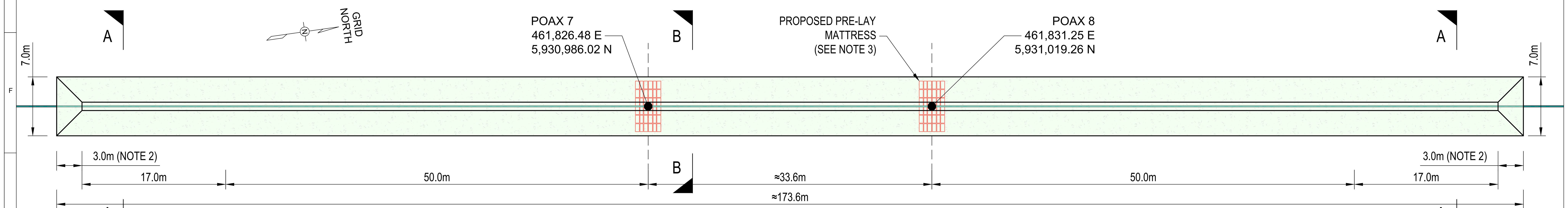
NUMBER	TITLE

NOTES:

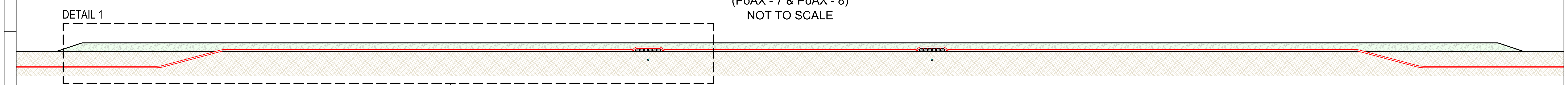
1. THE CABLE MINIMUM BENDING RADIUS IS ASSUMED TO BE 2.4m DURING INSTALLATION AND OPERATION.
2. ROCK BERM PROTECTION EXTENTS TO BE CONFIRMED BASED ON EXISTING GROUND SLOPE. PROTECTION SHOULD BE EXTENDED UNTIL CABLE REACHES A BURIAL DEPTH OF 2.0m.
3. PROPERTIES OF PRE-LAY MATTRESSES AND POST LAY ROCK BERM SHALL BE AS PER CABLE CROSSING DESIGN REPORT - POINT OF AYR TO DOUGLAS CCS 10562701DSRH1039W.
4. ALL COORDINATES ARE IN EUROPEAN DATUM 1950 UTM ZONE 30N.
5. ALL DIMENSIONS ARE MINIMUM AND THE ROCK BERM MAY EXTEND BEYOND THE STATED DIMENSIONS.

ABBREVIATIONS:

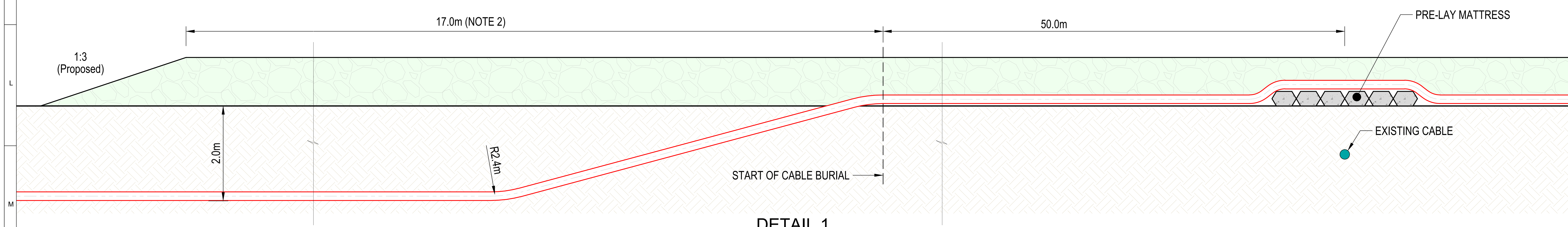
LBCCS	LIVERPOOL BAY CARBON CAPTURE & STORAGE PROJECT
POA	POINT OF AYR
TYP.	TYPICAL
WD	WATER DEPTH



PLAN VIEW OF WESTERN LINK CROSSINGS
(PoAX - 7 & PoAX - 8)
NOT TO SCALE



SECTION VIEW OF WESTERN LINK CROSSINGS
NOT TO SCALE



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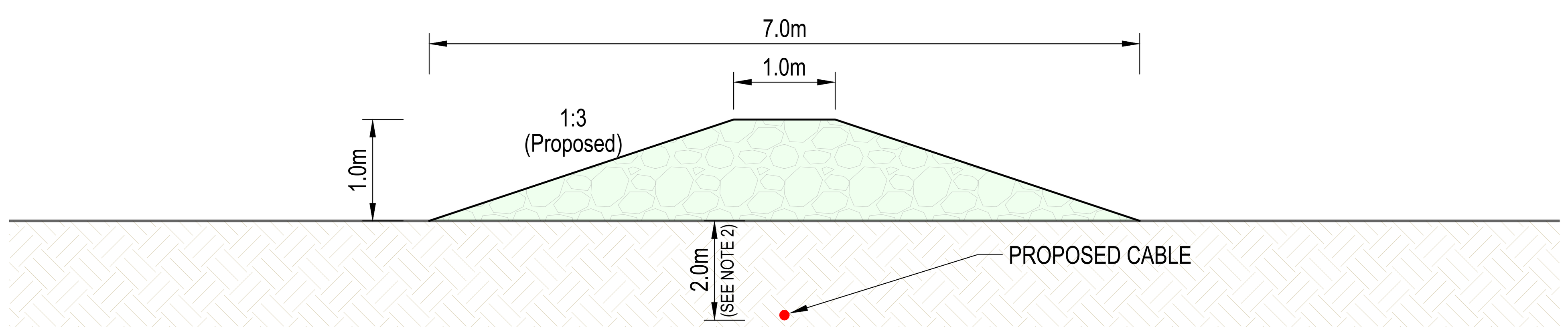

SECTION A-A
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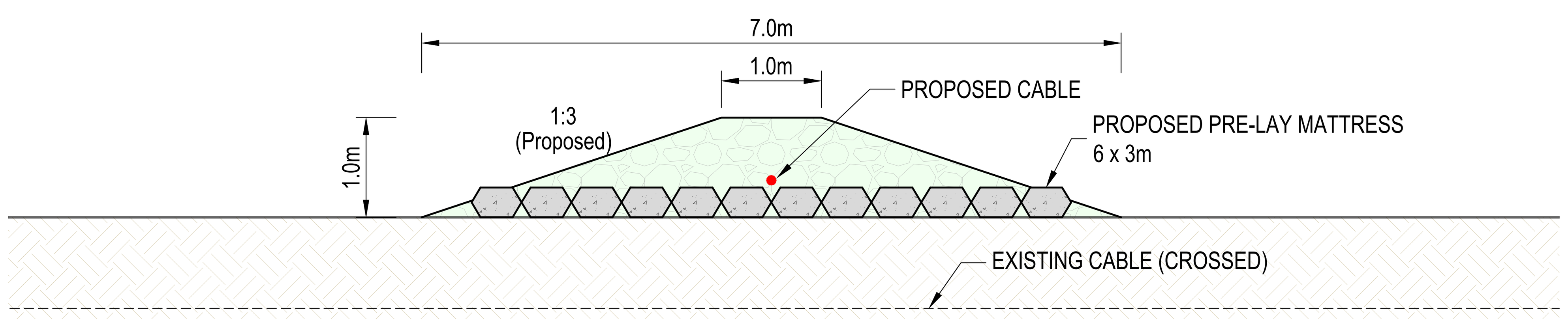

SECTION B-B
NOT TO SCALE

Crossing ID	Pre-Lay Protection		Post-Lay Protection			Total Quantity / Volume (Nos. / m³)
	Type	Quantity	Type	Total Length (m)	Quantity	
PoAX-7 & PoAX-8	Standard Concrete Mattress	2 Nos.	Rock Berm	171	735 m3	735 m3

Note: 10% design/placing tolerance has been assumed for rock volume estimation.

Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approval	Company Approval
EX-DE	05	17.04.26	APPROVED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	04	07.04.26	APPROVED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	03	05.03.26	APPROVED FOR DESIGN	BCA	LSU	BOK	BOK	GC
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EX-DE	01	28.01.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC
EX-DE	00	20.01.26	ISSUED FOR DESIGN	BCA	LSU	BOK	BOK	GC

Revision index

Company logo and business name: liverpool bay ccs

LCI Activity Code GB20250014
Contract Code 000593

Company Document ID: 10562701DSDN1048W
Job. N. JA1351

Contractor logo and business name: wood.

Contractor Document ID: OP271234-GN-GAS-0011
Contractor N.

Vendor logo and business name: NOT APPLICABLE

Vendor Document ID: NOT APPLICABLE
Purchase Order N.

Facility and Sub Facility Description: SEALINE DOUGLAS CCS - POINT OF AYR GAS PLANT OFFSHORE CABLES

Project and SoW Description: LBA CCS PROJECT Engineering for Cable Laying

Scale: AS SHOWN | Sheet of Sheets: 1 of 1

Document Title: CABLE CROSSING GENERAL ARRANGEMENT WESTERN LINK CROSSING

Supersedes N. NOT APPLICABLE
Superseded by N.

Plant Area: 1 | Functional Unit: 0

Software: Autocad

File Name OP271234-GN-GAS-0011.DWG

APPENDIX C: CABLE BURIAL RISK ASSESSMENT (CBRA) REPORTS

1. **POINT OF AYR TO DOUGLAS CCS**
2. **DOUGLAS CCS TO HAMILTON NORTH**
3. **DOUGLAS CCS TO HAMILTON MAIN**
4. **DOUGLAS CCS TO LENNOX**

LB CCS PROJECT

Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT

Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection

Cable Burial Risk Assessment (CBRA) Report - Point of Ayr to Douglas CCS

EX-DE	02	05/02/2026	Issued for Design	JBR	BOK	BOK	BOK	GC
EX-DE	01	28/01/2026	Issued for Design	JBR	BOK	BOK	BOK	GC
EX-DE	00	22/01/2026	Issued for Design	JBR	BOK	BOK	BOK	
Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approved	Company Approved
Revision Index								

Company logo and business name liverpool bay ccs	LCI Activity Code: **GB20250014** Project code: **000593**	Company Document ID: **10562701DSQJ1025W** Job N: JA1351
Contractor logo and business name wood.		Contractor Document ID: **OP271234-GN-REP-0009** Contract N.:
Vendor logo and business name **N/A**		Vendor Document ID: **N/A** Purchase Order N.:

Facility & Sub Facility Description Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection	Project and SoW description LB CCS PROJECT Engineering for Cable Laying	Scale N/A	Sheet of Sheets 1 / 21
Document Title Cable Burial Risk Assessment (CBRA) Report - Point of Ayr to Douglas CCS		Supersedes N: N/A Superseded by N: N/A	
		Plant Area 1	Functional Unit 0

REVISION LIST

00	Issued for Design
01	Issued for Design
02	Issued for Design

HOLD RECORD

TABLE OF CONTENTS

List of Figures

List of Tables

1.0 INTRODUCTION

1.1 Project Overview

Eni's Liverpool Bay CCS Transport & Storage Project (LBA CCS T&S Project) is being developed in parallel with and as a key part of the HyNet Northwest full-chain hydrogen and CCS industrial decarbonization project (the HyNet Project), which is designed to transform a region of the UK into the world's first low carbon industrial cluster by 2030. The HyNet Project was conceived in 2016 with the objective of decarbonizing the entire industrial cluster to Net Zero. The HyNet Project is being developed on a phased approach based on CO2 emissions capture from existing industrial facilities, alongside capture from new-build hydrogen generation facilities. While industrial decarbonization is the anchor, the HyNet Project builds the infrastructure backbone for a full regional hydrogen economy and leverages the opportunity to repurpose for future CCS service the existing oil and gas facilities at Point of Ayr and offshore in Liverpool Bay. CO2 storage is provided in well-known gas fields that are owned and operated by Eni UK.

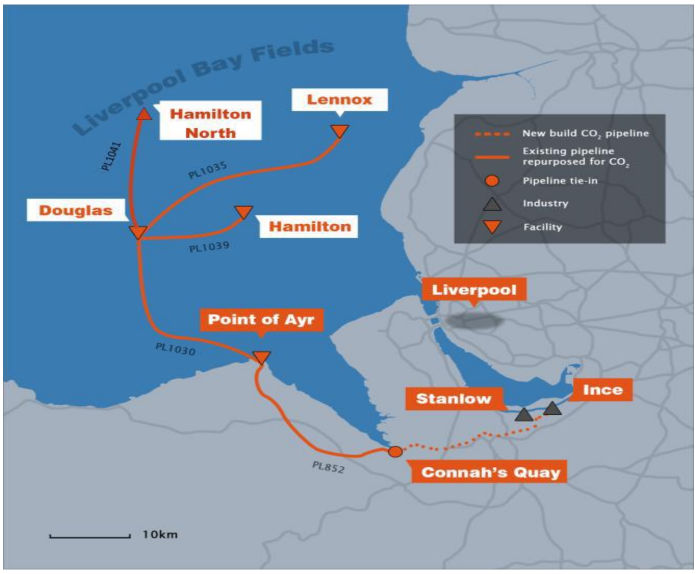


Figure 1.1 Liverpool Bay CCS Project Schematic

As part of Onshore Scope, CO2 emissions from these sources will be transported along a new-build pipeline which will connect Ince AGI with Stanlow AGI and then run from Stanlow AGI to the south of Chester, and then on to the Flint AGI (Above Ground Installation) located in the vicinity of Connah's Quay power station which is the termination point of the existing pipeline (P852). At the Flint AGI the new-build pipeline will connect to the existing pipeline (owned and operated by Eni). The existing onshore natural gas import pipeline will be repurposed to become a CO2 export pipeline and will transport the CO2 to the existing Point of Ayr (PoA) gas terminal.

As part of Offshore Scope, the existing offshore natural gas import pipeline from PoA gas terminal will be repurposed to become a CO2 export pipeline and will transport the CO2 to the Douglas complex. From the Douglas complex, CO2 will be transported along re-purposed natural gas pipelines to the Hamilton platform for injection into the Hamilton reservoir, to the Hamilton North platform for injection into the Hamilton North reservoir, to the Lennox platform for injection into the Lennox reservoir.

1.2 Wood Scope of Work

Wood has been contracted by ENI to provide offshore cable installation engineering services for the LBA CCS T&S project, for the detailed design phase of the submarine composite cable.

The Tasks involved in this study are as follows:

Table 1-1 Wood Scope of Work Task Breakdown

Task No.	Task Title
Task 1	Route and Survey Review and Design Premise
Task 2	On-Bottom Stability
Task 3	Free Span Analysis
Task 4	Cable Protection Studies
Task 4.1	**Cable Burial Risk Assessment**
Task 4.2	External Protection Design
Task 4.3	HDD Design
Task 5	Cable Crossing Design

The present document is a key deliverable for Task 4.1.

1.3 Scope of the Document

This document presents the methodology, results and conclusions of the cable burial risk assessment (CBRA) for the Point of Ayr to Douglas cable. This study was undertaken by Wood for the LBA CCS T&S project.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Term	Definition
Company	The party that initiates the project and ultimately pays for its design and construction i.e. COMPANY will generally specify technical requirements. The term "COMPANY" also includes agents or consultants authorized to act for, and on behalf of, COMPANY.
Contract	An acceptance of legal relations between two or more parties for the transfer of goods or services for value.
Contractor	A person or organization that undertakes responsibility for the execution of a contract.
Supplier	The party (Manufacturer or Vendor) that manufactures or supplies equipment or services to perform the duties specified by the Company or Contractor
Shall	A mandatory provision
Should	An advisory provision

2.2 Abbreviations

AIS	Automatic Identification System
CBRA	Cable Burial Risk Assessment
DOL	Depth of Lowering
DWT	Deadweight tonnage
KP	Kilometre Point
LBA	Liverpool Bay Area
PoA	Point of Ayr
SLB	Simultaneous Lay & Burial
TSS	Traffic Separation Scheme
UXO	Unexploded Explosive Ordnance

3.0 REFERENCES

References used in this document are summarised in this section.

3.1 Project Documents

[Ref 1]	10562701DGRA1001W	Cable Design Study Premise - Point of Ayr to Douglas CCS
[Ref 2]	A4814-ENI-NRA-1	Navigational Risk Assessment - RPS Group
[Ref 3]	F279461-005a (01)	Volume 5a UXO Sediment Mobility Study – FUGRO
[Ref 4]	A5538	Anatec – AIS Shipping Study Liverpool Bay CCS Cables
[Ref 5]	HA_Dredging_20251103	EMODnet Human Activities, Dredging
[Ref 6]	10562701DSCX1009W	Cable On-Bottom Stability Report - Point of Ayr to Douglas CCS

3.2 International Codes and Standards

[Ref 7]	CTC835	Cable Burial Risk Assessment Methodology Guidance
[Ref 8]	DNV-RP-F107	Risk assessment of pipeline protection

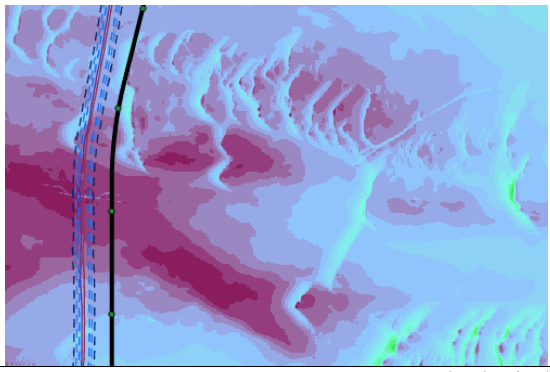
4.0 RISK ASSESSMENT

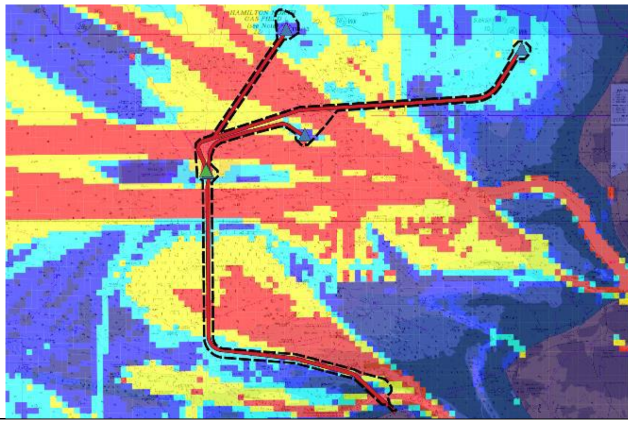
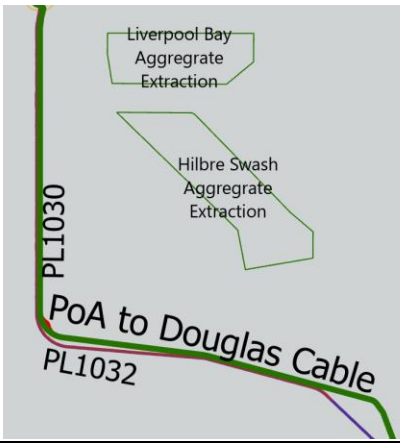
4.1 General

A risk assessment has been performed, considering risks to the cable along the proposed cable route. The outcomes are presented in Table 4-1.

The key risks for this route are fishing, shipping and sediment mobility. These are evaluated in Section 5.0.

Table 4-1 Risk Assessment

Threat Type	**Threat Description**	**General notes on treatment in CBRA**	**Risk Assessment -** Point of Ayr to Douglas
Natural	Sediment Mobility	CBRA recommends burial beneath non-mobile sediment. Pre-sweeping or increased DOL typically required.	Sand waves / mega-ripples visible on MBES data near Douglas platform. This typically indicates the potential for sediment mobility. 
Natural	Seismic Activity	CBRA does not recommend burial as a means of protection from seismic activity, therefore cable routing should take this into consideration	Minor seismic activity present in LBA. Recent (09/10/25) 1.3 magnitude earthquake north of project area (53.730 -3.180). 712 seismic events recorded within 100km radius of LBA from 27/10/2000 to 27/10/2025. Average recorded magnitude: 1.22 (95% C.I: 1.17, 1.27). Max recorded magnitude: 3.9 (21/10/2002, 53.481, -2.915) Source: British Geological Survey 1998 - 2019 (c)UKRI http://www.bgs.ac.uk mailto:www-bgs@bgs.ac.uk, “BGS Earthquake Seismology.” https://www.earthquakes.bgs.ac.uk/index.html
Natural	Submarine Landslides	CBRA does not recommend burial as a means of protection from submarine landslide, therefore cable routing should take this into consideration.	Ridge with slope of 20° between KP 32 and 32.5 adjacent and coinciding with cable route.

Anthropogenic	Shipping	Probabilistic assessment methodology recommended by CBRA.	PoA to Douglas cable intersects Gwynt y Mor wind farm and is also in proximity to North Hoyle and Burbo Bank Extension wind farms. Small wind farm vessel traffic prevalent along the route. Significant vessel activity at approach of cable to Douglas Platform. Platform bisects lanes of Liverpool Bay Traffic Separation Scheme (TSS). Traffic in TSS expected to rise if new OWF developments displace existing traffic [Ref 2]. 
Anthropogenic	Fishing	Typical DOL for protection from fishing equipment is 0.6 m (0.3 m x FOS 2).	Virtually no bottom trawling activity in project area.
Anthropogenic	Mining / Aggregate Extraction	CBRA does not recommend burial as a means of protection from mining / aggregate extraction activities, therefore cable routing should take this into consideration and avoid these areas.	Hilbre Swash Aggregate Extraction Zone is approximately 3.5km from the route, however it does not coincide with the chosen route at any point. 
Anthropogenic	Dredging	In areas where dredging is practiced, CBRA recommends burial below the maximum dredged level. Pre-dredging or increased DOL typically required.	Dredging recorded in Dee Estuary and Mersey River [Ref 5] however no data coinciding with work area.
Anthropogenic	3rd Party Infrastructure (Cables, Pipelines, Other)		Total of 10 cable crossings along route.
Anthropogenic	3rd Party Infrastructure (Aquaculture)		No information available on Aquaculture areas in LBA.

Anthropogenic	UXOs	CBRA does not consider burial as a means of protection from UXOs. Cable route should either divert around confirmed UXOs, or they should be removed.	No data available.
Anthropogenic	Dumping		No information available on dumping areas in LBA.

5.0 CBRA

5.1 General

The required depth of lowering shall be determined based on the key risks from the risk assessment, namely; fishing, shipping and seabed mobility. This section addresses the requirements for each risk and the Section 6.0 provides the conclusions and final recommended depth of lowering along the route.

5.2 Fishing

Based on research carried out and presented in the Carbon Trust CBRA methodology guideline [Ref 7], the maximum penetration depth for typical fishing equipment is 0.3 m, even in very soft sediments. If a typical factor of safety of 2 is applied, a minimum DOL of 0.6 m is required in areas where bottom trawling occurs.

5.3 Shipping

CBRA includes a probabilistic methodology for quantifying the risk to a cable from anchor strike.

5.3.1 Vessel Data

The vessel input data used in this study was provided by Anatec [Ref 4]. Vessel crossing data of the planned PoA to Douglas cable route was recorded based on Automatic Identification System (AIS) data between 1st November 2024 and 31st October 2025. The cable route was divided into 500m sections, from 1 to 67, in order to indicate the location of each vessel crossing. The dataset includes key vessel details such as type, length, draught and deadweight tonnage (DWT). Table 5-1 provides a summary and description of all shipping data provided in the survey.

To better reflect typical vessel traffic, temporary vessels such as those conducting surveys or temporary works were excluded. Vessel traffic contained entirely within the safety zone at the Douglas platform were also excluded to prevent stationary vessels in the vicinity of the platform from inflating numbers of crossings.

Table 5-1 Anatec Tabular Shipping Data Parameters

Parameter	Description
MMSI	Nine-digit number assigned to each unique vessel
Name	Name of vessel as broadcast on AIS
Call Sign	Sequence of letters and numbers unique to each vessel
Vessel Type	Vessel type category based on broadcast information, Anatec's in-house vessel databases and desk-based research.
Vessel Length (m)	Vessel length in metres (m) based on AIS vessel broadcast, house databases and desk-based research.
Vessel Beam (m)	Vessel width in metres (m) based on AIS vessel broadcast, house databases and desk-based research
Broadcast Draught (m)	Draught of vessel in metres (m) as broadcast on AIS
DWT	Vessel deadweight tonnage (DWT), based on desk-based research, Anatec's in-house databases and publicly available data. It is noted that certain smaller vessels do not have a valid DWT (e.g. wind farm support, recreational and fishing vessels) and will be assigned DWT of 0.
Vessel Speed (knots)	Speed of the vessel at the crossing of the cable route, based on speed broadcast on AIS close to the crossing, measured in knots.
Vessel Course	Bearing of the vessel track at the location of the crossing.
Anchor Mass (kg)	Mass of anchor carried by the vessel, in kilograms (kg), based on Anatec's Anchor Model.
Cable ID	Unique identifier for each 500m section of the cable route, numbered starting from 1 at the landfall (0-0.5km), to 67 (33.0-33.4km) at the Douglas end of the cable route. It is noted that section 67 is approximately 400m in length.

A total of 11,480 vessels [Ref 4] are recorded as crossing the PoA to Douglas cable route within the one-year duration of the survey. As can be seen in Figure 5.1, the majority of vessels crossing the cable route are small craft under 1000 DWT. The largest vessel recorded was a tanker, “Eagle Venice”, with a DWT of 298,911 tons, crossing the cable route between KP 30 and 30.5.

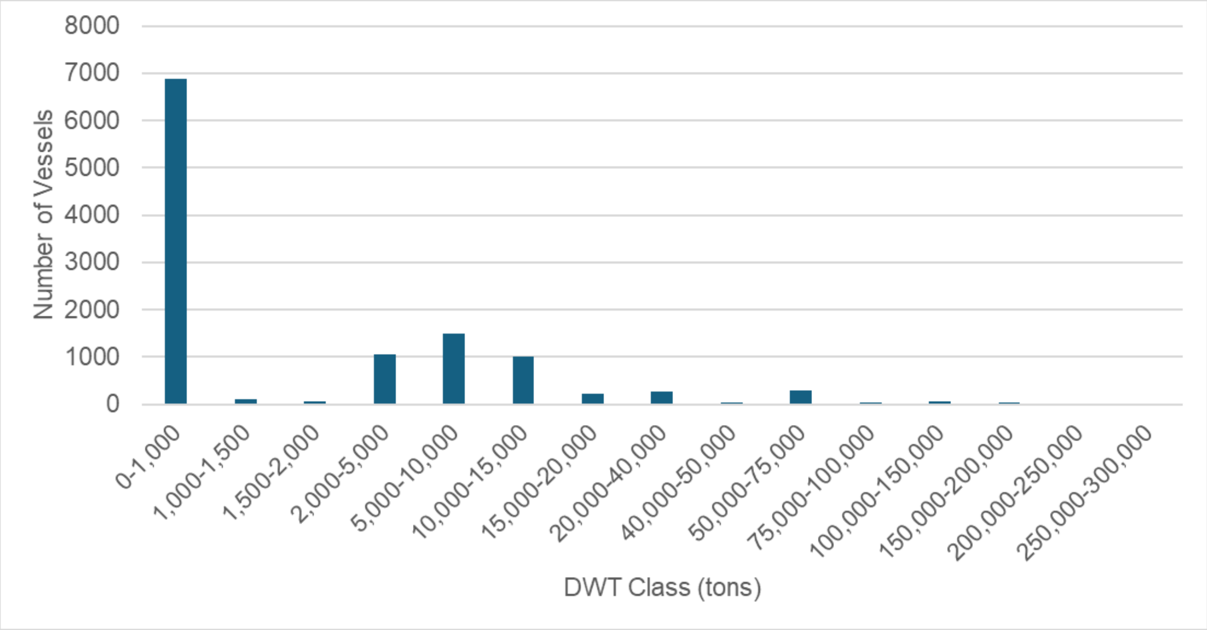


Figure 5.1 Vessel DWT distribution

Wind farm vessels make up approximately half of all vessel traffic, as shown in Figure 5.2. Cargo vessels account for approximately 26% followed by tanker and oil and gas vessels at approximately 10%. Fishing vessels account for a relatively small amount of vessel traffic at 3%.

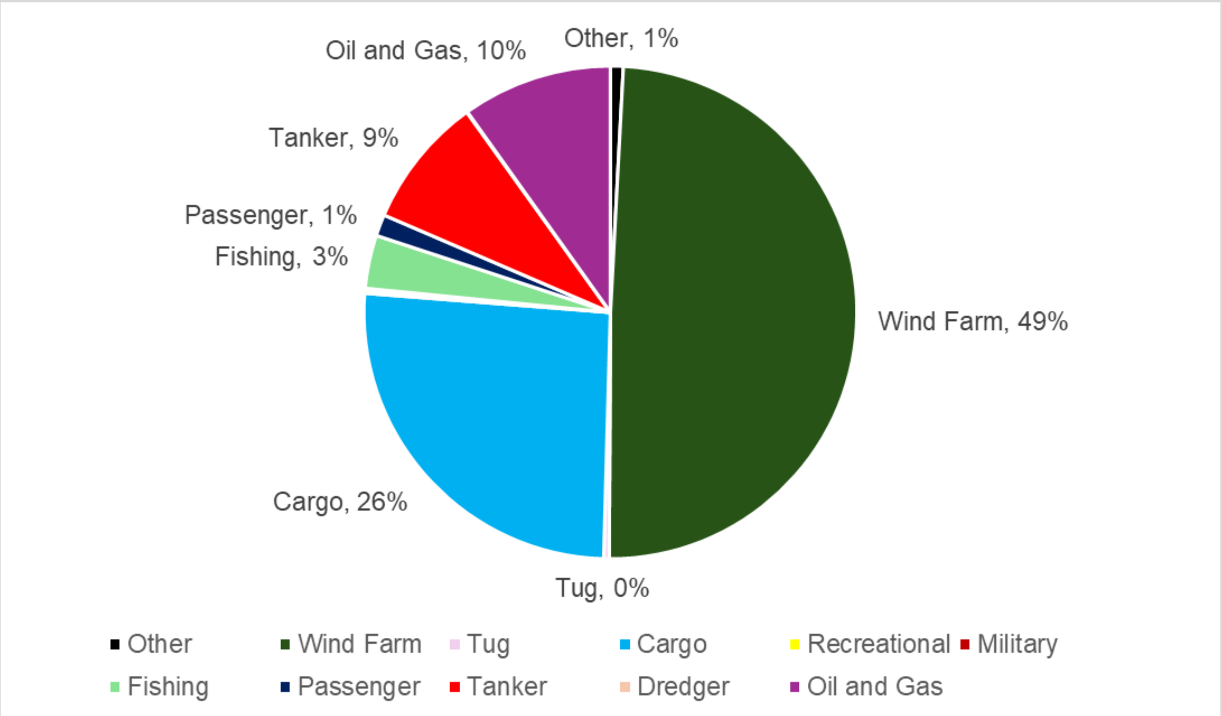


Figure 5.2 Vessel type distribution derived from [Ref 4]

Wind farm vessels dominate the distribution of cable route crossings from the start of the route to approximately KP 29, as can be seen in Figure 5.3. A spike in vessel traffic can be observed from KP 1.5 to 2.5, attributable to use of the Welsh channel by vessels. The majority of cargo and tanker vessels are present from KP 29 to 32.5. This can be attributed to the use of the Liverpool Bay Traffic Separation Scheme (TSS) corridor, which intersects the cable route at this section. Most vessels from KP 32 to the route end are oil and gas vessels. This can be associated with access to the Douglas platform, which is in proximity to where the route terminates.

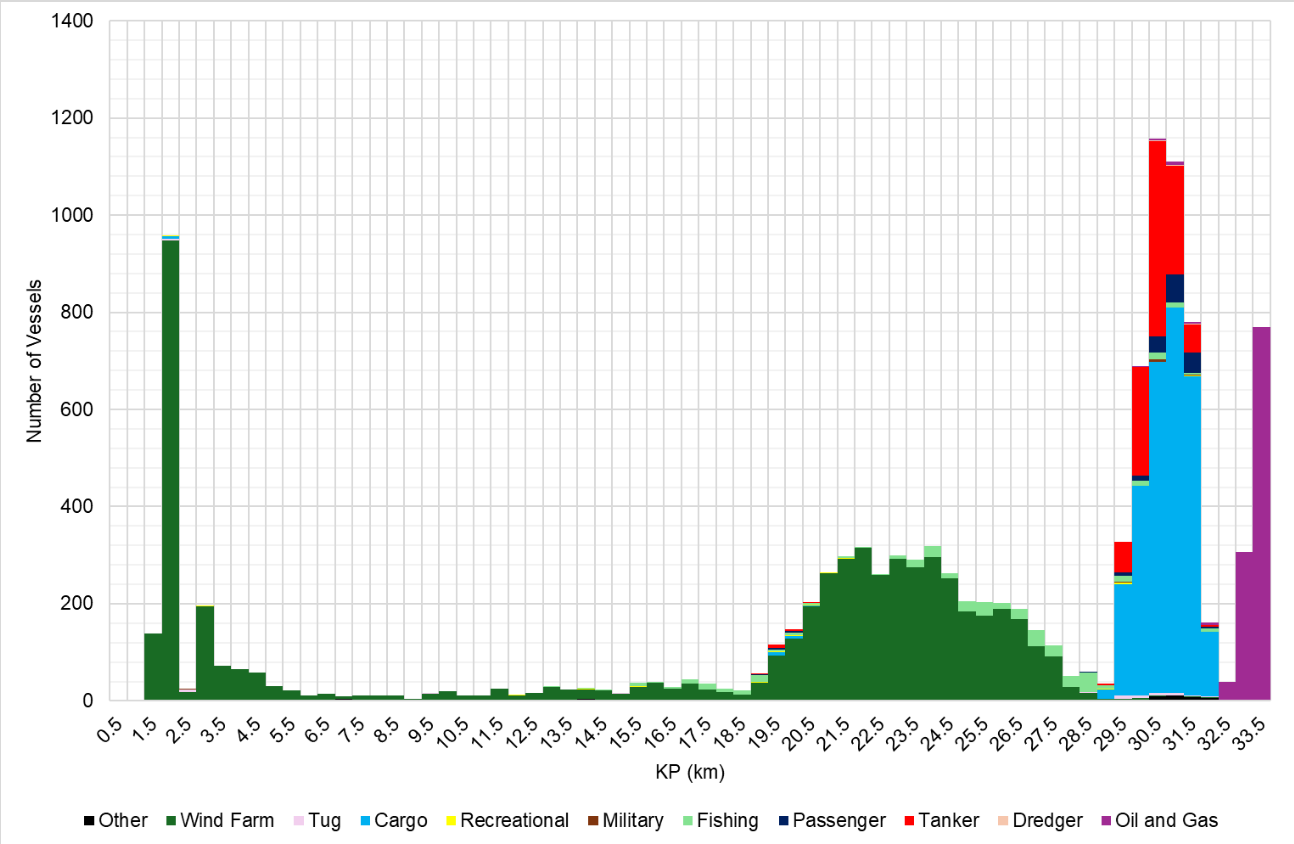


Figure 5.3 Distribution of Vessel Crossings Along Cable Route

5.3.2 Probabilistic Assessment of Shipping Threat

In order to calculate the probability of an anchor strike on the cable, the probabilistic formula shown in Figure 5.4 was used.

$$P_{Strike} = P_{Traffic\ Risk} \sum_{1}^{Number\ of\ vessels\ in\ the\ section} \left(\frac{D_{Ship\ Drag}}{V_{Ship} * 8760\ hrs\ per\ year} * P_{Incident} * P_{WD} \right)$$

Equation 1 Probabilistic formula to assess the risk from anchoring

Where:

$P_{Traffic\ Risk}$	probability modifier based on the tolerable level of risk
P_{WD}	probability modifier for nature and depth of seabed
V_{Ship} (metre/hr)	ship speed when the anchor is deployed
$D_{Ship\ Drag}$ (metres)	distance travelled by the anchor in order to be a threat to the cable
$P_{Incident}$	probability of incident requiring the deployment of an anchor for that vessel size and type
8760 hrs	factor to annualise the results

Figure 5.4 Probabilistic Formula to Assess the Risk from Anchoring, Carbon Trust [Ref 7]

Values for V_{Ship} were taken from the vessel dataset [Ref 4]. $D_{Ship,Drag,}$ which represents the distance a vessel must travel while dragging its anchor to pose a threat to the cable, was set to 500 m. This value was chosen because the vessel traffic dataset was segmented into 500 m intervals. The value used for P_{WD} was determined using the table shown in Figure 5.5. KP 1.5 to 2.5 was designated as a narrow shipping channel, accounting for the presence of the Welsh channel in this section. Vessel DWT (t) and water depth were used in combination to then determine the corresponding P_{WD} value.

Vessel deadweight, DWT (t)	2,000	5,000	20,000
Vessel draft	4.0	6.0	10.0
Water Depth/Profile	Probability Modifier		
Water Depth Greater than e.g. 50m	0	0	0.1
Water Depth between e.g. 30m and 50m	0.0	0.1	0.3
Water Depth between e.g. 10m and 30m	0.3	0.5	0.9
Wide Shipping Channel with shallow water at margins	0.2	0.5	0.6
Narrow Shipping Channel with shallow water at margins	0.3	0.7	0.9
Proximity of a designated anchorage	0.9	0.9	0.9

Figure 5.5 Water Depth Classification Guidance for P_{WD}

Several published failure rates are used within the CBRA methodology, as can be seen in Figure 5.6. In this study, the "Probability of loss of control on board a ship when on collision course per pass" rate of 2.0×10^{-4}, as published in DNV-RP-F107 [Ref 8], is used. This value is used as the probability of an incident occurring requiring deployment of an anchor ($P_{incident}$).

Reference	Probability per vessel per year	Return period (years)
DNV-RP-F107: Probability of loss of control onboard when on collision course per pass (main reasons no crew on bridge, negligent/tired/drunk crew, accident or radar failure/poor visibility)	$2x10^{-4}$	5000
DNV-RP-F107: Machinery breakdown for single engine tankers in the north sea	$1.75x10^{-1}$	5.7
Kristoffersen & Monnier (1997) (SAFECO)	2.5x10-4	4000
DNV for Marine Coastguard Agency Probability of engine failure	$1.5x10^{-4}$	6667
Southampton Solent University, 15 years of Shipping Accidents: A review for WWF Average vessel loss rate per year (1997 to 2011)	$1.43x10^{-3}$	700
IMO, International Shipping Facts and Figures Average vessel loss rate per year (2006 to 2010)	$1.44x10^{-3}$	694
OGP Total loss per ship per year	$3x10^{-3}$	333

Figure 5.6 $P_{incident}$ Values Published in CBRA Methodology

A value of 1 for $P_{traffic}$ has been applied and represents a desire to protect from all vessels. The CBRA methodology allows for a lower value to be applied, if a project decision was made to protect from a lower percentile of vessels, e.g., 0.9 for 90th percentile. Using these input values, results for P_{Strike} were calculated for each instance of a vessel crossing along the cable route. These results were then divided into 500m route segments in order to investigate the change in P_{Strike} probability along the route. Additionally, the cumulative P_{Strike} from all vessel traffic was summed to determine the overall anchor strike risk for the entire cable route.

5.3.3 Anchor Penetration

In order to determine the P_{strike} for a given DOL, it is necessary to determine the expected anchor penetration depth of each vessel was calculated. The anchor specifications in Table 5-2 were used to determine the penetration depth of each vessel anchor based on the vessel DWT (tons) and sediment type in the crossing area.

Table 5-2 Anchor Specifications

ID	DWT Class (tons)			ANCHOR WEIGHT (kg)	FLUKE LENGTH (m)	Penetration depths of anchors (m)					
	min	max	DWT (tons)			Rock > 1MPa	Grainy soils and riprap	Stiff clays > 150kPa	Sandy soils	Soft to firm clays from 40 to 150kPa	Very soft clays < 40kPa
A	0	1000	0-1,000	718	0.92	0.23	0.46	0.46	0.92	1.38	3.69
B	1000	1500	1,000-1,500	846	0.96	0.24	0.48	0.48	0.96	1.44	3.84
C	1500	2000	1,500-2,000	973	1.00	0.25	0.50	0.50	1.00	1.50	3.99
D	2000	5000	2,000-5,000	1695	1.20	0.30	0.60	0.60	1.20	1.80	4.79
E	5000	10000	5,000-10,000	2771	1.46	0.37	0.73	0.73	1.46	2.20	5.86
F	10000	15000	10,000-15,000	4100	1.74	0.44	0.87	0.87	1.74	2.61	6.96
G	15000	20000	15,000-20,000	5216	1.93	0.48	0.97	0.97	1.93	2.90	7.73
H	20000	40000	20,000-40,000	7862	2.27	0.57	1.13	1.13	2.27	3.40	9.06
I	40000	50000	40,000-50,000	9042	2.37	0.59	1.18	1.18	2.37	3.55	9.47
J	50000	75000	50,000-75,000	11615	2.52	0.63	1.26	1.26	2.52	3.78	10.08
K	75000	100000	75,000-100,000	13702	2.60	0.65	1.30	1.30	2.60	3.90	10.39
L	100000	150000	100,000-150,000	16697	2.69	0.67	1.34	1.34	2.69	4.03	10.75
M	150000	200000	150,000-200,000	18582	2.76	0.69	1.38	1.38	2.76	4.14	11.04
N	200000	250000	200,000-250,000	19912	2.83	0.71	1.41	1.41	2.83	4.24	11.32
O	250000	300000	250,000-300,000	21242	2.92	0.73	1.46	1.46	2.92	4.38	11.68
P	300000	350000	300,000-350,000	23230	3.10	0.78	1.55	1.55	3.10	4.65	12.40
Q	350000	400000	350,000-400,000	26250	3.60	0.90	1.80	1.80	3.60	5.40	14.40

5.3.4 Assumptions

- AIS data covering 01/11/2024 - 31/10/2025 is assumed to be representative of typical annual vessel traffic for the purposes of P_{Strike} estimation. Inter-annual variability and atypical operational periods are not explicitly modelled.
- The anchor drag distance $D_{Ship,Drag}$ is set to 500 m to align with the 500 m route segmentation. It is assumed this provides a reasonable proxy for the distance over which a vessel in distress may drag anchor while posing a threat to the cable.

- $P_{Incident}$ is taken as 2.0×10^-4 per pass (DNV-RP-F107) and is assumed applicable to the vessel population and operating context for the route as the probability of an incident requiring anchor deployment.

5.3.5 Results

Results for P_{Strike} at different depths of lowering (DOL) can be seen in Table 5-3. At the surface level (0 m), the P_{Strike} is highest at 1.19×10^{-5}, corresponding to an estimated return period of approximately 83,718 years. Lowering the cable by just 1 m reduces the probability by approximately 14%, while a depth of 1.5 m results in an order-of-magnitude decrease, extending the return period beyond 1 million years. At 2 m, the probability drops further to 4.33×10^{-7}, equating to over 2.3 million years, and at 3 m, the risk is effectively eliminated (P_{Strike} = 0).

Table 5-3 P-Strike Results Table

DOL (m)	P-Strike	Return Period (Years)
0	1.19×10^{-5}	83,718
1	1.03×10^{-5}	97,178
1.5	9.52×10^{-7}	1,050,561
2	4.33×10^{-7}	2,309,926
3	0	0

A significant increase in P_{Strike} can be observed in Figure 5.7 at the end of the cable route from KP 33 to 33.5, close to the Douglas platform. Increases in P_{Strike} can also be seen at the Welsh channel at approximately KP 1.5 and in the Liverpool Bay TSS corridor from KP 29 to 32.5. These spikes are attributable to increased vessel traffic in these sections, as discussed in Section 5.3.1.

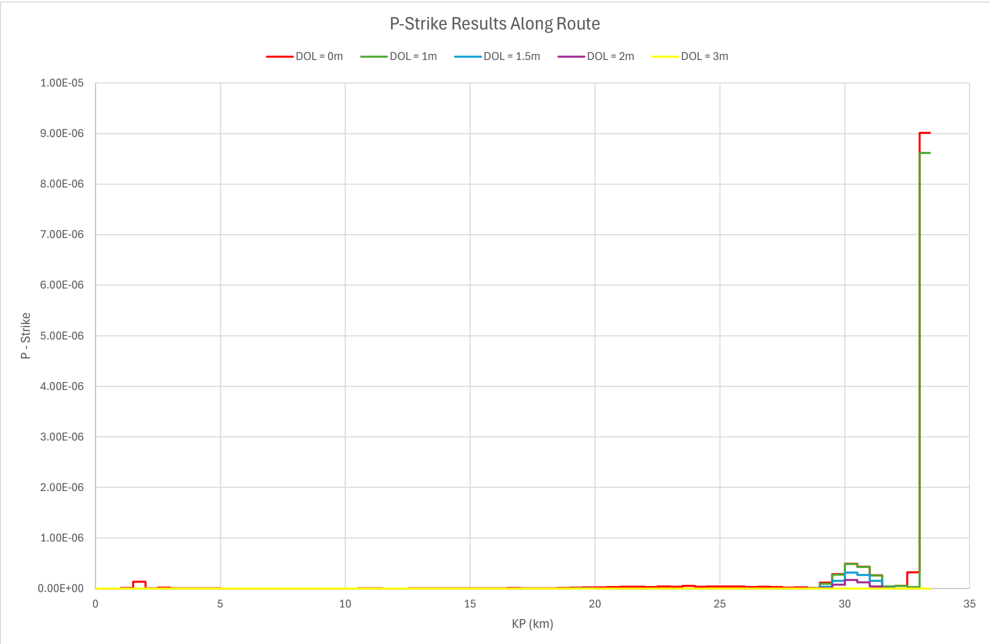


Figure 5.7 P_{Strike} Results Along Cable Route

Although spikes in anchor strike probability can generally be linked to increased vessel traffic, traffic near the Douglas platform (KP 33.5) is lower than in the Liverpool Bay TSS corridor. Yet, the probability of P_{Strike} is significantly higher toward the end of the cable route. This can be attributed to the vessels at the Douglas platform having lower vessel speed than that of the vessel traffic in the TSS corridor. These slower moving oil

& gas vessels greatly increase P_{Strike} by decreasing the value of V_{Ship} in the probabilistic formula shown in Figure 5.4.

5.4 Seabed Challenging Areas and Mobility

Figure 5.8 presents the challenging areas along the route for cable burial. In particular, sandwaves and bedforms and associated seabed mobility is a challenge over a significant length of the route. This drives the selection of the burial depth in order to avoid cable exposures over the lifetime of the asset. In addition, sediment depth is a challenge.

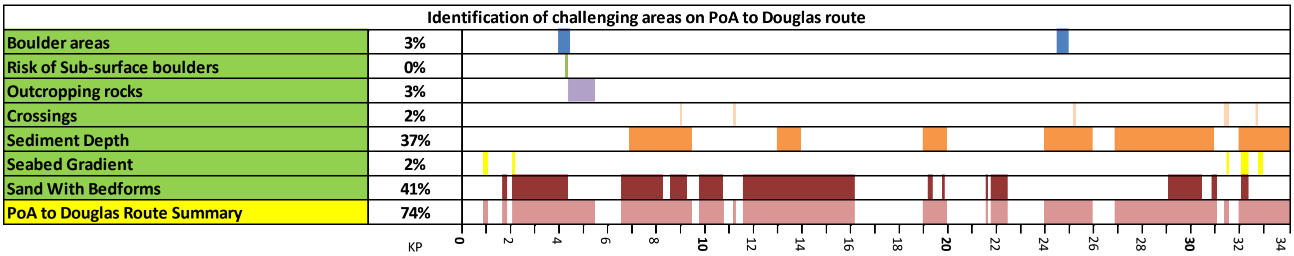


Figure 5.8 Challenging Areas on the Route

A sediment mobility study has been performed by Fugro as part of the UXO scope of work [Ref 3]. This study is restricted to assessment of previous seabed mobility and does not provide predictions for future sediment mobility. Figure 5.9 shows the variation in seabed elevation along the route since 2019 from various surveys (none of the surveys cover the entire route) with the latest bathymetry data representing the baseline. This shows seabed variation of less than 1m across the majority of the route over this time. The larger variations are over the first 11km of the route. It can be seen from KP 4.5 onwards that there was some reduction in seabed elevation between 2019 (red) and 2023 (orange) with a further small reduction to the current seabed level. Over the first 4.5km there has been a significant amount of seabed movement since 2019. This is discussed further below.

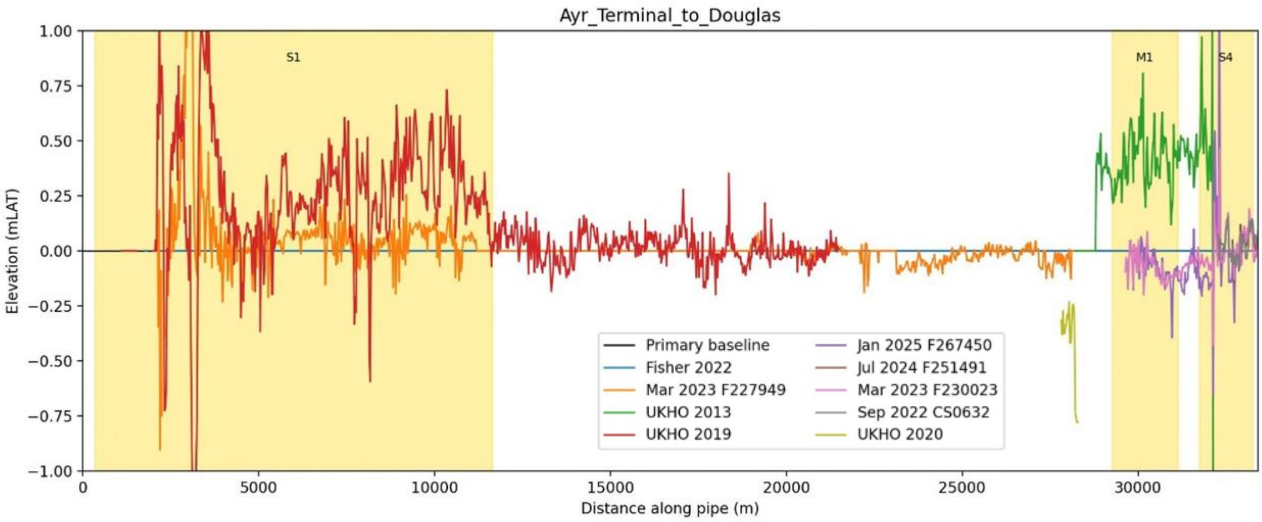


Figure 5.9 Seabed Variation across the various datasets along the route

Figure 5.10 shows the maximum variation in the seabed over the previous 80years. For the majority of the route this is less than 2m. The region close to the platform shows increased levels of seabed mobility (KP 32.5 onwards), however, this section will be externally protected by mattresses thus reducing the risk of cable exposure in this area due to seabed mobility.

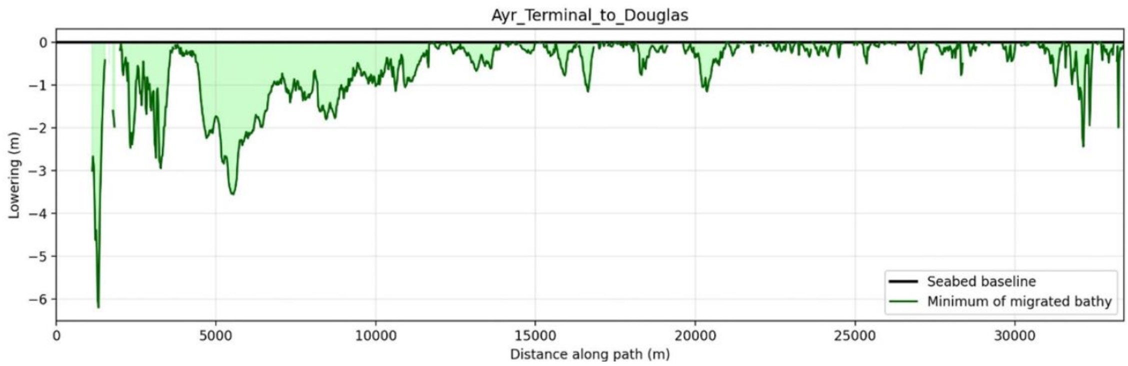


Figure 5.10 Expected depth to lowest historical bathymetry over past 80 years; PoA to Douglas route

There have been high levels of seabed mobility over the first 6km of the route in the last 80 years. This is attributed to dredging works in the Welsh Channel and migration of the West Hoyle Spit eastwards over that time. This migration is towards the cable route as shown in Figure 5.11. This should result in increased burial depth of the cable over time rather than cable exposure.

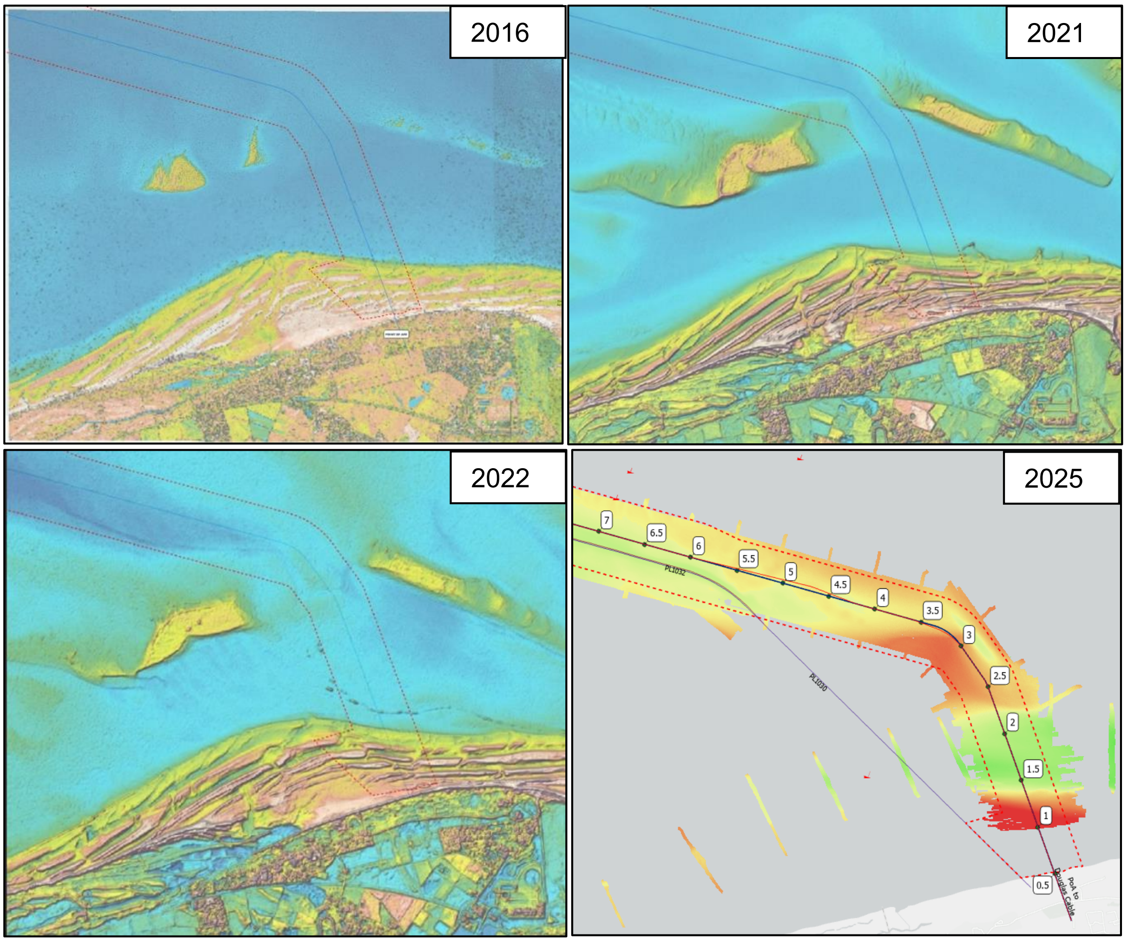


Figure 5.11 Development of the West Hoyle Spit since 2016

There is a requirement to maintain a water depth of 9m through the Welsh Channel. Figure 5.12 shows the water depth at LAT across the welsh channel based on the 2025 bathymetry survey and the top of pipe considering a Depth of Cover of 2.0m. This shows that a depth of cover of 2.0m in this area should be sufficient to meet the port authority requirements.

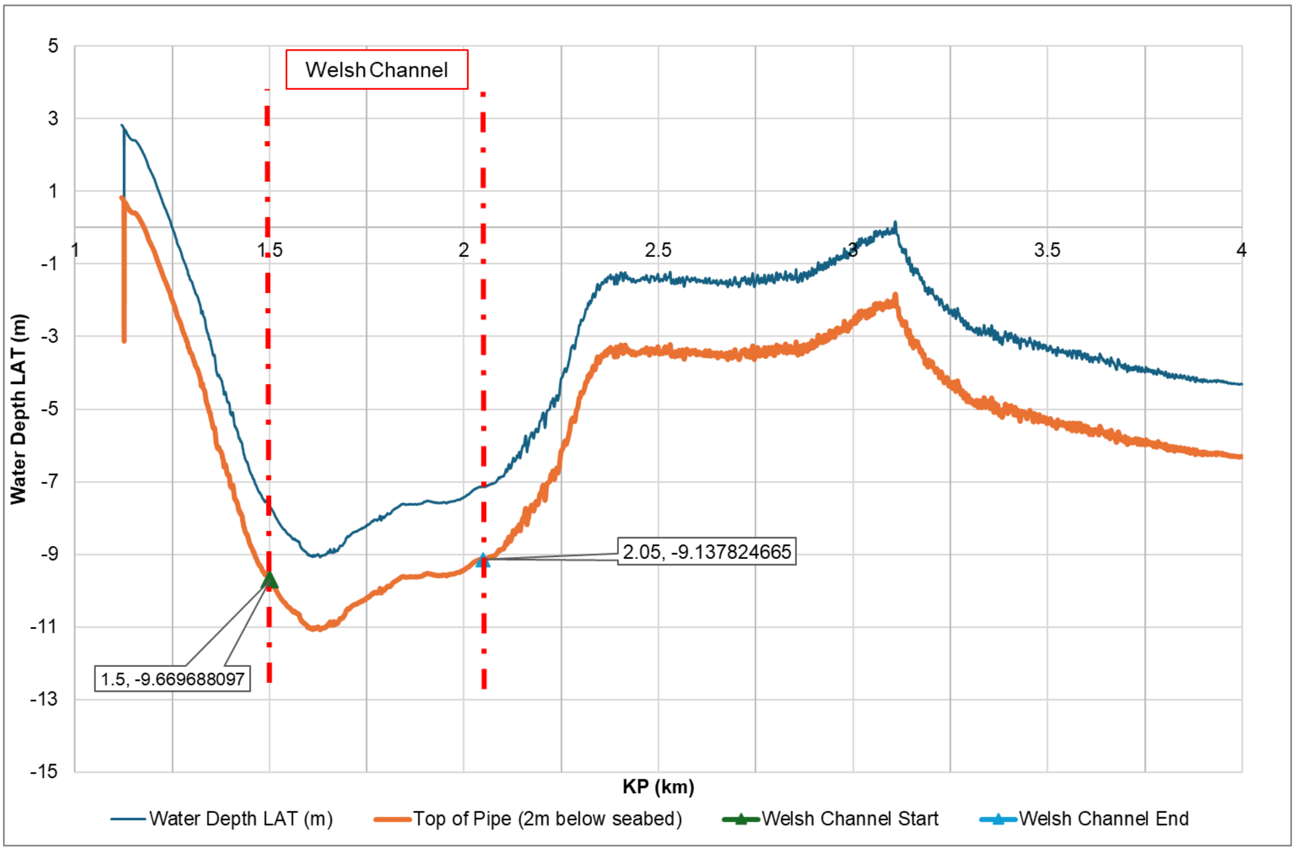


Figure 5.12 Seabed Elevation and proposed Burial in the Welsh Channel

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The risk assessment for the cable route indicates that the key risks for the lifetime of the cable are fishing, shipping and sediment mobility.

Fishing

- A minimum DOL of 0.6 m is required along the route in order to mitigate the risk from bottom trawling.

Shipping

- Anchor strike risk is highest near the Douglas platform and Liverpool Bay Traffic Separation Scheme (TSS) corridor.
- Vessel traffic analysis shows:
  - High vessel density near KP 1.5 - 2.5 (Welsh channel) and KP 29- 32.5 (TSS corridor).
  - Increased risk near Douglas platform due to slower vessel speeds despite lower traffic volume.
- Probabilistic analysis indicates that for a surface lay (0 m): $P_{Strike} = 1.19 \times 10^{-5}$ (return period ~83,718 years). Therefore, depth of lowering will be governed by fishing and seabed mobility risk.

Sediment Mobility

- There is a high level of seabed mobility along the route indicated by areas of sandwaves and bedforms. Assessment of historical data from 2019 to date suggest that seabed mobility is limited to the top 1m along the majority of the route with the exception of the Welsh Channel and the area around the West Hoyle Spit whether higher variations have been noted over the last 80 years.

6.2 Recommendations

It is recommended that a Depth of Cover of 2.0m as shown in Figure 6.1 below, be adopted along the entire route with the exception of crossings and locations which are protected by concrete mattresses or rock berms.

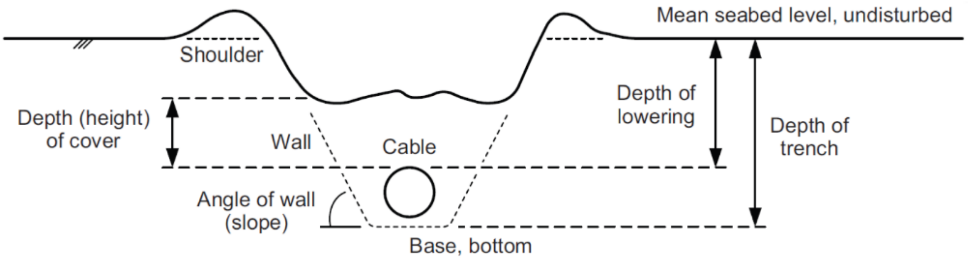


Figure 6.1 Depth of Burial Definitions

Due to issues regarding on-bottom stability [Ref 6] it is recommended to bury the cable using a Simultaneous Lay and Burial Tool. The Depth of Cover of 2.0m should be achievable with this tooling. However, due to sediment type and depth along the route it is recommended to perform some preparatory works to reduce the stiffness of the seabed along the proposed route for ease of burial with an SLB tool later.

LB CCS PROJECT

Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT
Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection

Cable Burial Risk Assessment (CBRA) Report - Douglas CCS to Hamilton North

EX-DE	00	12/02/2026	Issued for Design	JBR	BOK	BOK	BOK	GC
Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approved	Company Approved
Revision Index								

Company logo and business name liverpool bay ccs	LCI Activity Code: **GB20250014** Project code: **000593**	Company Document ID: **10265601DSQJ1027W** Job N: JA1351
Contractor logo and business name wood.		Contractor Document ID: **OP271234-GN-REP-0011** Contract N.:
Vendor logo and business name **N/A**		Vendor Document ID: **N/A** Purchase Order N.:

Facility & Sub Facility Description Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection	Project and SoW description LB CCS PROJECT Engineering for Cable Laying	Scale N/A	Sheet of Sheets 1 / 19
Document Title Cable Burial Risk Assessment (CBRA) Report - Douglas CCS to Hamilton North		Supersedes N: N/A Superseded by N: N/A	
		Plant Area 1	Functional Unit 0

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REVISION LIST

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HOLD RECORD

TABLE OF CONTENTS

List of Figures

List of Tables

1.0 INTRODUCTION

1.1 Project Overview

Eni's Liverpool Bay CCS Transport & Storage Project (LBA CCS T&S Project) is being developed in parallel with and as a key part of the HyNet Northwest full-chain hydrogen and CCS industrial decarbonization project (the HyNet Project), which is designed to transform a region of the UK into the world's first low carbon industrial cluster by 2030. The HyNet Project was conceived in 2016 with the objective of decarbonizing the entire industrial cluster to Net Zero. The HyNet Project is being developed on a phased approach based on CO2 emissions capture from existing industrial facilities, alongside capture from new-build hydrogen generation facilities. While industrial decarbonization is the anchor, the HyNet Project builds the infrastructure backbone for a full regional hydrogen economy and leverages the opportunity to repurpose for future CCS service the existing oil and gas facilities at Point of Ayr and offshore in Liverpool Bay. CO2 storage is provided in well-known gas fields that are owned and operated by Eni UK.

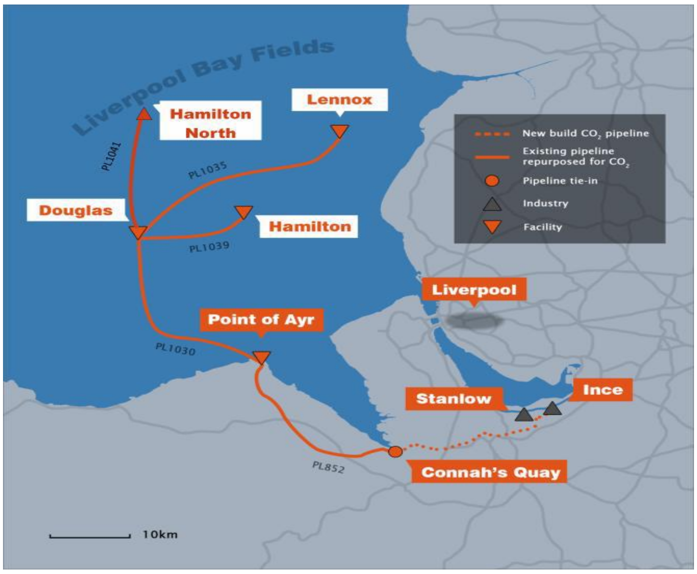


Figure 1.1 Liverpool Bay CCS Project Schematic

As part of Onshore Scope, CO2 emissions from these sources will be transported along a new-build pipeline which will connect Ince AGI with Stanlow AGI and then run from Stanlow AGI to the south of Chester, and then on to the Flint AGI (Above Ground Installation) located in the vicinity of Connah's Quay power station which is the termination point of the existing pipeline (P852). At the Flint AGI the new-build pipeline will connect to the existing pipeline (owned and operated by Eni). The existing onshore natural gas import pipeline will be repurposed to become a CO2 export pipeline and will transport the CO2 to the existing Point of Ayr (PoA) gas terminal.

As part of Offshore Scope, the existing offshore natural gas import pipeline from PoA gas terminal will be repurposed to become a CO2 export pipeline and will transport the CO2 to the Douglas complex. From the Douglas complex, CO2 will be transported along re-purposed natural gas pipelines to the Hamilton platform for injection into the Hamilton reservoir, to the Hamilton North platform for injection into the Hamilton North reservoir, to the Lennox platform for injection into the Lennox reservoir.

1.2 Wood Scope of Work

Wood has been contracted by ENI to provide offshore cable installation engineering services for the LBA CCS T&S project, for the detailed design phase of the submarine composite cable.

The Tasks involved in this study are as follows:

Table 1-1 Wood Scope of Work Task Breakdown

Task No.	Task Title
Task 1	Route and Survey Review and Design Premise
Task 2	On-Bottom Stability
Task 3	Free Span Analysis
Task 4	Cable Protection Studies
Task 4.1	**Cable Burial Risk Assessment**
Task 4.2	External Protection Design
Task 4.3	HDD Design
Task 5	Cable Crossing Design

The present document is a key deliverable for Task 4.1.

1.3 Scope of the Document

This document presents the methodology, results and conclusions of the cable burial risk assessment (CBRA) for the Douglas to Hamilton North cable. This study was undertaken by Wood for the LBA CCS T&S project.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Term	Definition
Company	The party that initiates the project and ultimately pays for its design and construction i.e. COMPANY will generally specify technical requirements. The term “COMPANY” also includes agents or consultants authorized to act for, and on behalf of, COMPANY.
Contract	An acceptance of legal relations between two or more parties for the transfer of goods or services for value.
Contractor	A person or organization that undertakes responsibility for the execution of a contract.
Supplier	The party (Manufacturer or Vendor) that manufactures or supplies equipment or services to perform the duties specified by the Company or Contractor
Shall	A mandatory provision
Should	An advisory provision

2.2 Abbreviations

AGI	Above Ground Installation
AIS	Automatic Identification System
CBRA	Cable Burial Risk Assessment
DOL	Depth of Lowering
DWT	Deadweight tonnage
FOS	Factor of Safety
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LBA	Liverpool Bay Area
OWF	Offshore Wind Farm
PoA	Point of Ayr
SLB	Simultaneous Lay & Burial
TSS	Traffic Separation Scheme
UXO	Unexploded Explosive Ordnance

3.0 REFERENCES

References used in this document are summarised in this section.

3.1 Project Documents

[Ref 1]	10265601DGRA1003W	Cable Design Study Premise - Douglas CCS to Hamilton North
[Ref 2]	A4814-ENI-NRA-1	Navigational Risk Assessment - RPS Group
[Ref 3]	F279461-005a (01)	Volume 5a UXO Sediment Mobility Study – FUGRO
[Ref 4]	A5538	Anatec – AIS Shipping Study Liverpool Bay CCS Cables
[Ref 5]	HA_Dredging_20251103	EMODnet Human Activities, Dredging
[Ref 6]	10265601DSCX1011W	Cable On-Bottom Stability Report - Douglas CCS to Hamilton North

3.2 International Codes and Standards

[Ref 7]	CTC835	Cable Burial Risk Assessment Methodology Guidance
[Ref 8]	DNV-RP-F107	Risk assessment of pipeline protection

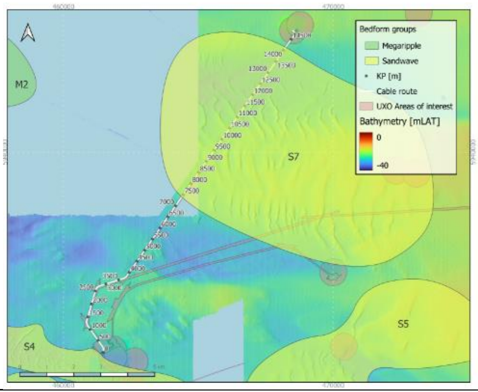
4.0 RISK ASSESSMENT

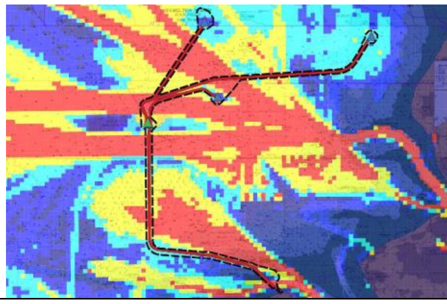
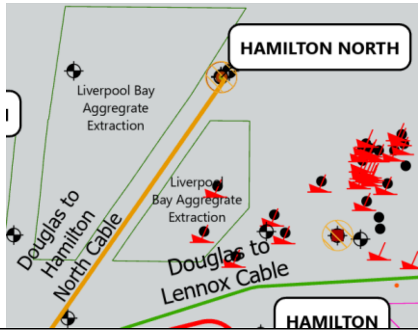
4.1 General

A risk assessment has been performed, considering risks to the cable along the proposed cable route. The outcomes are presented in Table 4-1.

The key risks for this route are fishing, shipping and sediment mobility. These are evaluated in Section 5.0.

Table 4-1 Risk Assessment

Threat Type	Threat Description	General notes on treatment in CBRA	**Risk Assessment -** Point of Ayr to Douglas
Natural	Sediment Mobility	CBRA recommends burial beneath non-mobile sediment. Pre-sweeping or increased DOL typically required.	Sand wave areas present along route. 
Natural	Seismic Activity	CBRA does not recommend burial as a means of protection from seismic activity, therefore cable routing should take this into consideration	Minor seismic activity present in LBA. Recent (09/10/25) 1.3 magnitude earthquake north of project area (53.730 -3.180). 712 seismic events recorded within 100km radius of LBA from 27/10/2000 to 27/10/2025. Average recorded magnitude: 1.22 (95% C.I: 1.17, 1.27). Max recorded magnitude: 3.9 (21/10/2002, 53.481, -2.915) Source: British Geological Survey 1998 - 2019 (c)UKRI http://www.bgs.ac.uk mailto:www-bgs@bgs.ac.uk, “BGS Earthquake Seismology.” https://www.earthquakes.bgs.ac.uk/index.html
Natural	Submarine Landslides	CBRA does not recommend burial as a means of protection from submarine landslide, therefore cable routing should take this into consideration.	Sandwave adjacent to route at KP 7.5 with slope of 27 deg.

Anthropogenic	Shipping	Probabilistic assessment methodology recommended by CBRA.	Significant vessel activity at approach of cable to Douglas Platform. Platform bisects lanes of Liverpool Bay Traffic Separation Scheme (TSS). Traffic in TSS expected to rise if new OWF developments displace existing traffic [Ref 2]. 
Anthropogenic	Fishing	Typical DOL for protection from fishing equipment is 0.6 m (0.3 m x FOS 2).	Virtually no bottom trawling activity in project area.
Anthropogenic	Mining / Aggregate Extraction	CBRA does not recommend burial as a means of protection from mining / aggregate extraction activities, therefore cable routing should take this into consideration and avoid these areas.	Hamilton North Cable intersects the Liverpool Bay Aggregrate Extraction Zone. Approximately 500m from either extraction areas. 
Anthropogenic	Dredging	In areas where dredging is practiced, CBRA recommends burial below the maximum dredged level. Pre-dredging or increased DOL typically required.	Dredging recorded in Dee Estuary and Mersey River [Ref 5] however no data coinciding with work area.
Anthropogenic	3rd Party Infrastructure (Cables, Pipelines, Other)		Total of 6 cable crossings along route.
Anthropogenic	3rd Party Infrastructure (Aquaculture)		No information available on Aquaculture areas in LBA.
Anthropogenic	UXOs	CBRA does not consider burial as a means of protection from UXOs. Cable route should either divert around confirmed UXOs, or they should be removed.	No data available.
Anthropogenic	Dumping		No information available on dumping areas in LBA.

5.0 CBRA

5.1 General

The required depth of lowering shall be determined based on the key risks from the risk assessment, namely; fishing, shipping and seabed mobility. This section addresses the requirements for each risk and the Section 6.0 provides the conclusions and final recommended depth of lowering along the route.

5.2 Fishing

Based on research carried out and presented in the Carbon Trust CBRA methodology guideline [Ref 7], the maximum penetration depth for typical fishing equipment is 0.3 m, even in very soft sediments. If a typical factor of safety of 2 is applied, a minimum DOL of 0.6 m is required in areas where bottom trawling occurs.

5.3 Shipping

CBRA includes a probabilistic methodology for quantifying the risk to a cable from anchor strike.

5.3.1 Vessel Data

The vessel input data used in this study was provided by Anatec [Ref 4]. Vessel crossing data of the planned PoA to Douglas cable route was recorded based on Automatic Identification System (AIS) data between 1st November 2024 and 31st October 2025. The cable route was divided into 500m sections, from 1 to 67, in order to indicate the location of each vessel crossing. The dataset includes key vessel details such as type, length, draught and deadweight tonnage (DWT). Table 5-1 provides a summary and description of all shipping data provided in the survey.

To better reflect typical vessel traffic, temporary vessels such as those conducting surveys or temporary works were excluded. Vessel traffic contained entirely within the safety zone at the Douglas platform were also excluded to prevent stationary vessels in the vicinity of the platform from inflating numbers of crossings.

Table 5-1 Anatec Tabular Shipping Data Parameters

Parameter	Description
MMSI	Nine-digit number assigned to each unique vessel
Name	Name of vessel as broadcast on AIS
Call Sign	Sequence of letters and numbers unique to each vessel
Vessel Type	Vessel type category based on broadcast information, Anatec's in-house vessel databases and desk-based research.
Vessel Length (m)	Vessel length in metres (m) based on AIS vessel broadcast, house databases and desk-based research.
Vessel Beam (m)	Vessel width in metres (m) based on AIS vessel broadcast, house databases and desk-based research
Broadcast Draught (m)	Draught of vessel in metres (m) as broadcast on AIS
DWT	Vessel deadweight tonnage (DWT), based on desk-based research, Anatec's in-house databases and publicly available data. It is noted that certain smaller vessels do not have a valid DWT (e.g. wind farm support, recreational and fishing vessels) and will be assigned DWT of 0.
Vessel Speed (knots)	Speed of the vessel at the crossing of the cable route, based on speed broadcast on AIS close to the crossing, measured in knots.
Vessel Course	Bearing of the vessel track at the location of the crossing.
Anchor Mass (kg)	Mass of anchor carried by the vessel, in kilograms (kg), based on Anatec's Anchor Model.
Cable ID	Unique identifier for each 500m section of the cable route, numbered starting from 1 at the landfall (0-0.5km), to 67 (33.0-33.4km) at the Douglas end of the cable route. It is noted that section 67 is approximately 400m in length.

A total of 7817 vessels [Ref 4] are recorded as crossing the Douglas to Lennox cable route within the one-year duration of the survey. As can be seen in Figure 5.1, the majority of vessels recorded are between 2000 and 15,000 DWT alongside a sizeable proportion of small vessels under 1000 DWT. The largest vessel recorded was a tanker, "DHT Europe", with a DWT of 317,826 tons, crossing the cable route between KP 2.5 and 3.

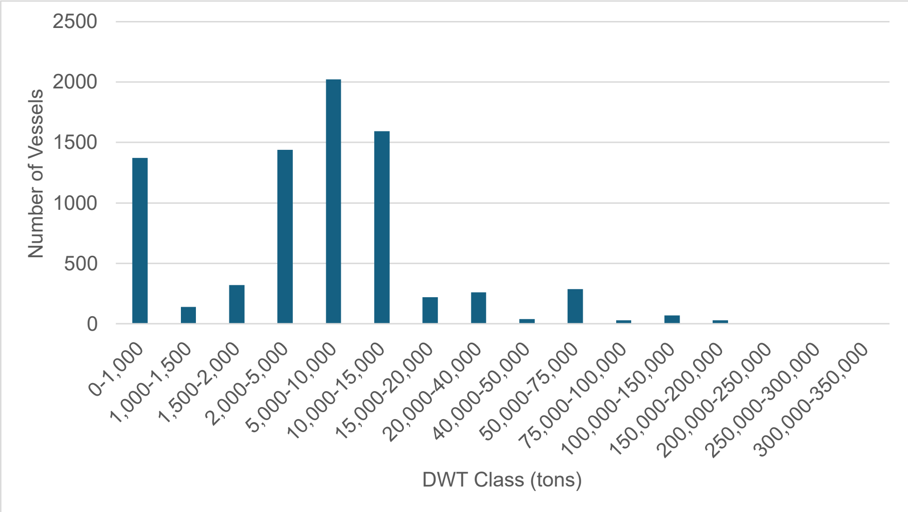


Figure 5.1 Vessel DWT distribution

Cargo vessels make up over a third of all vessel traffic, as shown in Figure 5.2. Passenger vessels account for approximately 26% followed by oil and gas vessels at approximately 17%. Fishing vessels account for a relatively small amount of vessel traffic at 3%.

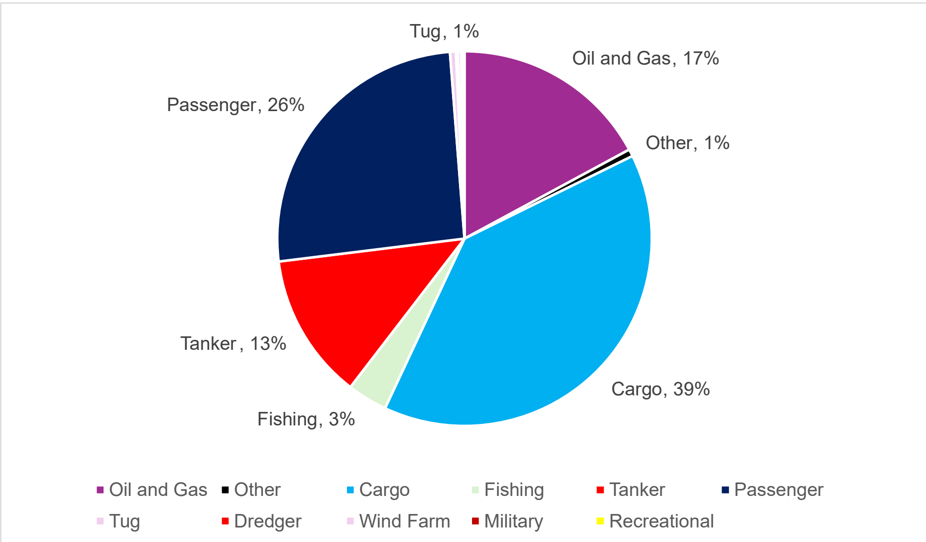


Figure 5.2 Vessel type distribution derived from [Ref 4]

As can be seen in Figure 5.3, the highest level of vessel traffic occurs from KP 1 to 4, dominated by cargo and tanker vessel traffic. This can be attributed to the use of the Liverpool Bay Traffic Separation Scheme (TSS) corridor, which intersects the cable route at this section. Beyond KP 4, vessel activity declines sharply and remains low until approximately KP 8.5. From KP 9 to KP 11, a distinct increase in crossings is visible, characterised mainly by passenger vessels, along with contributions from other categories such as tugs and recreational craft. A further peak occurs between KP 12 and KP 13.5, again dominated by passenger vessel traffic, before tapering off towards the end of the route.

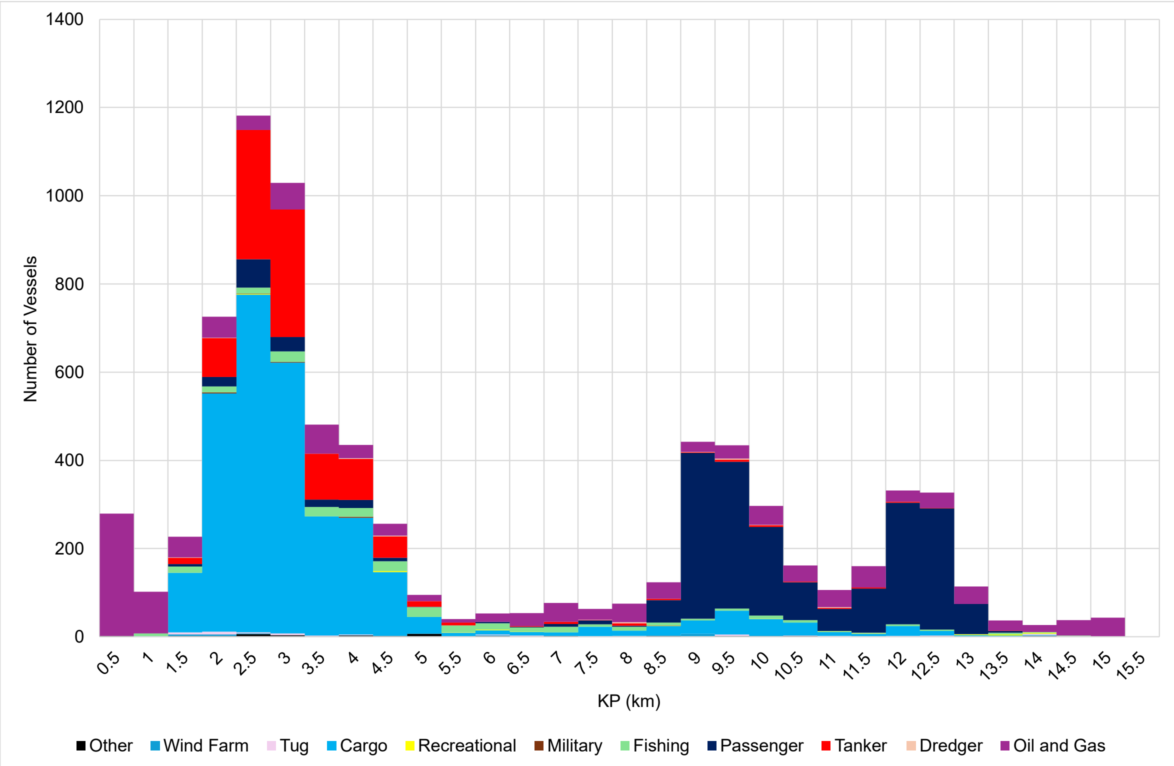


Figure 5.3 Distribution of Vessel Crossings Along Cable Route

5.3.2 Probabilistic Assessment of Shipping Threat

In order to calculate the probability of an anchor strike on the cable, the probabilistic formula shown in Figure 5.4 was used.

$$P_{Strike} = P_{Traffic\ Risk} \sum_{1}^{Number\ of\ vessels\ in\ the\ section} \left(\frac{D_{Ship\ Drag}}{V_{Ship} * 8760\ hrs\ per\ year} * P_{Incident} * P_{WD} \right)$$

Equation 1 Probabilistic formula to assess the risk from anchoring

Where:

$P_{Traffic\ Risk}$	probability modifier based on the tolerable level of risk
P_{WD}	probability modifier for nature and depth of seabed
V_{Ship} (metre/hr)	ship speed when the anchor is deployed
$D_{Ship\ Drag}$ (metres)	distance travelled by the anchor in order to be a threat to the cable
$P_{incident}$	probability of incident requiring the deployment of an anchor for that vessel size and type
8760 hrs	factor to annualise the results

Figure 5.4 Probabilistic Formula to Assess the Risk from Anchoring, Carbon Trust [Ref 7]

Values for V_{Ship} were taken from the vessel dataset [Ref 4]. $D_{Ship,Drag}$, which represents the distance a vessel must travel while dragging its anchor to pose a threat to the cable, was set to 500 m. This value was chosen because the vessel traffic dataset was segmented into 500 m intervals. The value used for P_{WD} was determined using the table shown in Figure 5.5. KP 1.5 to 2.5 was designated as a narrow shipping channel, accounting for the presence of the Welsh channel in this section. Vessel DWT (t) and water depth were used in combination to then determine the corresponding P_{WD} value.

Vessel deadweight, DWT (t)	2,000	5,000	20,000
Vessel draft	4.0	6.0	10.0
Water Depth/Profile	Probability Modifier		
Water Depth Greater than e.g. 50m	0	0	0.1
Water Depth between e.g. 30m and 50m	0.0	0.1	0.3
Water Depth between e.g. 10m and 30m	0.3	0.5	0.9
Wide Shipping Channel with shallow water at margins	0.2	0.5	0.6
Narrow Shipping Channel with shallow water at margins	0.3	0.7	0.9
Proximity of a designated anchorage	0.9	0.9	0.9

Figure 5.5 Water Depth Classification Guidance for P_{WD}

Several published failure rates are used within the CBRA methodology, as can be seen in Figure 5.6. In this study, the "Probability of loss of control on board a ship when on collision course per pass" rate of 2.0×10^{-4}, as published in DNV-RP-F107 [Ref 8], is used. This value is used as the probability of an incident occurring requiring deployment of an anchor ($P_{incident}$).

Reference	Probability per vessel per year	Return period (years)
DNV-RP-F107: Probability of loss of control onboard when on collision course per pass (main reasons no crew on bridge, negligent/tired/drunk crew, accident or radar failure/poor visibility)	2×10^{-4}	5000
DNV-RP-F107: Machinery breakdown for single engine tankers in the north sea	1.75×10^{-1}	5.7
Kristoffersen & Monnier (1997) (SAFECO)	2.5x10-4	4000
DNV for Marine Coastguard Agency Probability of engine failure	1.5×10^{-4}	6667
Southampton Solent University, 15 years of Shipping Accidents: A review for WWF Average vessel loss rate per year (1997 to 2011)	1.43×10^{-3}	700
IMO, International Shipping Facts and Figures Average vessel loss rate per year (2006 to 2010)	1.44×10^{-3}	694
OGP Total loss per ship per year	3×10^{-3}	333

Figure 5.6 $P_{incident}$ Values Published in CBRA Methodology

A value of 1 for $P_{traffic}$ has been applied and represents a desire to protect from all vessels. The CBRA methodology allows for a lower value to be applied, if a project decision was made to protect from a lower percentile of vessels, e.g., 0.9 for 90th percentile. Using these input values, results for P_{Strike} were calculated for each instance of a vessel crossing along the cable route. These results were then divided into 500m route segments in order to investigate the change in P_{Strike} probability along the route. Additionally, the cumulative P_{Strike} from all vessel traffic was summed to determine the overall anchor strike risk for the entire cable route.

5.3.3 Anchor Penetration

In order to determine the P_{strike} for a given DOL, it is necessary to determine the expected anchor penetration depth of each vessel was calculated. The anchor specifications in Table 5-2 were used to determine the penetration depth of each vessel anchor based on the vessel DWT (tons) and sediment type in the crossing area.

Table 5-2 Anchor Specifications

ID	DWT Class (tons)			ANCHOR WEIGHT (kg)	FLUKE LENGTH (m)	Penetration depths of anchors (m)					
	min	max	DWT (tons)			Rock > 1MPa	Grainy soils and riprap	Stiff clays > 150kPa	Sandy soils	Soft to firm clays from 40 to 150kPa	Very soft clays < 40kPa
A	0	1000	0-1,000	718	0.92	0.23	0.46	0.46	0.92	1.38	3.69
B	1000	1500	1,000-1,500	846	0.96	0.24	0.48	0.48	0.96	1.44	3.84
C	1500	2000	1,500-2,000	973	1.00	0.25	0.50	0.50	1.00	1.50	3.99
D	2000	5000	2,000-5,000	1695	1.20	0.30	0.60	0.60	1.20	1.80	4.79
E	5000	10000	5,000-10,000	2771	1.46	0.37	0.73	0.73	1.46	2.20	5.86
F	10000	15000	10,000-15,000	4100	1.74	0.44	0.87	0.87	1.74	2.61	6.96
G	15000	20000	15,000-20,000	5216	1.93	0.48	0.97	0.97	1.93	2.90	7.73
H	20000	40000	20,000-40,000	7862	2.27	0.57	1.13	1.13	2.27	3.40	9.06
I	40000	50000	40,000-50,000	9042	2.37	0.59	1.18	1.18	2.37	3.55	9.47
J	50000	75000	50,000-75,000	11615	2.52	0.63	1.26	1.26	2.52	3.78	10.08
K	75000	100000	75,000-100,000	13702	2.60	0.65	1.30	1.30	2.60	3.90	10.39
L	100000	150000	100,000-150,000	16697	2.69	0.67	1.34	1.34	2.69	4.03	10.75
M	150000	200000	150,000-200,000	18582	2.76	0.69	1.38	1.38	2.76	4.14	11.04
N	200000	250000	200,000-250,000	19912	2.83	0.71	1.41	1.41	2.83	4.24	11.32
O	250000	300000	250,000-300,000	21242	2.92	0.73	1.46	1.46	2.92	4.38	11.68
P	300000	350000	300,000-350,000	23230	3.10	0.78	1.55	1.55	3.10	4.65	12.40
Q	350000	400000	350,000-400,000	26250	3.60	0.90	1.80	1.80	3.60	5.40	14.40

5.3.4 Assumptions

- AIS data covering 01/11/2024 - 31/10/2025 is assumed to be representative of typical annual vessel traffic for the purposes of P_{Strike} estimation. Inter-annual variability and atypical operational periods are not explicitly modelled.
- The anchor drag distance $D_{Ship,Drag}$ is set to 500 m to align with the 500 m route segmentation. It is assumed this provides a reasonable proxy for the distance over which a vessel in distress may drag anchor while posing a threat to the cable.
- $P_{Incident}$ is taken as 2.0×10^-4 per pass (DNV-RP-F107) and is assumed applicable to the vessel population and operating context for the route as the probability of an incident requiring anchor deployment.

5.3.5 Results

Results for P_{Strike} at different depths of lowering (DOL) can be seen in Table 5-3. At the surface level (0 m), the P_{Strike} is highest at 3.22×10^{-6}, corresponding to an estimated return period of approximately 310,554 years. Lowering the cable by just 1 m reduces the probability by approximately 17%, while a depth of 1.5 m results in an order-of-magnitude decrease, extending the return period beyond 1 million years. At 2 m, the probability drops further to 3.22×10^{-7}, equating to over 3 million years, and at 3 m, the risk is effectively eliminated (P_{Strike} = 0).

Table 5-3 P-Strike Results Table

DOL (m)	P-Strike	Return Period (Years)
0	3.22×10^{-6}	310,554
1	2.69×10^{-6}	372,308
1.5	8.79×10^{-7}	1,137,239
2	3.22×10^{-7}	3,110,141
3	0	0

As shown in Figure 5.7, elevated P-Strike values occur at the start of the cable route between KP 0.5 and KP 1. A further increase in P-Strike is observed from approximately KP 2 to KP 4, Beyond KP 4, P-Strike values decline significantly before rising again in a broader peak from KP 9 to KP 12.5. This mid-route increase remains dominated by the lowest DOL cases, with higher DOLs showing substantially reduced P-Strike throughout. These elevated sections correspond to areas of increased vessel activity along the route, as discussed in Section 5.3.1.

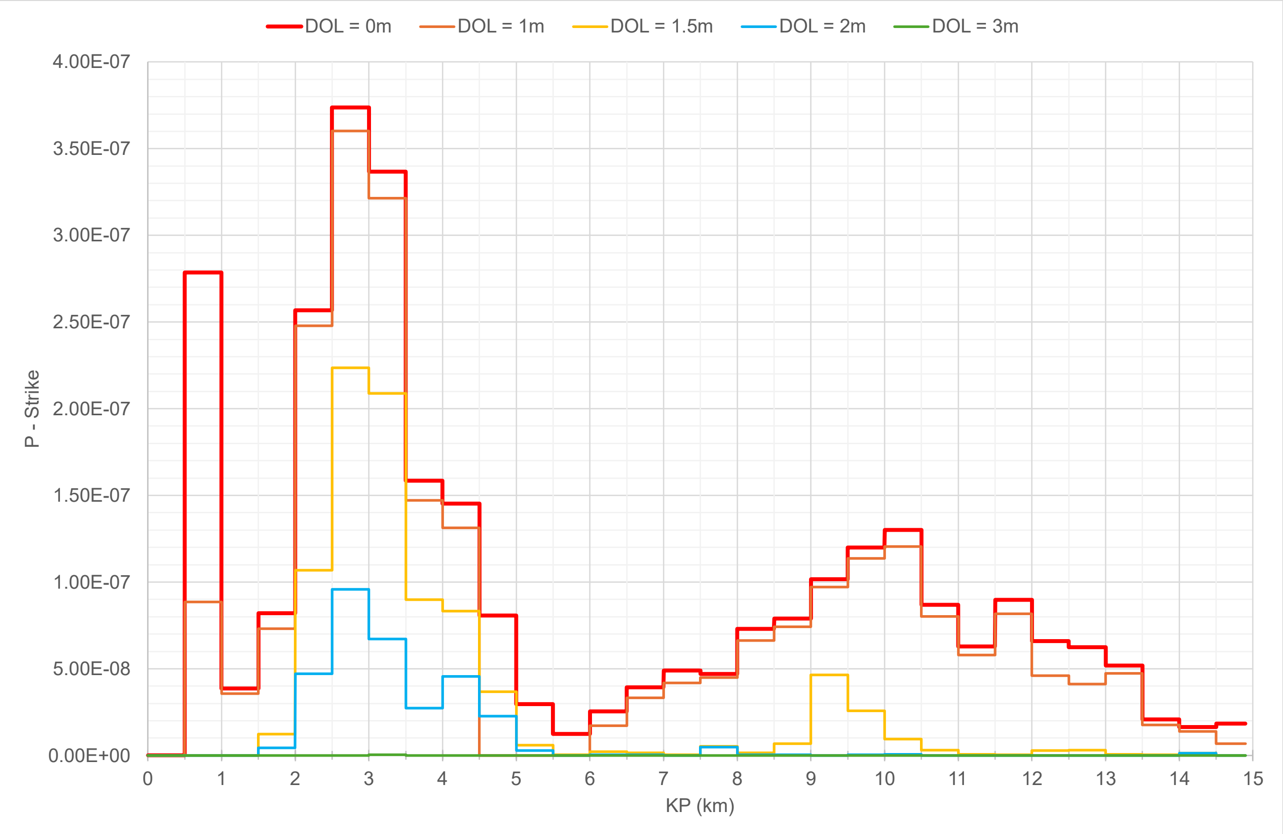


Figure 5.7 P_{Strike} Results Along Cable Route

5.4 Seabed Challenging Areas and Mobility

Figure 5.8 presents the challenging areas along the route for cable burial. In particular, sandwaves and bedforms and associated seabed mobility is a challenge over a significant length of the route. This drives the selection of the burial depth in order to avoid cable exposures over the lifetime of the asset. In addition, sediment depth is a challenge.

Identification of challenging areas on Douglas to Hamilton North route	
Boulder areas	**0%**
Risk of Sub-surface boulders	**0%**
Outcropping rocks	**0%**
Crossings	**2%**
Sediment Depth	**0%**
Seabed Gradient	**1%**
Sand With Bedforms	**38%**
Douglas to Hamilton North Route Summary	**40%**

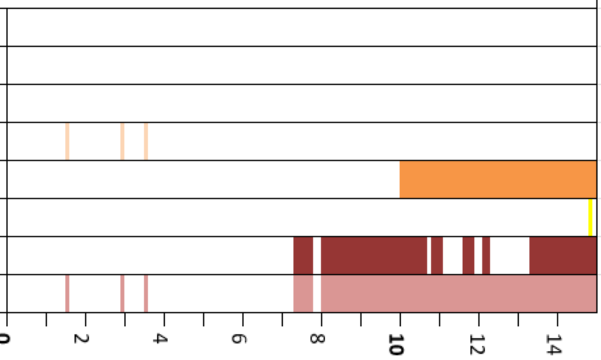


Figure 5.8 Challenging Areas on the Route

A sediment mobility study has been performed by Fugro as part of the UXO scope of work [Ref 3]. This study is restricted to assessment of previous seabed mobility and does not provide predictions for future sediment mobility. Figure 5.9 shows the variation in seabed elevation along the route since 2013 from various surveys (none of the surveys cover the entire route) with the latest bathymetry data representing the baseline.

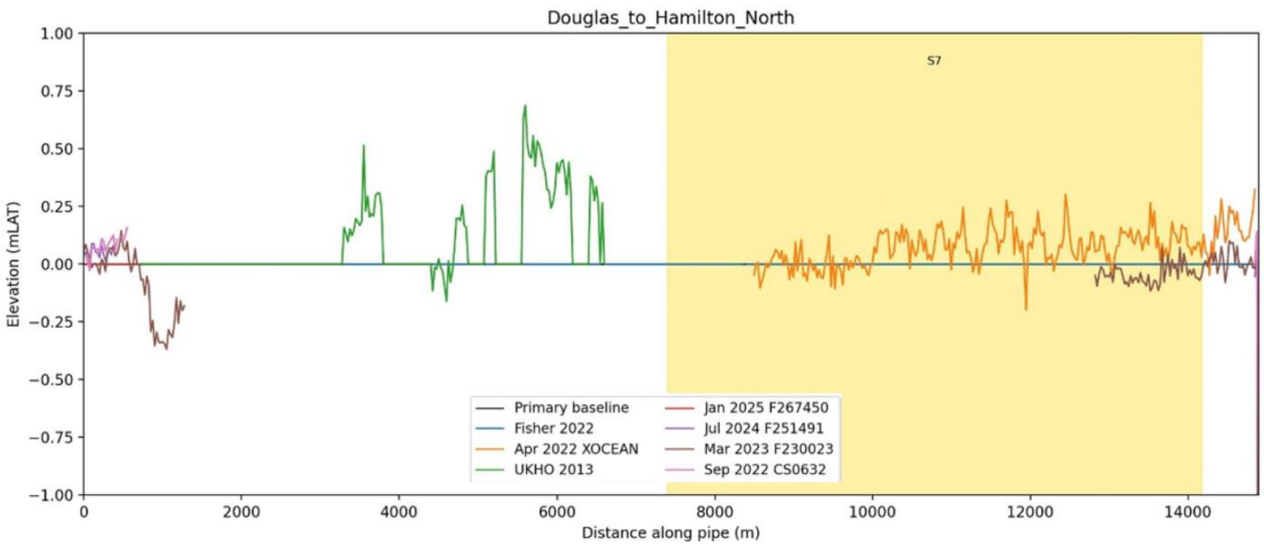


Figure 5.9 Seabed Variation across the various datasets along the route

Figure 5.10 shows the maximum variation in the seabed over the previous 80 years. For the majority of the route this is less than 2m. Spikes in sediment mobility from KP 9 to 12, associated with sandwave regions can be observed.

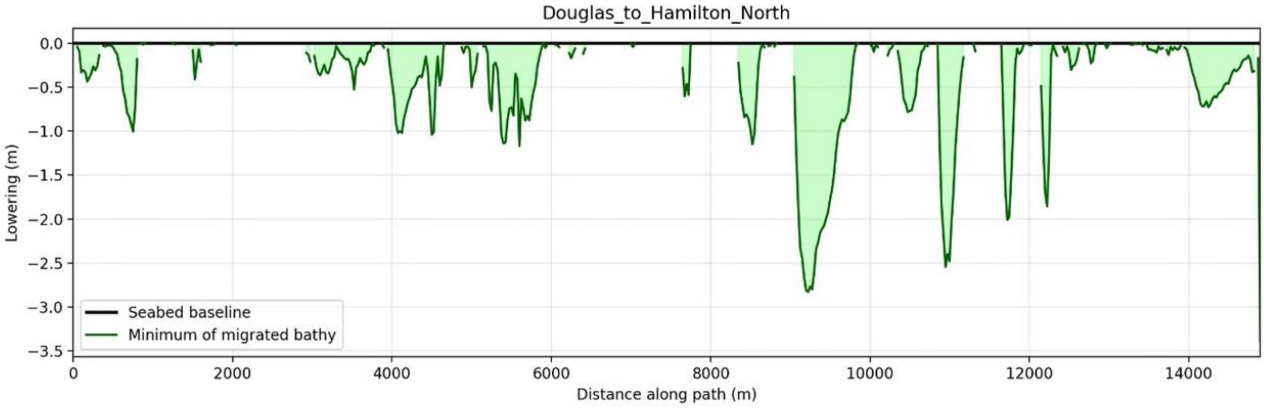


Figure 5.10 Expected depth to lowest historical bathymetry over past 80 years; Douglas to Hamilton North route

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The risk assessment for the cable route indicates that the key risks for the lifetime of the cable are fishing, shipping and sediment mobility.

Fishing

- A minimum DOL of 0.6 m is required along the route in order to mitigate the risk from bottom trawling.

Shipping

- Anchor strike risk is highest near the Douglas platform and Liverpool Bay Traffic Separation Scheme (TSS) corridor.
- Vessel traffic analysis shows:
    - High vessel density near KP 1.5 - 4 (TSS corridor).
    - Increased risk near Douglas platform due to slower vessel speeds despite lower traffic volume.
- Probabilistic analysis indicates that for a surface lay (0 m): $P_{Strike} = 3.22 \times 10^{-6}$ (return period ~310,554 years). Therefore, depth of lowering will be governed by fishing and seabed mobility risk.

Sediment Mobility

- There is a high level of seabed mobility along the route indicated by areas of sandwaves and bedforms. Assessment of historical data from 2019 to date suggest that seabed mobility is limited to the top 1m along the majority of the route.

6.2 Recommendations

It is recommended that a Depth of Cover of 2.0m as shown in Figure 6.1 below, be adopted along the entire route with the exception of crossings and locations which are protected by concrete mattresses or rock berms.

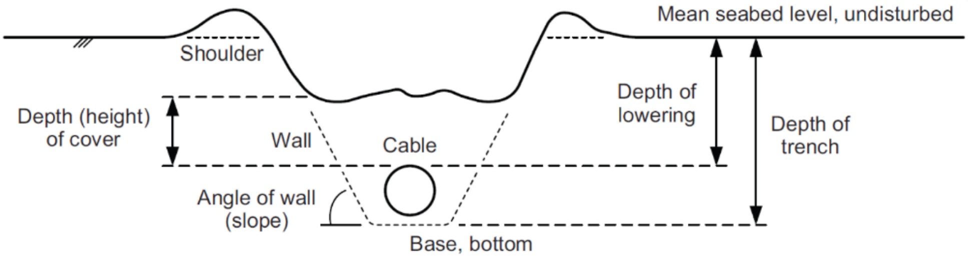


Figure 6.1 Depth of Burial Definitions

Due to issues regarding on-bottom stability [Ref 6] it is recommended to bury the cable using a Simultaneous Lay and Burial Tool. The Depth of Cover of 2.0m should be achievable with this tooling. However, due to sediment type and depth along the route it is recommended to perform some preparatory works to reduce the stiffness of the seabed along the proposed route for ease of burial with an SLB tool later.

LB CCS PROJECT

Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT
Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection

Cable Burial Risk Assessment (CBRA) Report - Douglas CCS to Hamilton Main

EX-DE	00	12/02/2026	Issued for Design	JBR	BOK	BOK	BOK	GC
Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approved	Company Approved
Revision Index								

Company logo and business name liverpool bay ccs	LCI Activity Code: **GB20250014** Project code: **000593**	Company Document ID: **10255601DSQJ1026W** Job N: JA1351
Contractor logo and business name wood.		Contractor Document ID: **OP271234-GN-REP-0010** Contract N.:
Vendor logo and business name **N/A**		Vendor Document ID: **N/A** Purchase Order N.:

Facility & Sub Facility Description Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection	Project and SoW description LB CCS PROJECT Engineering for Cable Laying	Scale N/A	Sheet of Sheets 1 / 19
Document Title Cable Burial Risk Assessment (CBRA) Report - Douglas CCS to Hamilton Main		Supersedes N: N/A Superseded by N: N/A	
		Plant Area 1	Functional Unit 0

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File Name: 10255601DSQJ1026W _EXDE_00.docx

REVISION LIST

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HOLD RECORD

TABLE OF CONTENTS

List of Figures

List of Tables

1.0 INTRODUCTION

1.1 Project Overview

Eni's Liverpool Bay CCS Transport & Storage Project (LBA CCS T&S Project) is being developed in parallel with and as a key part of the HyNet Northwest full-chain hydrogen and CCS industrial decarbonization project (the HyNet Project), which is designed to transform a region of the UK into the world's first low carbon industrial cluster by 2030. The HyNet Project was conceived in 2016 with the objective of decarbonizing the entire industrial cluster to Net Zero. The HyNet Project is being developed on a phased approach based on CO2 emissions capture from existing industrial facilities, alongside capture from new-build hydrogen generation facilities. While industrial decarbonization is the anchor, the HyNet Project builds the infrastructure backbone for a full regional hydrogen economy and leverages the opportunity to repurpose for future CCS service the existing oil and gas facilities at Point of Ayr and offshore in Liverpool Bay. CO2 storage is provided in well-known gas fields that are owned and operated by Eni UK.

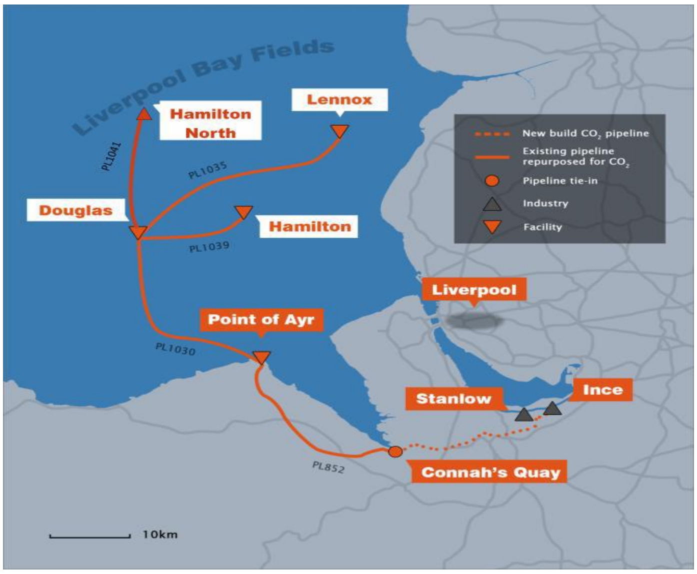


Figure 1.1 Liverpool Bay CCS Project Schematic

As part of Onshore Scope, CO2 emissions from these sources will be transported along a new-build pipeline which will connect Ince AGI with Stanlow AGI and then run from Stanlow AGI to the south of Chester, and then on to the Flint AGI (Above Ground Installation) located in the vicinity of Connah's Quay power station which is the termination point of the existing pipeline (P852). At the Flint AGI the new-build pipeline will connect to the existing pipeline (owned and operated by Eni). The existing onshore natural gas import pipeline will be repurposed to become a CO2 export pipeline and will transport the CO2 to the existing Point of Ayr (PoA) gas terminal.

As part of Offshore Scope, the existing offshore natural gas import pipeline from PoA gas terminal will be repurposed to become a CO2 export pipeline and will transport the CO2 to the Douglas complex. From the Douglas complex, CO2 will be transported along re-purposed natural gas pipelines to the Hamilton platform for injection into the Hamilton reservoir, to the Hamilton North platform for injection into the Hamilton North reservoir, to the Lennox platform for injection into the Lennox reservoir.

1.2 Wood Scope of Work

Wood has been contracted by ENI to provide offshore cable installation engineering services for the LBA CCS T&S project, for the detailed design phase of the submarine composite cable.

The Tasks involved in this study are as follows:

Table 1-1 Wood Scope of Work Task Breakdown

Task No.	Task Title
Task 1	Route and Survey Review and Design Premise
Task 2	On-Bottom Stability
Task 3	Free Span Analysis
Task 4	Cable Protection Studies
Task 4.1	**Cable Burial Risk Assessment**
Task 4.2	External Protection Design
Task 4.3	HDD Design
Task 5	Cable Crossing Design

The present document is a key deliverable for Task 4.1.

1.3 Scope of the Document

This document presents the methodology, results and conclusions of the cable burial risk assessment (CBRA) for the Douglas to Hamilton Main cable. This study was undertaken by Wood for the LBA CCS T&S project.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Term	Definition
Company	The party that initiates the project and ultimately pays for its design and construction i.e. COMPANY will generally specify technical requirements. The term “COMPANY” also includes agents or consultants authorized to act for, and on behalf of, COMPANY.
Contract	An acceptance of legal relations between two or more parties for the transfer of goods or services for value.
Contractor	A person or organization that undertakes responsibility for the execution of a contract.
Supplier	The party (Manufacturer or Vendor) that manufactures or supplies equipment or services to perform the duties specified by the Company or Contractor
Shall	A mandatory provision
Should	An advisory provision

2.2 Abbreviations

AGI	Above Ground Installation
AIS	Automatic Identification System
CBRA	Cable Burial Risk Assessment
DOL	Depth of Lowering
DWT	Deadweight tonnage
FOS	Factor of Safety
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LBA	Liverpool Bay Area
OWF	Offshore Wind Farm
PoA	Point of Ayr
SLB	Simultaneous Lay & Burial
TSS	Traffic Separation Scheme
UXO	Unexploded Explosive Ordnance

3.0 REFERENCES

References used in this document are summarised in this section.

3.1 Project Documents

[Ref 1]	10255601DGRA1002W	Cable Design Study Premise - Douglas CCS to Hamilton Main
[Ref 2]	A4814-ENI-NRA-1	Navigational Risk Assessment - RPS Group
[Ref 3]	F279461-005a (01)	Volume 5a UXO Sediment Mobility Study – FUGRO
[Ref 4]	A5538	Anatec – AIS Shipping Study Liverpool Bay CCS Cables
[Ref 5]	HA_Dredging_20251103	EMODnet Human Activities, Dredging
[Ref 6]	10255601DSCX1010W	Cable On-Bottom Stability Report - Douglas CCS to Hamilton Main

3.2 International Codes and Standards

[Ref 7]	CTC835	Cable Burial Risk Assessment Methodology Guidance
[Ref 8]	DNV-RP-F107	Risk assessment of pipeline protection

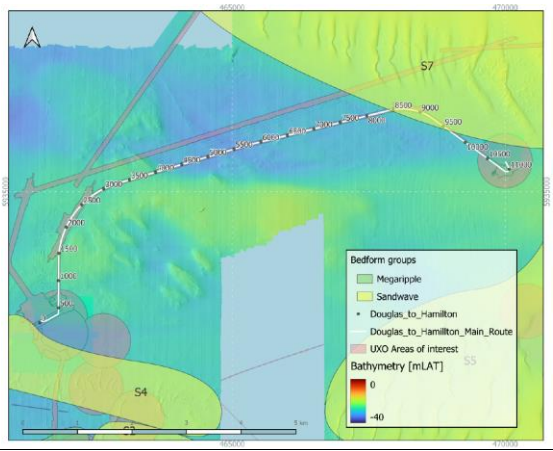
4.0 RISK ASSESSMENT

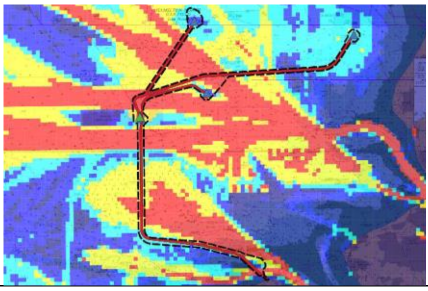
4.1 General

A risk assessment has been performed, considering risks to the cable along the proposed cable route. The outcomes are presented in Table 4-1.

The key risks for this route are fishing, shipping and sediment mobility. These are evaluated in Section 5.0.

Table 4-1 Risk Assessment

Threat Type	**Threat Description**	**General notes on treatment in CBRA**	**Risk Assessment -** Point of Ayr to Douglas
Natural	Sediment Mobility	CBRA recommends burial beneath non-mobile sediment. Pre-sweeping or increased DOL typically required.	Sand wave areas present along route. 
Natural	Seismic Activity	CBRA does not recommend burial as a means of protection from seismic activity, therefore cable routing should take this into consideration	Minor seismic activity present in LBA. Recent (09/10/25) 1.3 magnitude earthquake north of project area (53.730 -3.180). 712 seismic events recorded within 100km radius of LBA from 27/10/2000 to 27/10/2025. Average recorded magnitude: 1.22 (95% C.I: 1.17, 1.27). Max recorded magnitude: 3.9 (21/10/2002, 53.481, -2.915) Source: British Geological Survey 1998 - 2019 (c)UKRI http://www.bgs.ac.uk mailto:www-bgs@bgs.ac.uk, “BGS Earthquake Seismology.” https://www.earthquakes.bgs.ac.uk/index.html
Natural	Submarine Landslides	CBRA does not recommend burial as a means of protection from submarine landslide, therefore cable routing should take this into consideration.	

Anthropogenic	Shipping	Probabilistic assessment methodology recommended by CBRA.	Significant vessel activity at approach of cable to Douglas Platform. Platform bisects lanes of Liverpool Bay Traffic Separation Scheme (TSS). Traffic in TSS expected to rise if new OWF developments displace existing traffic [Ref 2]. 
Anthropogenic	Fishing	Typical DOL for protection from fishing equipment is 0.6 m (0.3 m x FOS 2).	Virtually no bottom trawling activity in project area.
Anthropogenic	Mining / Aggregate Extraction	CBRA does not recommend burial as a means of protection from mining / aggregate extraction activities, therefore cable routing should take this into consideration and avoid these areas.	No extraction zones adjacent.
Anthropogenic	Dredging	In areas where dredging is practiced, CBRA recommends burial below the maximum dredged level. Pre-dredging or increased DOL typically required.	Dredging recorded in Dee Estuary and Mersey River [Ref 5] however no data coinciding with work area.
Anthropogenic	3rd Party Infrastructure (Cables, Pipelines, Other)		Total of 9 cable crossings along route.
Anthropogenic	3rd Party Infrastructure (Aquaculture)		No information available on Aquaculture areas in LBA.
Anthropogenic	UXOs	CBRA does not consider burial as a means of protection from UXOs. Cable route should either divert around confirmed UXOs, or they should be removed.	No data available.
Anthropogenic	Dumping		No information available on dumping areas in LBA.

5.0 CBRA

5.1 General

The required depth of lowering shall be determined based on the key risks from the risk assessment, namely; fishing, shipping and seabed mobility. This section addresses the requirements for each risk and the Section 6.0 provides the conclusions and final recommended depth of lowering along the route.

5.2 Fishing

Based on research carried out and presented in the Carbon Trust CBRA methodology guideline [Ref 7], the maximum penetration depth for typical fishing equipment is 0.3 m, even in very soft sediments. If a typical factor of safety of 2 is applied, a minimum DOL of 0.6 m is required in areas where bottom trawling occurs.

5.3 Shipping

CBRA includes a probabilistic methodology for quantifying the risk to a cable from anchor strike.

5.3.1 Vessel Data

The vessel input data used in this study was provided by Anatec [Ref 4]. Vessel crossing data of the planned PoA to Douglas cable route was recorded based on Automatic Identification System (AIS) data between 1st November 2024 and 31st October 2025. The cable route was divided into 500m sections, from 1 to 67, in order to indicate the location of each vessel crossing. The dataset includes key vessel details such as type, length, draught and deadweight tonnage (DWT). Table 5-1 provides a summary and description of all shipping data provided in the survey.

To better reflect typical vessel traffic, temporary vessels such as those conducting surveys or temporary works were excluded. Vessel traffic contained entirely within the safety zone at the Douglas platform were also excluded to prevent stationary vessels in the vicinity of the platform from inflating numbers of crossings.

Table 5-1 Anatec Tabular Shipping Data Parameters

Parameter	Description
MMSI	Nine-digit number assigned to each unique vessel
Name	Name of vessel as broadcast on AIS
Call Sign	Sequence of letters and numbers unique to each vessel
Vessel Type	Vessel type category based on broadcast information, Anatec's in-house vessel databases and desk-based research.
Vessel Length (m)	Vessel length in metres (m) based on AIS vessel broadcast, house databases and desk-based research.
Vessel Beam (m)	Vessel width in metres (m) based on AIS vessel broadcast, house databases and desk-based research
Broadcast Draught (m)	Draught of vessel in metres (m) as broadcast on AIS
DWT	Vessel deadweight tonnage (DWT), based on desk-based research, Anatec's in-house databases and publicly available data. It is noted that certain smaller vessels do not have a valid DWT (e.g. wind farm support, recreational and fishing vessels) and will be assigned DWT of 0.
Vessel Speed (knots)	Speed of the vessel at the crossing of the cable route, based on speed broadcast on AIS close to the crossing, measured in knots.
Vessel Course	Bearing of the vessel track at the location of the crossing.
Anchor Mass (kg)	Mass of anchor carried by the vessel, in kilograms (kg), based on Anatec's Anchor Model.
Cable ID	Unique identifier for each 500m section of the cable route, numbered starting from 1 at the landfall (0-0.5km), to 67 (33.0-33.4km) at the Douglas end of the cable route. It is noted that section 67 is approximately 400m in length.

A total of 6732 vessels [Ref 4] are recorded as crossing the Douglas to Hamilton Main cable route within the one-year duration of the survey. As can be seen in Figure 5.1, the majority of vessels recorded are between 2000 and 15,000 DWT alongside a sizeable proportion of small vessels under 1000 DWT. The largest vessel recorded was a tanker, "DHT Europe", with a DWT of 317,826 tons, crossing the cable route between KP 2.5 and 3.

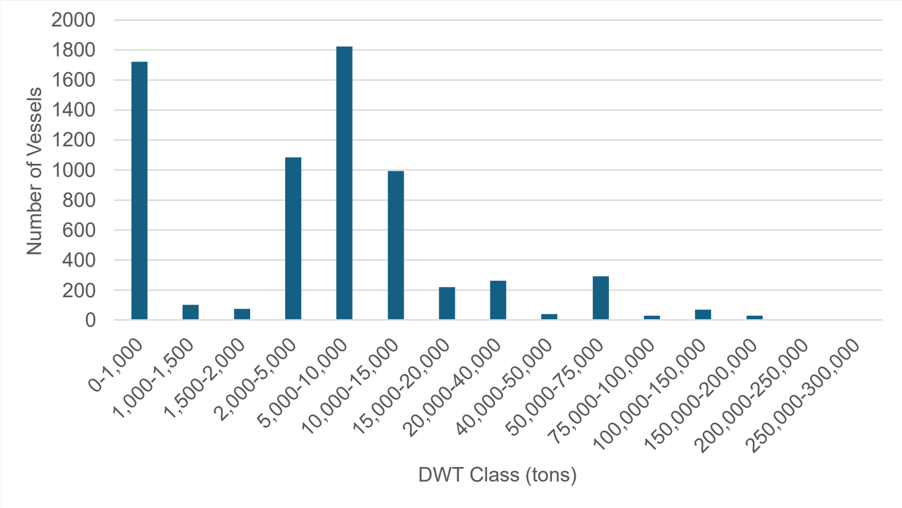


Figure 5.1 Vessel DWT distribution

Cargo vessels make up over a third of all vessel traffic, as shown in Figure 5.2. Cargo vessels account for approximately 43% followed by oil and gas vessels at approximately 31%. Fishing vessels account for a relatively small amount of vessel traffic at 6%.

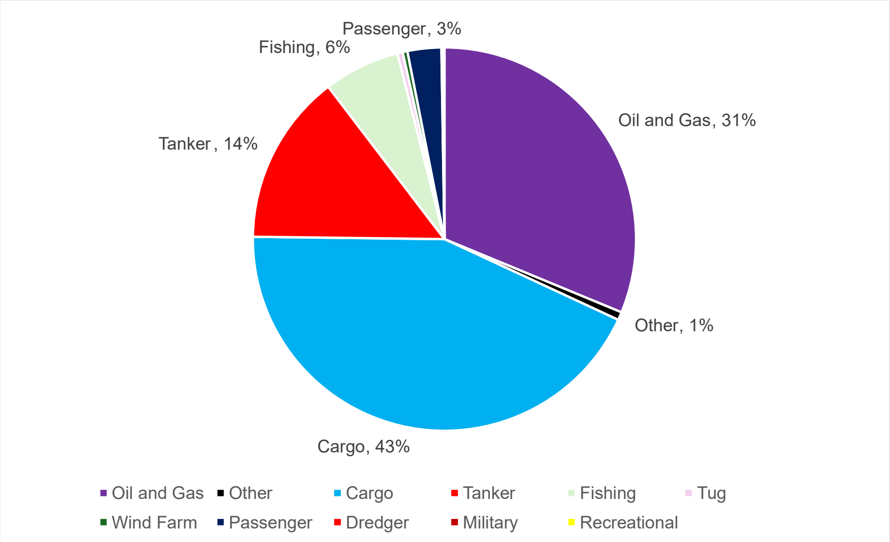


Figure 5.2 Vessel type distribution derived from [Ref 4]

As can be seen in Figure 5.3, the highest level of vessel traffic occurs at the start of the cable route between KP 0.5 and KP 1.5, dominated by oil and gas vessel movements associated with the Douglas platform. A second major concentration of traffic is observed from KP 1.5 to KP 3.5, where cargo vessels form the largest proportion of crossings, associated with Traffic Separation Scheme (TSS). Vessel activity then decreases steadily beyond KP 4, with only low levels of mixed-category traffic recorded until approximately KP 10. From KP 10 to KP 11.5, a further increase is visible, characterised primarily by oil and gas vessels, before activity reduces again towards the end of the assessed route.

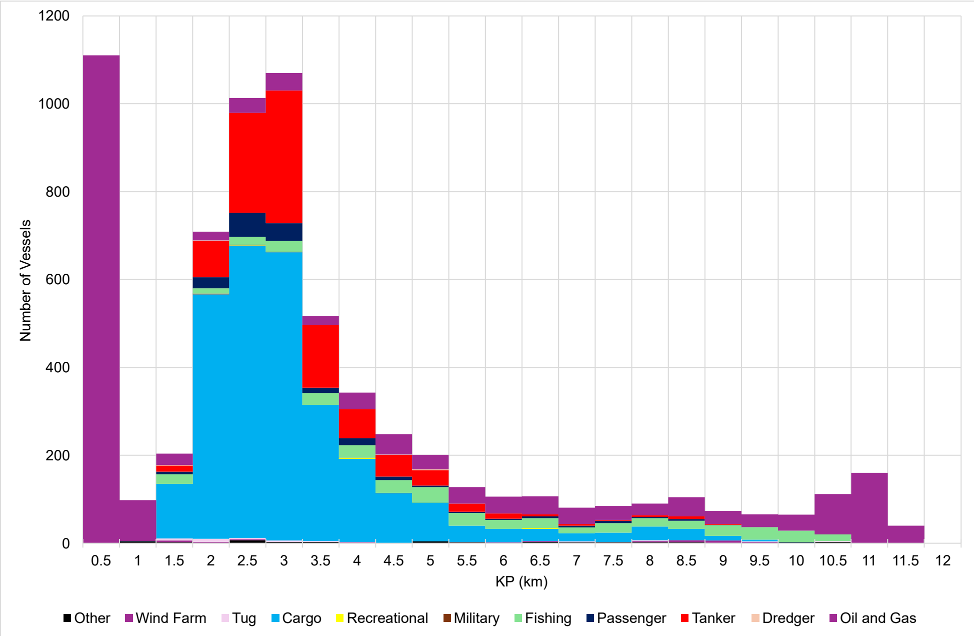


Figure 5.3 Distribution of Vessel Crossings Along Cable Route

5.3.2 Probabilistic Assessment of Shipping Threat

In order to calculate the probability of an anchor strike on the cable, the probabilistic formula shown in Figure 5.4 was used.

$$P_{Strike} = P_{Traffic\ Risk} \sum_{1}^{Number\ of\ vessels\ in\ the\ section} \left(\frac{D_{Ship\ Drag}}{V_{Ship} * 8760\ hrs\ per\ year} * P_{Incident} * P_{WD} \right)$$

Equation 1 Probabilistic formula to assess the risk from anchoring

Where:

$P_{Traffic\ Risk}$	probability modifier based on the tolerable level of risk
P_{WD}	probability modifier for nature and depth of seabed
V_{Ship} (metre/hr)	ship speed when the anchor is deployed
$D_{Ship\ Drag}$ (metres)	distance travelled by the anchor in order to be a threat to the cable
$P_{incident}$	probability of incident requiring the deployment of an anchor for that vessel size and type
8760 hrs	factor to annualise the results

Figure 5.4 Probabilistic Formula to Assess the Risk from Anchoring, Carbon Trust [Ref 7]

Values for V_{Ship} were taken from the vessel dataset [Ref 4]. $D_{Ship,Drag,}$ which represents the distance a vessel must travel while dragging its anchor to pose a threat to the cable, was set to 500 m. This value was chosen because the vessel traffic dataset was segmented into 500 m intervals. The value used for P_{WD} was determined using the table shown in Figure 5.5. KP 1.5 to 2.5 was designated as a narrow shipping channel, accounting for the presence of the Welsh channel in this section. Vessel DWT (t) and water depth were used in combination to then determine the corresponding P_{WD} value.

Vessel deadweight, DWT (t)	2,000	5,000	20,000
Vessel draft	4.0	6.0	10.0
Water Depth/Profile	Probability Modifier		
Water Depth Greater than e.g. 50m	0	0	0.1
Water Depth between e.g. 30m and 50m	0.0	0.1	0.3
Water Depth between e.g. 10m and 30m	0.3	0.5	0.9
Wide Shipping Channel with shallow water at margins	0.2	0.5	0.6
Narrow Shipping Channel with shallow water at margins	0.3	0.7	0.9
Proximity of a designated anchorage	0.9	0.9	0.9

Figure 5.5 Water Depth Classification Guidance for P_{WD}

Several published failure rates are used within the CBRA methodology, as can be seen in Figure 5.6. In this study, the "Probability of loss of control on board a ship when on collision course per pass" rate of 2.0×10^{-4}, as published in DNV-RP-F107 [Ref 8], is used. This value is used as the probability of an incident occurring requiring deployment of an anchor ($P_{incident}$).

Reference	Probability per vessel per year	Return period (years)
DNV-RP-F107: Probability of loss of control onboard when on collision course per pass (main reasons no crew on bridge, negligent/tired/drunk crew, accident or radar failure/poor visibility)	$2x10^{-4}$	5000
DNV-RP-F107: Machinery breakdown for single engine tankers in the north sea	$1.75x10^{-1}$	5.7
Kristoffersen & Monnier (1997) (SAFECO)	2.5x10-4	4000
DNV for Marine Coastguard Agency Probability of engine failure	$1.5x10^{-4}$	6667
Southampton Solent University, 15 years of Shipping Accidents: A review for WWF Average vessel loss rate per year (1997 to 2011)	$1.43x10^{-3}$	700
IMO, International Shipping Facts and Figures Average vessel loss rate per year (2006 to 2010)	$1.44x10^{-3}$	694
OGP Total loss per ship per year	$3x10^{-3}$	333

Figure 5.6 $P_{incident}$ Values Published in CBRA Methodology

A value of 1 for $P_{traffic}$ has been applied and represents a desire to protect from all vessels. The CBRA methodology allows for a lower value to be applied, if a project decision was made to protect from a lower percentile of vessels, e.g., 0.9 for 90th percentile. Using these input values, results for P_{Strike} were calculated for each instance of a vessel crossing along the cable route. These results were then divided into 500m route segments in order to investigate the change in P_{Strike} probability along the route. Additionally, the cumulative P_{Strike} from all vessel traffic was summed to determine the overall anchor strike risk for the entire cable route.

5.3.3 Anchor Penetration

In order to determine the P_{strike} for a given DOL, it is necessary to determine the expected anchor penetration depth of each vessel was calculated. The anchor specifications in Table 5-2 were used to determine the penetration depth of each vessel anchor based on the vessel DWT (tons) and sediment type in the crossing area.

Table 5-2 Anchor Specifications

ID	DWT Class (tons)			ANCHOR WEIGHT (kg)	FLUKE LENGTH (m)	Penetration depths of anchors (m)					
	min	max	DWT (tons)			Rock > 1MPa	Grainy soils and riprap	Stiff clays > 150kPa	Sandy soils	Soft to firm clays from 40 to 150kPa	Very soft clays < 40kPa
A	0	1000	0-1,000	718	0.92	0.23	0.46	0.46	0.92	1.38	3.69
B	1000	1500	1,000-1,500	846	0.96	0.24	0.48	0.48	0.96	1.44	3.84
C	1500	2000	1,500-2,000	973	1.00	0.25	0.50	0.50	1.00	1.50	3.99
D	2000	5000	2,000-5,000	1695	1.20	0.30	0.60	0.60	1.20	1.80	4.79
E	5000	10000	5,000-10,000	2771	1.46	0.37	0.73	0.73	1.46	2.20	5.86
F	10000	15000	10,000-15,000	4100	1.74	0.44	0.87	0.87	1.74	2.61	6.96
G	15000	20000	15,000-20,000	5216	1.93	0.48	0.97	0.97	1.93	2.90	7.73
H	20000	40000	20,000-40,000	7862	2.27	0.57	1.13	1.13	2.27	3.40	9.06
I	40000	50000	40,000-50,000	9042	2.37	0.59	1.18	1.18	2.37	3.55	9.47
J	50000	75000	50,000-75,000	11615	2.52	0.63	1.26	1.26	2.52	3.78	10.08
K	75000	100000	75,000-100,000	13702	2.60	0.65	1.30	1.30	2.60	3.90	10.39
L	100000	150000	100,000-150,000	16697	2.69	0.67	1.34	1.34	2.69	4.03	10.75
M	150000	200000	150,000-200,000	18582	2.76	0.69	1.38	1.38	2.76	4.14	11.04
N	200000	250000	200,000-250,000	19912	2.83	0.71	1.41	1.41	2.83	4.24	11.32
O	250000	300000	250,000-300,000	21242	2.92	0.73	1.46	1.46	2.92	4.38	11.68
P	300000	350000	300,000-350,000	23230	3.10	0.78	1.55	1.55	3.10	4.65	12.40
Q	350000	400000	350,000-400,000	26250	3.60	0.90	1.80	1.80	3.60	5.40	14.40

5.3.4 Assumptions

- AIS data covering 01/11/2024 - 31/10/2025 is assumed to be representative of typical annual vessel traffic for the purposes of P_{Strike} estimation. Inter-annual variability and atypical operational periods are not explicitly modelled.
- The anchor drag distance $D_{Ship,Drag}$ is set to 500 m to align with the 500 m route segmentation. It is assumed this provides a reasonable proxy for the distance over which a vessel in distress may drag anchor while posing a threat to the cable.
- $P_{Incident}$ is taken as 2.0×10^-4 per pass (DNV-RP-F107) and is assumed applicable to the vessel population and operating context for the route as the probability of an incident requiring anchor deployment.

5.3.5 Results

Results for P_{Strike} at different depths of lowering (DOL) can be seen in Table 5-3. At the surface level (0 m), the P_{Strike} is highest at 2.94× 10^{-5}, corresponding to an estimated return period of approximately 34,042 years. Lowering the cable by just 1 m reduces the probability by approximately 4%, while a depth of 1.5 m results in an order-of-magnitude decrease, extending the return period beyond 1 million years. At 2 m, the probability drops further to 3.37× 10^{-7}, equating to approximately 3 million years, and at 3 m, the risk is effectively eliminated (P_{Strike} = 0).

Table 5-3 P-Strike Results Table

DOL (m)	P-Strike	Return Period (Years)
0	2.94× 10^{-5}	34,042
1	2.82× 10^{-5}	35,426
1.5	7.98× 10^{-7}	1,252,477
2	3.37× 10^{-7}	2,964,698
3	0	0

As shown in Figure 5.7, P-Strike values are heavily concentrated at the start of the cable route, with a pronounced peak between KP 0.5 and KP 1 for the 0 m and 1 m Depth of Lowering (DOL) scenarios. This spike can be associated with slow moving oil & gas vessels in the vicinity of the Douglas platform. P-Strike decreases sharply with increasing DOL, with the 1–3 m DOL scenarios showing only minimal residual values across the route. Beyond KP 1, P-Strike remains extremely low along the remainder of the route for all burial depths, indicating a substantially reduced risk profile where vessel traffic levels are lower.

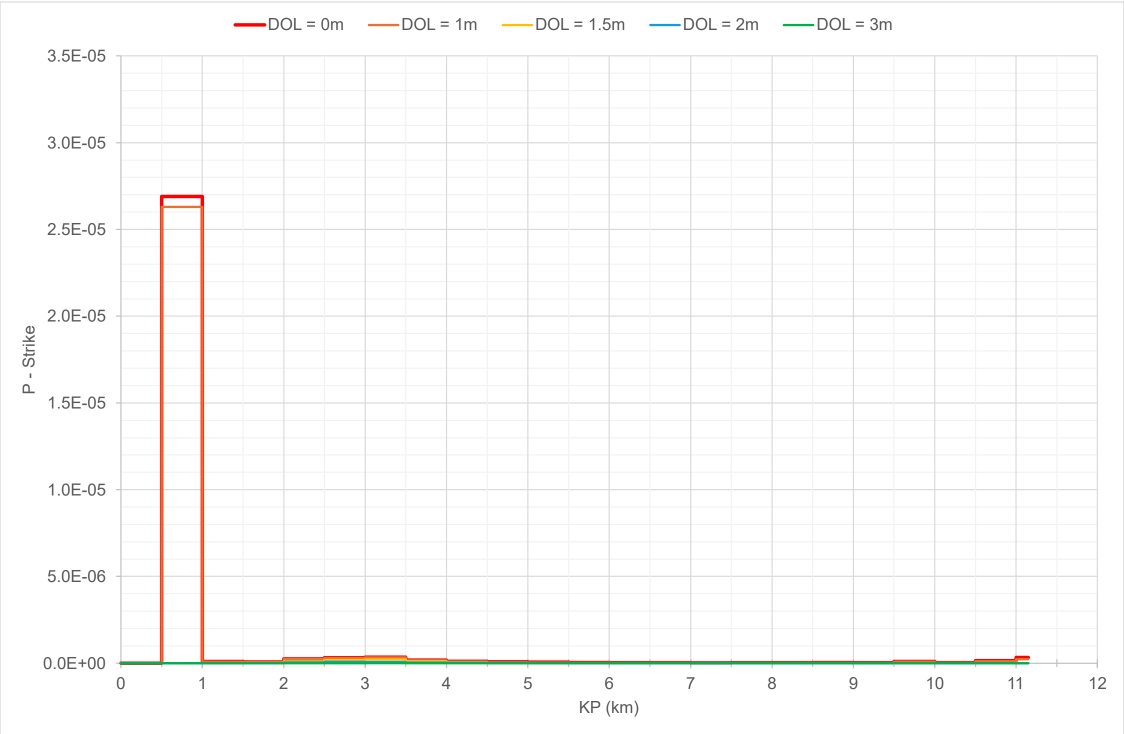


Figure 5.7 P_{Strike} Results Along Cable Route

5.4 Seabed Challenging Areas and Mobility

Figure 5.8 presents the challenging areas along the route for cable burial. In comparison to other cable routes, Douglas to Lennox a minimal amount of challenging areas associated with sediment depth, bedforms and boulder areas have been identified using the data provided.

Identification of challenging areas on Douglas to Hamilton Main route	
Boulder areas	**0%**
Risk of Sub-surface boulders	**0%**
Outcropping rocks	**0%**
Crossings	**3%**
Sediment Depth	**0%**
Seabed Gradient	**0%**
Sand With Bedforms	**0%**
Douglas to Hamilton Main Route Summary	**3%**

KP 0 2 4 6 8 10

Figure 5.8 Challenging Areas on the Route

A sediment mobility study has been performed by Fugro as part of the UXO scope of work [Ref 3]. This study is restricted to assessment of previous seabed mobility and does not provide predictions for future sediment mobility. Figure 5.9 shows the variation in seabed elevation along the route since 2013 from various surveys (none of the surveys cover the entire route) with the latest bathymetry data representing the baseline.

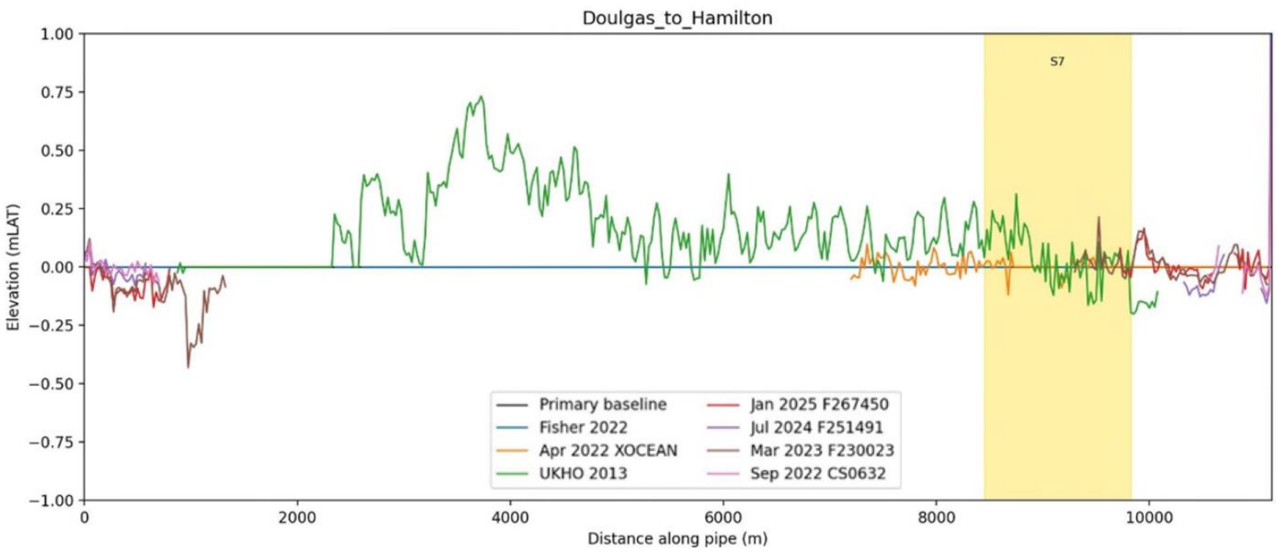


Figure 5.9 Seabed Variation across the various datasets along the route

Figure 5.10 shows the maximum variation in the seabed over the previous 80 years. For the majority of the route this is less than 2m. A significant spike in sediment mobility, greater than 2m, can be observed at KP 4.

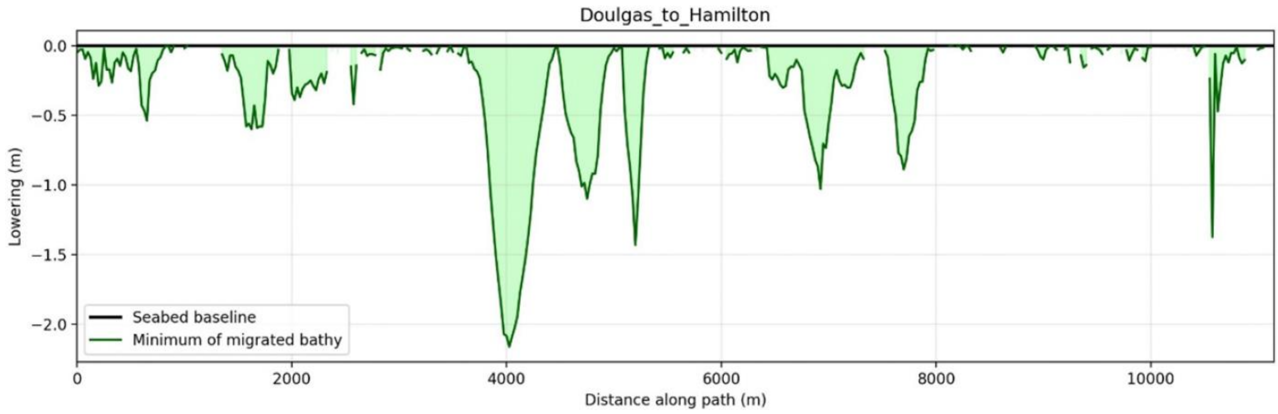


Figure 5.10 Expected depth to lowest historical bathymetry over past 80 years; Douglas to Hamilton Main route

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The risk assessment for the cable route indicates that the key risks for the lifetime of the cable are fishing, shipping and sediment mobility.

Fishing

- A minimum DOL of 0.6 m is required along the route in order to mitigate the risk from bottom trawling.

Shipping

- Anchor strike risk is highest near the Douglas platform between KP 0.5 and 1.
- Vessel traffic analysis shows:
  - High vessel density near KP 0 - 1.5 (Douglas platform) and KP 2 - 3.5 (TSS corridor).
  - Increased risk near Douglas platform due to slower vessel speeds despite lower traffic volume.
- Probabilistic analysis indicates that for a surface lay (0 m): $P_{Strike} = 2.94 \times 10^{-5}$ (return period ~34,042 years). Therefore, depth of lowering will be governed by fishing and seabed mobility risk.

Sediment Mobility

- There is a high level of seabed mobility along the route indicated by areas of sandwaves and bedforms. Assessment of historical data from 2019 to date suggest that seabed mobility is limited to the top 1m along the majority of the route.

6.2 Recommendations

It is recommended that a Depth of Cover of 2.0m as shown in Figure 6.1 below, be adopted along the entire route with the exception of crossings and locations which are protected by concrete mattresses or rock berms.

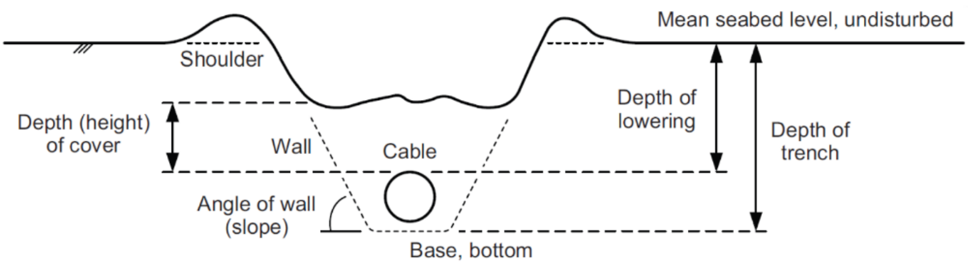


Figure 6.1 Depth of Burial Definitions

Due to issues regarding on-bottom stability [Ref 6] it is recommended to bury the cable using a Simultaneous Lay and Burial Tool. The Depth of Cover of 2.0m should be achievable with this tooling. However, due to sediment type and depth along the route it is recommended to perform some preparatory works to reduce the stiffness of the seabed along the proposed route for ease of burial with an SLB tool later.

LB CCS PROJECT

Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT
Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection

Cable Burial Risk Assessment (CBRA) Report - Douglas CCS to Lennox

EX-DE	00	12/02/2026	Issued for Design	JBR	BOK	BOK	BOK	GC
Validity Status	Revision Number	Date	Description	Prepared by	Checked by	Approved by	Contractor Approved	Company Approved
Revision Index								

Company logo and business name liverpool bay ccs	LCI Activity Code: **GB20250014** Project code: **000593**	Company Document ID: **10245601DSQJ1028W** Job N: JA1351
Contractor logo and business name wood.		Contractor Document ID: **OP271234-GN-REP-0012** Contract N.:
Vendor logo and business name **N/A**		Vendor Document ID: **N/A** Purchase Order N.:

Facility & Sub Facility Description Sealine DOUGLAS CCS - POINT OF AYR GAS PLANT Onshore plant at Point of Ayr to Douglas CCS Platform Cable connection	Project and SoW description LB CCS PROJECT Engineering for Cable Laying	Scale N/A	Sheet of Sheets 1 / 19
Document Title Cable Burial Risk Assessment (CBRA) Report - Douglas CCS to Lennox		Supersedes N: N/A Superseded by N: N/A	
		Plant Area 1	Functional Unit 0

REVISION LIST

00	Issued for Design

HOLD RECORD

TABLE OF CONTENTS

List of Figures

List of Tables

1.0 INTRODUCTION

1.1 Project Overview

Eni's Liverpool Bay CCS Transport & Storage Project (LBA CCS T&S Project) is being developed in parallel with and as a key part of the HyNet Northwest full-chain hydrogen and CCS industrial decarbonization project (the HyNet Project), which is designed to transform a region of the UK into the world's first low carbon industrial cluster by 2030. The HyNet Project was conceived in 2016 with the objective of decarbonizing the entire industrial cluster to Net Zero. The HyNet Project is being developed on a phased approach based on CO2 emissions capture from existing industrial facilities, alongside capture from new-build hydrogen generation facilities. While industrial decarbonization is the anchor, the HyNet Project builds the infrastructure backbone for a full regional hydrogen economy and leverages the opportunity to repurpose for future CCS service the existing oil and gas facilities at Point of Ayr and offshore in Liverpool Bay. CO2 storage is provided in well-known gas fields that are owned and operated by Eni UK.

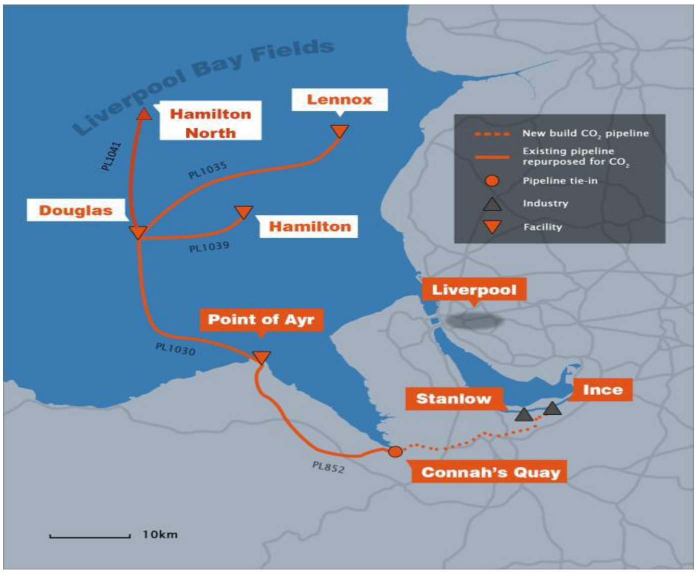


Figure 1.1 Liverpool Bay CCS Project Schematic

As part of Onshore Scope, CO2 emissions from these sources will be transported along a new-build pipeline which will connect Ince AGI with Stanlow AGI and then run from Stanlow AGI to the south of Chester, and then on to the Flint AGI (Above Ground Installation) located in the vicinity of Connah's Quay power station which is the termination point of the existing pipeline (P852). At the Flint AGI the new-build pipeline will connect to the existing pipeline (owned and operated by Eni). The existing onshore natural gas import pipeline will be repurposed to become a CO2 export pipeline and will transport the CO2 to the existing Point of Ayr (PoA) gas terminal.

As part of Offshore Scope, the existing offshore natural gas import pipeline from PoA gas terminal will be repurposed to become a CO2 export pipeline and will transport the CO2 to the Douglas complex. From the Douglas complex, CO2 will be transported along re-purposed natural gas pipelines to the Hamilton platform for injection into the Hamilton reservoir, to the Hamilton North platform for injection into the Hamilton North reservoir, to the Lennox platform for injection into the Lennox reservoir.

1.2 Wood Scope of Work

Wood has been contracted by ENI to provide offshore cable installation engineering services for the LBA CCS T&S project, for the detailed design phase of the submarine composite cable.

The Tasks involved in this study are as follows:

Table 1-1 Wood Scope of Work Task Breakdown

Task No.	Task Title
Task 1	Route and Survey Review and Design Premise
Task 2	On-Bottom Stability
Task 3	Free Span Analysis
Task 4	Cable Protection Studies
Task 4.1	**Cable Burial Risk Assessment**
Task 4.2	External Protection Design
Task 4.3	HDD Design
Task 5	Cable Crossing Design

The present document is a key deliverable for Task 4.1.

1.3 Scope of the Document

This document presents the methodology, results and conclusions of the cable burial risk assessment (CBRA) for the Douglas to Lennox cable. This study was undertaken by Wood for the LBA CCS T&S project.

2.0 DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

Term	Definition
Company	The party that initiates the project and ultimately pays for its design and construction i.e. COMPANY will generally specify technical requirements. The term “COMPANY” also includes agents or consultants authorized to act for, and on behalf of, COMPANY.
Contract	An acceptance of legal relations between two or more parties for the transfer of goods or services for value.
Contractor	A person or organization that undertakes responsibility for the execution of a contract.
Supplier	The party (Manufacturer or Vendor) that manufactures or supplies equipment or services to perform the duties specified by the Company or Contractor
Shall	A mandatory provision
Should	An advisory provision

2.2 Abbreviations

AGI	Above Ground Installation
AIS	Automatic Identification System
CBRA	Cable Burial Risk Assessment
DOL	Depth of Lowering
DWT	Deadweight tonnage
FOS	Factor of Safety
KP	Kilometre Point
LAT	Lowest Astronomical Tide
LBA	Liverpool Bay Area
OWF	Offshore Wind Farm
PoA	Point of Ayr
SLB	Simultaneous Lay & Burial
TSS	Traffic Separation Scheme
UXO	Unexploded Explosive Ordnance

3.0 REFERENCES

References used in this document are summarised in this section.

3.1 Project Documents

[Ref 1]	10245601DGRA1004W	Cable Design Study Premise - Douglas CCS to Lennox
[Ref 2]	A4814-ENI-NRA-1	Navigational Risk Assessment - RPS Group
[Ref 3]	F279461-005a (01)	Volume 5a UXO Sediment Mobility Study – FUGRO
[Ref 4]	A5538	Anatec – AIS Shipping Study Liverpool Bay CCS Cables
[Ref 5]	HA_Dredging_20251103	EMODnet Human Activities, Dredging
[Ref 6]	10245601DSCX1012W	Cable On-Bottom Stability Report - Douglas CCS to Lennox

3.2 International Codes and Standards

[Ref 7]	CTC835	Cable Burial Risk Assessment Methodology Guidance
[Ref 8]	DNV-RP-F107	Risk assessment of pipeline protection

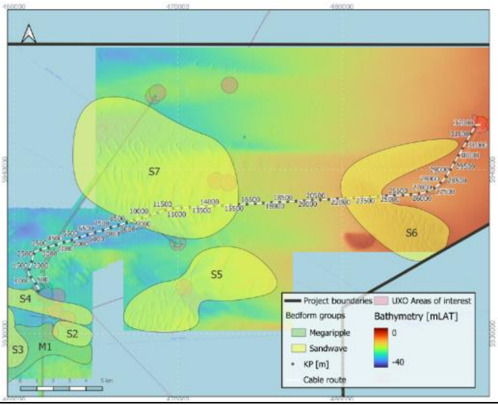
4.0 RISK ASSESSMENT

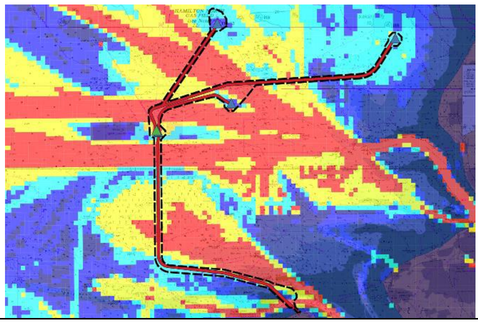
4.1 General

A risk assessment has been performed, considering risks to the cable along the proposed cable route. The outcomes are presented in Table 4-1.

The key risks for this route are fishing, shipping and sediment mobility. These are evaluated in Section 5.0.

Table 4-1 Risk Assessment

Threat Type	**Threat Description**	**General notes on treatment in CBRA**	**Risk Assessment -** Point of Ayr to Douglas
Natural	Sediment Mobility	CBRA recommends burial beneath non-mobile sediment. Pre-sweeping or increased DOL typically required.	Sand wave areas present along route. 
Natural	Seismic Activity	CBRA does not recommend burial as a means of protection from seismic activity, therefore cable routing should take this into consideration	Minor seismic activity present in LBA. Recent (09/10/25) 1.3 magnitude earthquake north of project area (53.730 -3.180). 712 seismic events recorded within 100km radius of LBA from 27/10/2000 to 27/10/2025. Average recorded magnitude: 1.22 (95% C.I: 1.17, 1.27). Max recorded magnitude: 3.9 (21/10/2002, 53.481, -2.915) Source: British Geological Survey 1998 - 2019 (c)UKRI http://www.bgs.ac.uk mailto:www-bgs@bgs.ac.uk, “BGS Earthquake Seismology.” https://www.earthquakes.bgs.ac.uk/index.html
Natural	Submarine Landslides	CBRA does not recommend burial as a means of protection from submarine landslide, therefore cable routing should take this into consideration.	Slope of 9.2° on sandwave close to KP 9.5.

Anthropogenic	Shipping	Probabilistic assessment methodology recommended by CBRA.	Significant vessel activity at approach of cable to Douglas Platform. Platform bisects lanes of Liverpool Bay Traffic Separation Scheme (TSS). Traffic in TSS expected to rise if new OWF developments displace existing traffic [Ref 2]. 
Anthropogenic	Fishing	Typical DOL for protection from fishing equipment is 0.6 m (0.3 m x FOS 2).	Virtually no bottom trawling activity in project area.
Anthropogenic	Mining / Aggregate Extraction	CBRA does not recommend burial as a means of protection from mining / aggregate extraction activities, therefore cable routing should take this into consideration and avoid these areas.	No extraction zones adjacent.
Anthropogenic	Dredging	In areas where dredging is practiced, CBRA recommends burial below the maximum dredged level. Pre-dredging or increased DOL typically required.	Dredging recorded in Dee Estuary and Mersey River [Ref 5] however no data coinciding with work area.
Anthropogenic	3rd Party Infrastructure (Cables, Pipelines, Other)		Total of 6 cable crossings along route.
Anthropogenic	3rd Party Infrastructure (Aquaculture)		No information available on Aquaculture areas in LBA.
Anthropogenic	UXOs	CBRA does not consider burial as a means of protection from UXOs. Cable route should either divert around confirmed UXOs, or they should be removed.	No data available.
Anthropogenic	Dumping		No information available on dumping areas in LBA.

5.0 CBRA

5.1 General

The required depth of lowering shall be determined based on the key risks from the risk assessment, namely; fishing, shipping and seabed mobility. This section addresses the requirements for each risk and the Section 6.0 provides the conclusions and final recommended depth of lowering along the route.

5.2 Fishing

Based on research carried out and presented in the Carbon Trust CBRA methodology guideline [Ref 7], the maximum penetration depth for typical fishing equipment is 0.3 m, even in very soft sediments. If a typical factor of safety of 2 is applied, a minimum DOL of 0.6 m is required in areas where bottom trawling occurs.

5.3 Shipping

CBRA includes a probabilistic methodology for quantifying the risk to a cable from anchor strike.

5.3.1 Vessel Data

The vessel input data used in this study was provided by Anatec [Ref 4]. Vessel crossing data of the planned PoA to Douglas cable route was recorded based on Automatic Identification System (AIS) data between 1st November 2024 and 31st October 2025. The cable route was divided into 500m sections, from 1 to 67, in order to indicate the location of each vessel crossing. The dataset includes key vessel details such as type, length, draught and deadweight tonnage (DWT). Table 5-1 provides a summary and description of all shipping data provided in the survey.

To better reflect typical vessel traffic, temporary vessels such as those conducting surveys or temporary works were excluded. Vessel traffic contained entirely within the safety zone at the Douglas platform were also excluded to prevent stationary vessels in the vicinity of the platform from inflating numbers of crossings.

Table 5-1 Anatec Tabular Shipping Data Parameters

Parameter	Description
MMSI	Nine-digit number assigned to each unique vessel
Name	Name of vessel as broadcast on AIS
Call Sign	Sequence of letters and numbers unique to each vessel
Vessel Type	Vessel type category based on broadcast information, Anatec's in-house vessel databases and desk-based research.
Vessel Length (m)	Vessel length in metres (m) based on AIS vessel broadcast, house databases and desk-based research.
Vessel Beam (m)	Vessel width in metres (m) based on AIS vessel broadcast, house databases and desk-based research
Broadcast Draught (m)	Draught of vessel in metres (m) as broadcast on AIS
DWT	Vessel deadweight tonnage (DWT), based on desk-based research, Anatec's in-house databases and publicly available data. It is noted that certain smaller vessels do not have a valid DWT (e.g. wind farm support, recreational and fishing vessels) and will be assigned DWT of 0.
Vessel Speed (knots)	Speed of the vessel at the crossing of the cable route, based on speed broadcast on AIS close to the crossing, measured in knots.
Vessel Course	Bearing of the vessel track at the location of the crossing.
Anchor Mass (kg)	Mass of anchor carried by the vessel, in kilograms (kg), based on Anatec's Anchor Model.
Cable ID	Unique identifier for each 500m section of the cable route, numbered starting from 1 at the landfall (0-0.5km), to 67 (33.0-33.4km) at the Douglas end of the cable route. It is noted that section 67 is approximately 400m in length.

A total of 9512 vessels [Ref 4] are recorded as crossing the Douglas to Lennox cable route within the one-year duration of the survey. As can be seen in Figure 5.1, the majority of vessels recorded are between 2000 and 15,000 DWT alongside a sizeable proportion of small vessels under 1000 DWT. The largest vessel recorded was a tanker, “DHT Europe”, with a DWT of 317,826 tons, crossing the cable route between KP 2.5 and 3.

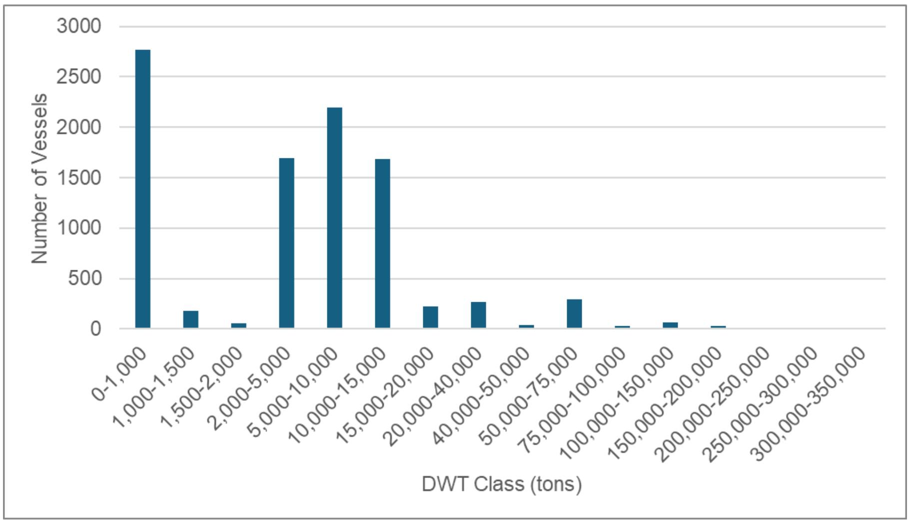


Figure 5.1 Vessel DWT distribution

Cargo vessels make up approximately a third of all vessel traffic, as shown in Figure 5.2. Passenger vessels account for approximately 23% followed by oil and gas vessels at approximately 19%. Fishing vessels account for a relatively small amount of vessel traffic at 6%.

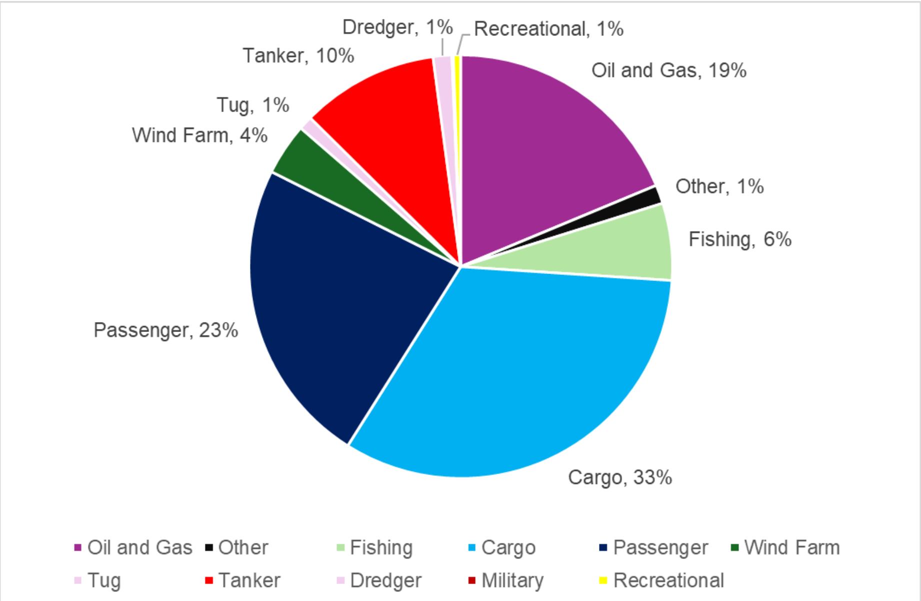


Figure 5.2 Vessel type distribution derived from [Ref 4]

As can be seen in Figure 5.3, oil & gas vessels are prevalent at the beginning of the route, close to the Douglas platform. The most significant spike in vessel traffic can be observed from KP 1.5 to 4. The majority of this traffic consists of cargo and tanker vessels. This can be attributed to the use of the Liverpool Bay Traffic Separation Scheme (TSS) corridor, which intersects the cable route at this section. Passenger vessel traffic is particularly prevalent from KP 10.5 to 16. Vessel traffic declines for the remainder of the route, with a slight increase in oil & gas vessels at the Lennox platform.

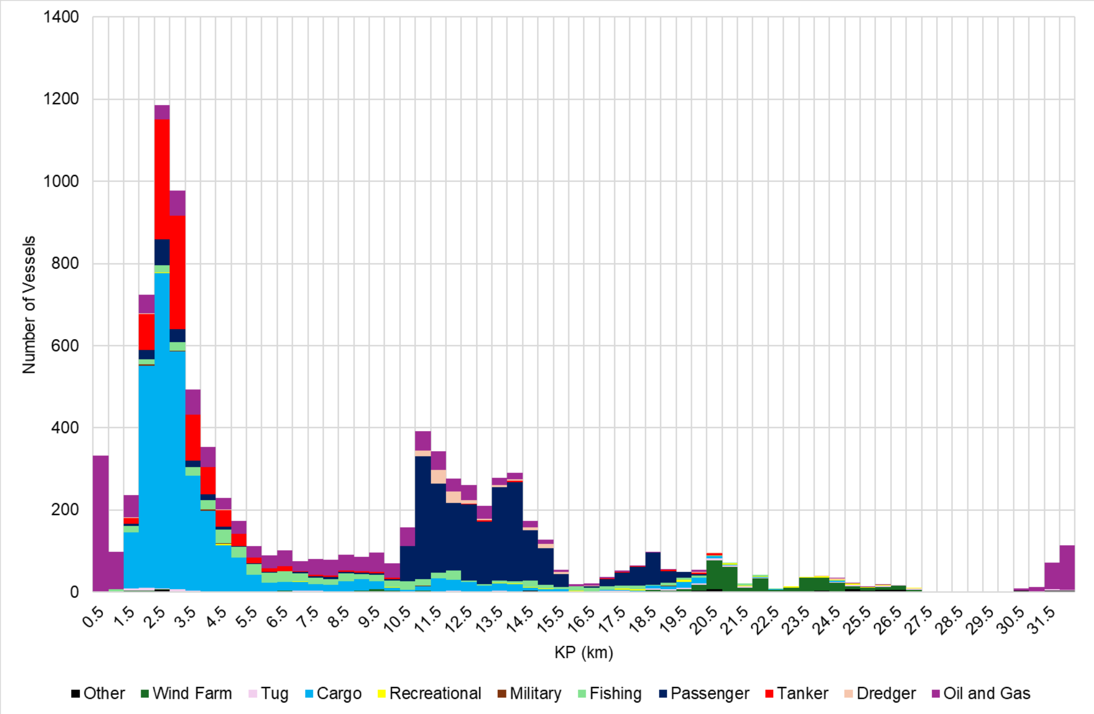


Figure 5.3 Distribution of Vessel Crossings Along Cable Route

5.3.2 Probabilistic Assessment of Shipping Threat

In order to calculate the probability of an anchor strike on the cable, the probabilistic formula shown in Figure 5.4 was used.

$$P_{Strike} = P_{Traffic\ Risk} \sum_{1}^{Number\ of\ vessels\ in\ the\ section} \left(\frac{D_{Ship\ Drag}}{V_{Ship} * 8760\ hrs\ per\ year} * P_{Incident} * P_{WD} \right)$$

Equation 1 Probabilistic formula to assess the risk from anchoring

Where:

$P_{Traffic\ Risk}$	probability modifier based on the tolerable level of risk
P_{WD}	probability modifier for nature and depth of seabed
V_{Ship} (metre/hr)	ship speed when the anchor is deployed
$D_{Ship\ Drag}$ (metres)	distance travelled by the anchor in order to be a threat to the cable
$P_{incident}$	probability of incident requiring the deployment of an anchor for that vessel size and type
8760 hrs	factor to annualise the results

Figure 5.4 Probabilistic Formula to Assess the Risk from Anchoring, Carbon Trust [Ref 7]

Values for V_{Ship} were taken from the vessel dataset [Ref 4]. $D_{Ship,Drag}$, which represents the distance a vessel must travel while dragging its anchor to pose a threat to the cable, was set to 500 m. This value was chosen because the vessel traffic dataset was segmented into 500 m intervals. The value used for P_{WD} was determined using the table shown in Figure 5.5. KP 1.5 to 2.5 was designated as a narrow shipping channel, accounting for the presence of the Welsh channel in this section. Vessel DWT (t) and water depth were used in combination to then determine the corresponding P_{WD} value.

Vessel deadweight, DWT (t)	2,000	5,000	20,000
Vessel draft	4.0	6.0	10.0
Water Depth/Profile	Probability Modifier		
Water Depth Greater than e.g. 50m	0	0	0.1
Water Depth between e.g. 30m and 50m	0.0	0.1	0.3
Water Depth between e.g. 10m and 30m	0.3	0.5	0.9
Wide Shipping Channel with shallow water at margins	0.2	0.5	0.6
Narrow Shipping Channel with shallow water at margins	0.3	0.7	0.9
Proximity of a designated anchorage	0.9	0.9	0.9

Figure 5.5 Water Depth Classification Guidance for P_{WD}

Several published failure rates are used within the CBRA methodology, as can be seen in Figure 5.6. In this study, the "Probability of loss of control on board a ship when on collision course per pass" rate of 2.0 × 10^{-4}, as published in DNV-RP-F107 [Ref 8], is used. This value is used as the probability of an incident occurring requiring deployment of an anchor ($P_{incident}$).

Reference	Probability per vessel per year	Return period (years)
DNV-RP-F107: Probability of loss of control onboard when on collision course per pass (main reasons no crew on bridge, negligent/tired/drunk crew, accident or radar failure/poor visibility)	$2x10^{-4}$	5000
DNV-RP-F107: Machinery breakdown for single engine tankers in the north sea	$1.75x10^{-1}$	5.7
Kristoffersen & Monnier (1997) (SAFECO)	2.5x10-4	4000
DNV for Marine Coastguard Agency Probability of engine failure	$1.5x10^{-4}$	6667
Southampton Solent University, 15 years of Shipping Accidents: A review for WWF Average vessel loss rate per year (1997 to 2011)	$1.43x10^{-3}$	700
IMO, International Shipping Facts and Figures Average vessel loss rate per year (2006 to 2010)	$1.44x10^{-3}$	694
OGP Total loss per ship per year	$3x10^{-3}$	333

Figure 5.6 $P_{incident}$ Values Published in CBRA Methodology

A value of 1 for $P_{traffic}$ has been applied and represents a desire to protect from all vessels. The CBRA methodology allows for a lower value to be applied, if a project decision was made to protect from a lower percentile of vessels, e.g., 0.9 for 90th percentile. Using these input values, results for P_{Strike} were calculated for each instance of a vessel crossing along the cable route. These results were then divided into 500m route segments in order to investigate the change in P_{Strike} probability along the route. Additionally, the cumulative P_{Strike} from all vessel traffic was summed to determine the overall anchor strike risk for the entire cable route.

5.3.3 Anchor Penetration

In order to determine the P_{strike} for a given DOL, it is necessary to determine the expected anchor penetration depth of each vessel was calculated. The anchor specifications in Table 5-2 were used to determine the penetration depth of each vessel anchor based on the vessel DWT (tons) and sediment type in the crossing area.

Table 5-2 Anchor Specifications

ID	DWT Class (tons)			ANCHOR WEIGHT (kg)	FLUKE LENGTH (m)	Penetration depths of anchors (m)					
	min	max	DWT (tons)			Rock > 1MPa	Grainy soils and riprap	Stiff clays > 150kPa	Sandy soils	Soft to firm clays from 40 to 150kPa	Very soft clays < 40kPa
A	0	1000	0-1,000	718	0.92	0.23	0.46	0.46	0.92	1.38	3.69
B	1000	1500	1,000-1,500	846	0.96	0.24	0.48	0.48	0.96	1.44	3.84
C	1500	2000	1,500-2,000	973	1.00	0.25	0.50	0.50	1.00	1.50	3.99
D	2000	5000	2,000-5,000	1695	1.20	0.30	0.60	0.60	1.20	1.80	4.79
E	5000	10000	5,000-10,000	2771	1.46	0.37	0.73	0.73	1.46	2.20	5.86
F	10000	15000	10,000-15,000	4100	1.74	0.44	0.87	0.87	1.74	2.61	6.96
G	15000	20000	15,000-20,000	5216	1.93	0.48	0.97	0.97	1.93	2.90	7.73
H	20000	40000	20,000-40,000	7862	2.27	0.57	1.13	1.13	2.27	3.40	9.06
I	40000	50000	40,000-50,000	9042	2.37	0.59	1.18	1.18	2.37	3.55	9.47
J	50000	75000	50,000-75,000	11615	2.52	0.63	1.26	1.26	2.52	3.78	10.08
K	75000	100000	75,000-100,000	13702	2.60	0.65	1.30	1.30	2.60	3.90	10.39
L	100000	150000	100,000-150,000	16697	2.69	0.67	1.34	1.34	2.69	4.03	10.75
M	150000	200000	150,000-200,000	18582	2.76	0.69	1.38	1.38	2.76	4.14	11.04
N	200000	250000	200,000-250,000	19912	2.83	0.71	1.41	1.41	2.83	4.24	11.32
O	250000	300000	250,000-300,000	21242	2.92	0.73	1.46	1.46	2.92	4.38	11.68
P	300000	350000	300,000-350,000	23230	3.10	0.78	1.55	1.55	3.10	4.65	12.40
Q	350000	400000	350,000-400,000	26250	3.60	0.90	1.80	1.80	3.60	5.40	14.40

5.3.4 Assumptions

- AIS data covering 01/11/2024 - 31/10/2025 is assumed to be representative of typical annual vessel traffic for the purposes of P_{Strike} estimation. Inter-annual variability and atypical operational periods are not explicitly modelled.
- The anchor drag distance $D_{Ship,Drag}$ is set to 500 m to align with the 500 m route segmentation. It is assumed this provides a reasonable proxy for the distance over which a vessel in distress may drag anchor while posing a threat to the cable.
- $P_{Incident}$ is taken as 2.0×10^-4 per pass (DNV-RP-F107) and is assumed applicable to the vessel population and operating context for the route as the probability of an incident requiring anchor deployment.

5.3.5 Results

Results for P_{Strike} at different depths of lowering (DOL) can be seen in Table 5-3. At the surface level (0 m), the P_{Strike} is highest at 4.93×10^{-6}, corresponding to an estimated return period of approximately 202,857 years. Lowering the cable by just 1 m reduces the probability by approximately 32%, while a depth of 1.5 m results in an order-of-magnitude decrease, extending the return period beyond 1 million years. At 2 m, the probability drops further to 3.26×10^{-7}, equating to over 3 million years, and at 3 m, the risk is effectively eliminated (P_{Strike} = 0).

Table 5-3 P-Strike Results Table

DOL (m)	P-Strike	Return Period (Years)
0	4.93×10^{-6}	202,857
1	3.33×10^{-6}	299,924
1.5	8.81×10^{-7}	1,135,105
2	3.26×10^{-7}	3,064,775
3	0	0

A significant increase in P_{Strike} can be observed in Figure 5.7 at the start of the cable route from KP 0.5 to 1, close to the Douglas platform. Increases in P_{Strike} can also be seen at the Liverpool Bay TSS corridor from approximately KP 2 to 4 and in the Liverpool Bay TSS corridor from KP 29 to 32.5. These spikes are attributable to increased vessel traffic in these sections, as discussed in Section 5.3.1.

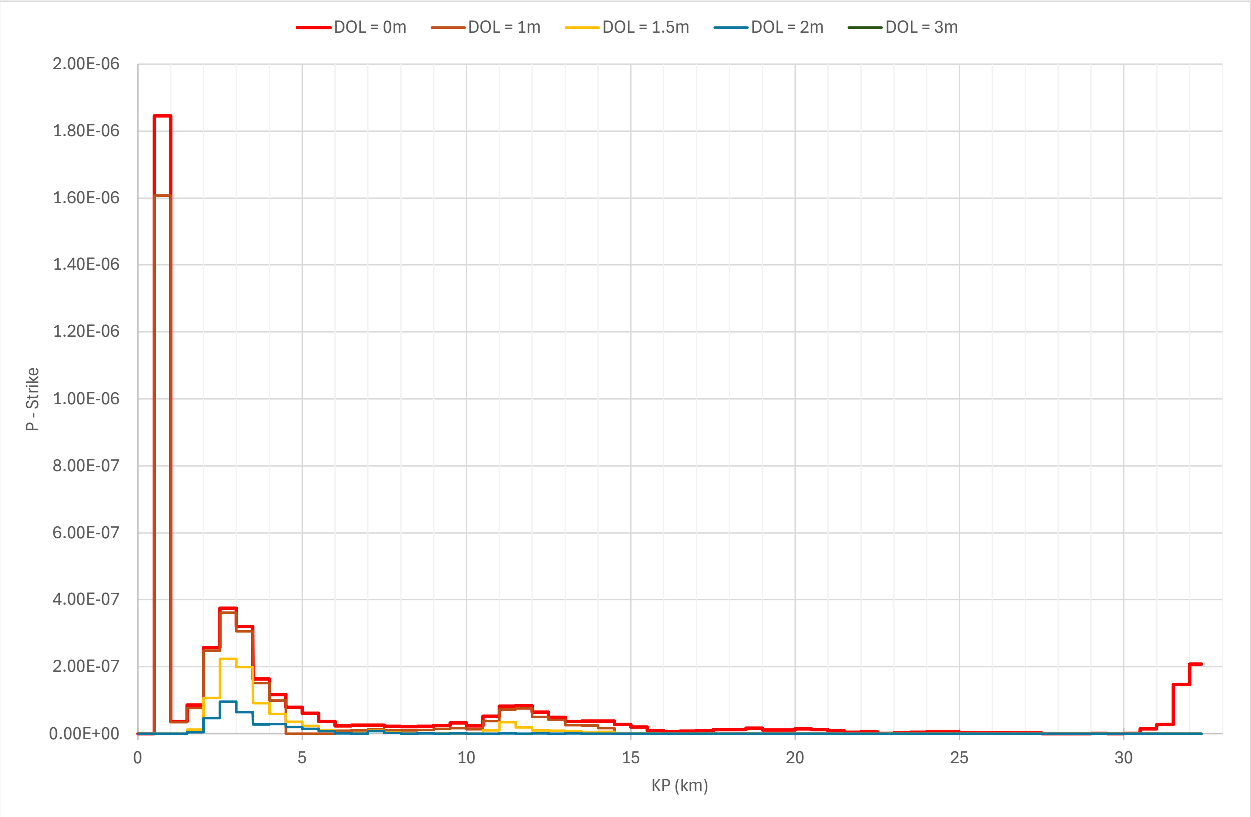


Figure 5.7 P_{Strike} Results Along Cable Route

5.4 Seabed Challenging Areas and Mobility

Figure 5.8 presents the challenging areas along the route for cable burial. In particular, sandwaves and bedforms and associated seabed mobility is a challenge over a significant length of the route. This drives the selection of the burial depth in order to avoid cable exposures over the lifetime of the asset. In addition, sediment depth is a challenge.

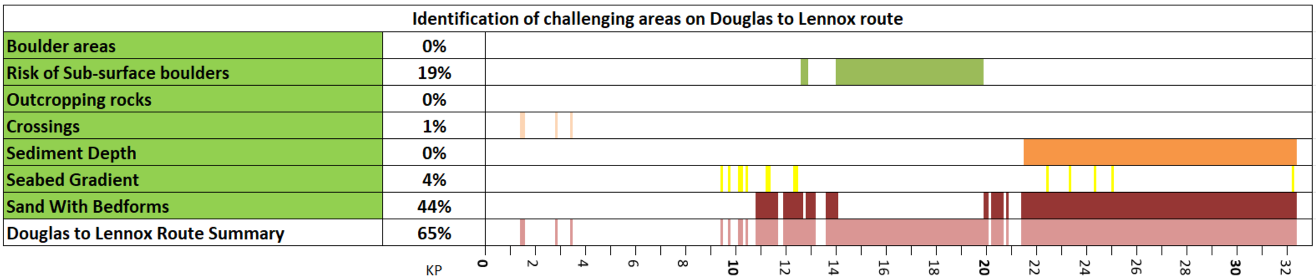


Figure 5.8 Challenging Areas on the Route

A sediment mobility study has been performed by Fugro as part of the UXO scope of work [Ref 3]. This study is restricted to assessment of previous seabed mobility and does not provide predictions for future sediment mobility. Figure 5.9 shows the variation in seabed elevation along the route since 2013 from various surveys (none of the surveys cover the entire route) with the latest bathymetry data representing the baseline.

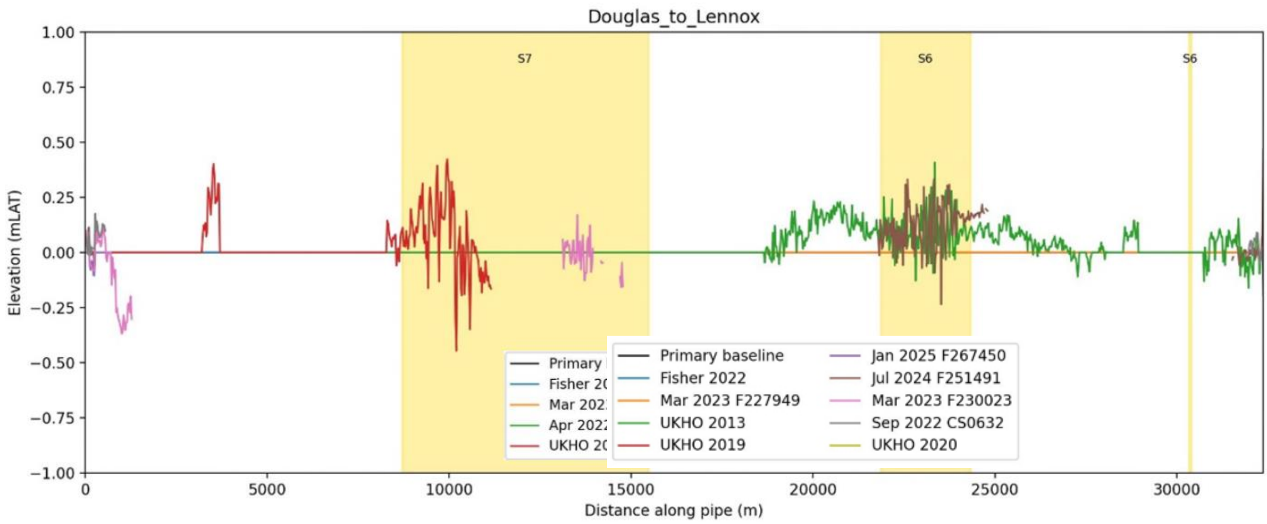


Figure 5.9 Seabed Variation across the various datasets along the route

Figure 5.10 shows the maximum variation in the seabed over the previous 80 years. For the majority of the route this is less than 2m. Spikes in sediment mobility from KP 9 to 15 and KP 22.5 to 25, associated with sandwave regions can be observed.

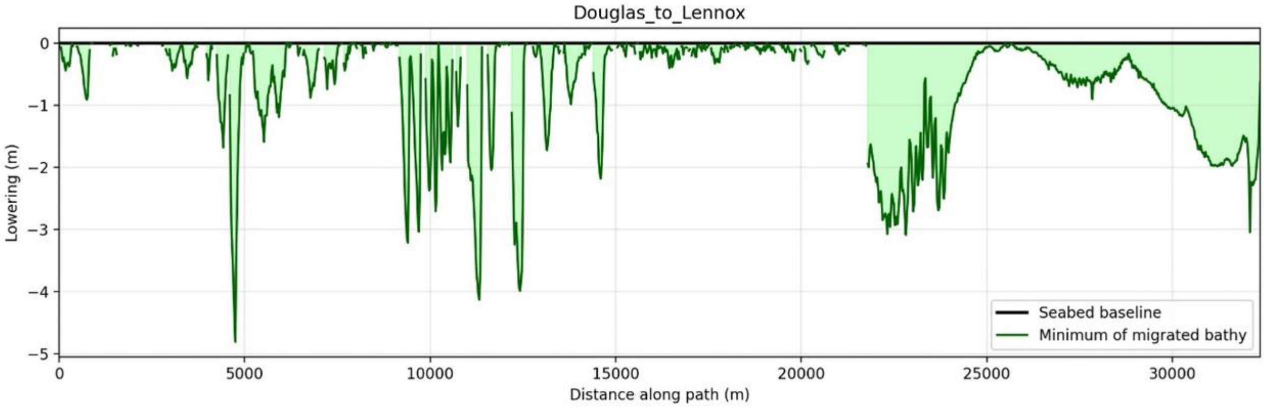


Figure 5.10 Expected depth to lowest historical bathymetry over past 80 years; Douglas to Lennox route

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Conclusions

The risk assessment for the cable route indicates that the key risks for the lifetime of the cable are fishing, shipping and sediment mobility.

Fishing

- A minimum DOL of 0.6 m is required along the route in order to mitigate the risk from bottom trawling.

Shipping

- Anchor strike risk is highest near the Douglas platform and Liverpool Bay Traffic Separation Scheme (TSS) corridor.
- Vessel traffic analysis shows:
  - Increased risk near Douglas platform due to slower vessel speeds despite lower traffic volume.
- Probabilistic analysis indicates that for a surface lay (0 m): P_{Strike} = 4.93 × 10^{-6} (return period ~202,857years). Therefore, depth of lowering will be governed by fishing and seabed mobility risk.

Sediment Mobility

- There is a high level of seabed mobility along the route indicated by areas of sandwaves and bedforms. Assessment of historical data over the past 80 years suggests that seabed mobility is limited to the top 1m along the majority of the route with the exception of the KP 9 to 15 and KP 22.5 to 25 where higher variations have been noted.

6.2 Recommendations

It is recommended that a Depth of Cover of 2.0m as shown in Figure 6.1 below, be adopted along the entire route with the exception of crossings and locations which are protected by concrete mattresses or rock berms.

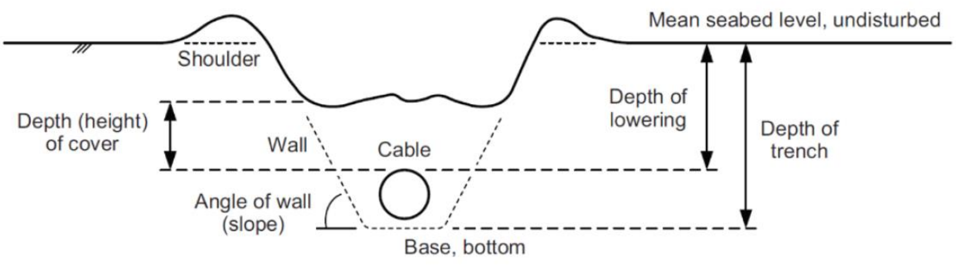


Figure 6.1 Depth of Burial Definitions

Due to issues regarding on-bottom stability [Ref 6] it is recommended to bury the cable using a Simultaneous Lay and Burial Tool. The Depth of Cover of 2.0m should be achievable with this tooling. However, due to sediment type and depth along the route it is recommended to perform some preparatory works to reduce the stiffness of the seabed along the proposed route for ease of burial with an SLB tool later.