**United States of America**
**Before the Department of Energy**
**Grid Deployment Office**

# Application of Caribbean Transmission Development Co. LLC for a Presidential Permit Project Hostos

November 2023

# Contents

**Appendices**



**Tables**



**Figures**

# Acronyms and Abbreviations

| | |
|---|---|
| AC | alternating current |
| ACSR | aluminum conductor steel reinforced |
| Atabey | Atabey Capital, LLC |
| BOEM | Bureau of Ocean Energy Management |
| CFR | *Code of Federal Regulations* |
| CTDC | Caribbean Transmission Development Co. LLC |
| DC | direct current |
| DOE | U.S. Department of Energy |
| EFH | Essential Fish Habitat |
| EMF | electromagnetic field |
| EO | Executive Order |
| FEMA | Federal Emergency Management Agency |
| GDO | Grid Development Office |
| HAPC | Habitat Area of Particular Concern |
| HDD | horizontal directional drill |
| HVAC | high-voltage alternating current |
| HVDC | high-voltage direct current |
| IUCN | International Union for Conservation of Nature |
| kV | kilovolt(s) |
| $mm^2$ | square millimeter(s) |
| MVA | megavolt-ampere(s) |
| MW | megawatt(s) |
| NFIP | National Flood Insurance Program |
| NOAA | National Oceanic and Atmospheric Administration |
| NRHP | National Register of Historic Places |
| NWI | National Wetlands Inventory |
| OEM | original equipment manufacturer |
| PPA | Presidential Permit Application |
| PRSHPO | Puerto Rico State Historic Preservation Officer |
| ROW | right-of-way |
| UNESCO | United Nations Educational, Scientific and Cultural Organization |

| | |
|---|---|
| USACE | U.S. Army Corps of Engineers |
| USFWS | U.S. Fish and Wildlife Service |
| UXO | unexploded ordnance |
| XLPE | crosslinked polyethylene |

# Introduction

Pursuant to Executive Order (EO) 10485, as amended by EO 12038, and *Code of Federal Regulations* (CFR) Title 10, Section 205.320 et seq., Caribbean Transmission Development Co. LLC (CTDC), a wholly owned subsidiary of Atabey Capital, LLC, hereby submits this application to the U.S. Department of Energy (DOE) for a Presidential Permit authorizing the construction, connection, operation, and maintenance of facilities for transmission of electric energy at the international border between the United States Commonwealth of Puerto Rico (Puerto Rico) and the Dominican Republic.

The electricity transmission project, known as Project Hostos, is a proposed undersea high-voltage direct current (HVDC) cable between Puerto Rico and the Dominican Republic to interconnect the two existing energy grids, providing energy redundancy and resiliency. The cable will operate at 320 kilovolts (kV) direct current with a capacity to transport electricity of up to 700 megawatts (MW) in either direction without requiring interrupting operations of either grid. The cable will also permit the black start of the Puerto Rico grid in case of a complete loss of grid power. In support of this request, CTDC submits the following information.

# Background

Natural disasters such as hurricanes and earthquakes routinely damage energy infrastructure in both the Dominican Republic and Puerto Rico. Since 1869 there have been 29 recorded hurricanes that have struck Puerto Rico and 15 recorded hurricanes in the Dominican Republic. In a seeming premonition of things to come, on September 21, 2016, one year before Hurricane Maria, a fire at one of the primary generation plants caused widespread, prolonged blackouts; the frailty of the energy grid was becoming evident. On September 20, 2017, Hurricane Maria significantly impacted all of Puerto Rico, leaving the island without power or clean drinking water ranging from a few weeks to over a year. Many people had been without power since Hurricane Irma affected the Puerto Rico energy grid 2 weeks prior, on September 6, 2017. Five years later, on September 8, 2022, Hurricane Fiona compounded recovery efforts from Hurricane Maria, leaving most of Puerto Rico without power for more than a week and some without power for over 4 weeks due to damage from sustained floods. Earthquakes are equally capable of damaging power generation. A total of 616 earthquakes, with a magnitude of 4 or greater, have occurred within 300 kilometers of the Dominican Republic and Puerto Rico's western side over the past 10 years.

Puerto Rico's antiquated generation plants are incapable of providing energy reliably and efficiently to the roughly 3.2 million American citizens living on the island. Hurricanes will continue to occur, with projections showing that these will increase in magnitude and force. Project Hostos will provide the ability for these islands to recover more quickly following these destructive natural events by providing a bi-directional subsea transmission line that connects the power grids of Puerto Rico and the Dominican Republic. If power generating facilities within Puerto Rico are damaged and unable to generate power, the power generating facilities within the Dominican Republic can provide power to Puerto Rico and vice versa, providing energy resilience to both islands.

Since the hurricanes in 2017, the DOE and six DOE national laboratories have provided Puerto Rico energy system stakeholders with assistance in improving the reliability and resilience of the island's electric system. Most of this assistance is related to the Puerto Rico Energy Public Policy Act (Act 17) passed by the Puerto Rico legislature in 2019 and a February 2022 Memorandum of Understanding between DOE, the U.S. Department of Homeland Security, the U.S. Department of Housing and Urban Development, and the Commonwealth of Puerto Rico.

It is imperative that Puerto Rico improves, modernizes, decarbonizes, and makes the power sources and overall energy grid system one that is reliable, resilient, and diversified. The Puerto Rico Electric Power Authority owns four thermoelectric generation plants, which were all constructed between 1960 and 1975: their expected operating life of 25 to 30 years is long past due. The conversion of the existing San Juan Combined Cycle Plant was completed between 2008 and 2009, though the original plant dates to the 1960s as well. The island's installed capacity is about 6,000 MW; the generation portfolio as it stands today is derived as follows: 15% Bunker C, 12% diesel, 18% coal, 48% liquified natural gas, and 6% from renewable

sources (wind and solar).[1] Suffice to say the system is antiquated and inefficient with little emphasis on sustainability and resiliency. AES, the privately-owned and operated coal plant is slated to go offline in 2027 when the current power purchase agreement expires. How Puerto Rico plans to supplement the roughly 15 to 20% of power supplied by AES when it goes offline in the next 4 years is unknown. Ecoeléctrica, another privately-owned and operated liquified natural gas plant supplying about 15% of power, has its own contract expiring in 2032. These two generation plants were built and commissioned during the early 2000s. So, without accounting for any external additional stresses to the generation system, Puerto Rico could lose about 30 to 40% of its generation sources by 2032. No large-scale projects are currently underway to replace AES or Ecoeléctrica. Given the timeframe it takes for energy projects to be developed within Puerto Rico, this is extremely worrisome in terms of ensuring the resilience of power generation.

According to online publications,[2] the Dominican Republic's installed capacity is 4,921 MW. Its portfolio on energy generation is roughly distributed as follows: 40% fuel oil #2 and #6, 18% gas, 3 % gas and fuel oil, 14% hydroelectric, 15% coal, and 10% renewables (solar, wind, and biomass). The generation capacity has increased over 50% in the past decade, with new projects under development in Manzanillo, Monte Cristi, and Puerto Plata to add an additional 1,000 MW of generation capacity. As of December 2022, peak demand reached 2,800 MW. A law enacted in February 2021, known as "Pacto Electrico" (Electric Pact), seeks electric sector reform by improving the nation's competitiveness and standard of living through the improvement of the apparent systemic shortfalls in energy distribution while augmenting renewable energy generation to diminish greenhouse emissions and battle high fuel costs. An article published by Forbes[3] in October 2022 mentions the fact that the Dominican Republic's grid is isolated and not interconnected with neighboring islands as a "natural limitation" to its energy security. This is an ailment that is repeated throughout the Caribbean, including Puerto Rico and the U.S. Virgin Islands, two United States territories.

Interconnection of the grids between Puerto Rico and the Dominican Republic would provide much needed resilience, contributing to the Caribbean's energy security. Interconnection of the grids would also aid in providing stable and reliable generation and transmission, which has been a poignant and persistent problem since Hurricane Maria decimated Puerto Rico's infrastructure. Project Hostos would also allow the islands' universal access to reliable, affordable, and abundant energy, ensuring energy equity. Through interconnection, the islands could share resources and diversify their electric supply, with the added benefit of selling excess capacity to each other.

# Project Description

Project Hostos considers installing a bi-directional, HVDC subsea transmission line connecting the existing electrical grids of Puerto Rico and the Dominican Republic. Due to the recognized need for reliable generation in Puerto Rico, the project does not initially consider that Puerto Rico will have the capacity to export generation to the Dominican Republic. The cable will have bi-directional capacities, to be prepared for when that situation changes as other planned projects and public policies are enacted in the U.S. territory.

The cable will connect the westernmost part of the Commonwealth of Puerto Rico with the easternmost part of the Dominican Republic. The cable will cross the Mona Passage underwater and make landfall in Mayagüez, Puerto Rico, at the Sila Maria Calderón Port. A converter station will be located within the port boundaries and will then connect to the existing grid at the electrical substation known as Mayagüez TC about a mile inland. On the Dominican Republic side, the line is currently proposed to make landfall at an area known as El Cabo, south of the Cap Cana resort development and north of the Punta Espada National Park. CTDC currently proposes to use horizontal directional drill (HDD) technology to bring the transmission

[1] Percentage obtained from live data information feed on August 10, 2023, at 11 AM EST by GeneraPR. GeneraPR operates the Puerto Rico Power Electric Authority's generation plants since July 1, 2023. Generation | Genera PR (genera-pr.com)

[2] Information obtained from: https://ecpamericas.org/newsletters/greening-the-power-grid-in-the-dominican-republic/ https://www.gem.wiki/Energy_profile:_Dominican_Republic#:~:text=As%20of%202020%2C%20the%20country's,52%25%20between%202010%20and%202019

https://www.trade.gov/country-commercial-guides/dominican-republic-renewable-energy#:~:text=The%20DR's%20installed%20generation%20capacity,demand%20is%20around%202%2C800%20MW.

[3] https://www.forbes.com/sites/kensilverstein/2022/10/03/the-dominican-republic-is-going-green-to-boost-tourism-and-energy-security/?sh=637c67e02d5b

line onshore to Puerto Rico and the Dominican Republic, thus minimizing or altogether avoiding impacts on nearshore terrestrial and marine resources. The HDD technique involves drilling a single borehole from a point onshore to the connection point in marine waters and feeding the cable through the borehole. In the Dominican Republic, onshore transmission would require construction of a DC transmission line approximately 65 miles long from the HDD location near Cap Cana to San Pedro de Macorís, with preference for using existing right-of-way (ROW) where feasible.

The Inflation Reduction Act of 2022 expanded the Bureau of Ocean Energy Management's (BOEM's) jurisdiction of the Continental Shelf, related to renewable energy production and transmission, to include U.S. Territorial waters. The power transmitted by the proposed transmission line will be a mixture of renewable and non-renewable energy. Project Hostos is agnostic to the type of energy it receives from the Dominican Republic. It can and will accept renewable energy sources as its energy fuel. As such, Project Hostos would require BOEM's permission for a ROW within Puerto Rico territorial waters.

The Grid Deployment Office (GDO) drives transmission investment, seeking continuous improvement and resilience betterments to critical generation facilities and transmission and distribution systems. Project Hostos is aligned with GDO in seeking greater resiliency among the two largest economies in the Caribbean by developing a high-capacity electric transmission line and connecting both countries. It is in the public's best interest to leverage all federal investments currently underway within Puerto Rico as it recovers from the 2017 hurricanes and the 2020 earthquakes and to seek resource adequacy by diversifying and adding reliable energy sources.

Project Hostos will complement the federal investment spent and earmarked to date to reconstruct the electric grid and to mitigate future disaster effects.

Due to the international nature of the proposed energy resiliency project, a U.S. Presidential Permit Application (PPA) is required by the DOE.

# (a) Information Regarding the Applicant

## (a)(1) Legal Name of the Applicant – §205.322(a)(1)

The legal name of the Applicant is Caribbean Transmission Development Co., LLC (CTDC), a wholly owned subsidiary of Atabey Capital, LLC. CTDC is a development company operating in Dorado, Puerto Rico. CTDC's headquarters is located at Costa de Oro D76 Calle C. Dorado, Puerto Rico 00646. CTDC is registered with the Internal Revenue Service with Employer Identification Number 66-1018122.

## (a)(2) Legal Name of All Partners – §205.322(a)(2)

Caribbean Transmission Development Co., LLC is 100% owned by Atabey Capital, LLC (Atabey). Atabey is a privately held capital management company located at Costa de Oro D76 Calle C. Dorado, Puerto Rico 00646.

## (a)(3) Communications and Correspondence – §205.322(a)(3)

All communications and correspondence regarding this application should be addressed to the following person:

Tirso Selman, Project Director
Caribbean Transmission Development Co., LLC
Costa de Oro D76 Calle C. Dorado, PR 00646
+1 787-754-9696
+1 786-715-7907
info@caribbeantransmission.com

## (a)(4) Foreign Ownership and Affiliations – §205.322(a)(4)

CTDC has been specifically created to oversee the development of a subsea energy interconnection cable project between Puerto Rico and the Dominican Republic called Project Hostos. CTDC does not have any current investments or ownership from foreign government. Atabey owns 100% of CTDC. Atabey owns and invests in projects within Puerto Rico. Atabey does not have any transmission lines or ownership participation with/from any foreign government.

## (a)(5) Foreign Contracts – §205.322(a)(5)

At the time of this writing, CTDC has no contracts with any foreign government or foreign private concerns.

## (a)(6) Opinion of Counsel – §205.322(a)(6)

As set forth in the opinion of counsel attached hereto as Appendix A, the construction, connection, operation, or maintenance of the proposed transmission facilities described herein are within the corporate powers of CTDC. Further, CTDC has complied with, or will comply with, all pertinent federal and state laws related to the construction, operation, or maintenance of the proposed Project Hostos.

# (b) Information Regarding the Project Hostos Transmission Facilities

## (b)(1) Description

### (b)(1)(i) Technical Description

#### (b)(1)(i)(A) Number of Circuits

The project would include one complete symmetrical monopole HVDC circuit. The circuit includes a positive and a negative cable run between two onshore HVDC converter stations, which are both connected to alternating current (AC) transmission networks at designated points of interconnection located in Puerto Rico and the Dominican Republic. Figure B-1 and Figure B-2 show a typical electrical single-line diagram and a general layout of a converter station, respectively.

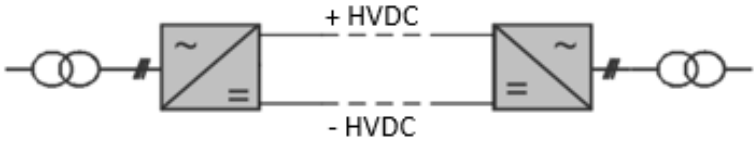



**Figure B-1. Electrical Single-line Diagram (HVDC Symmetrical Monopole)**

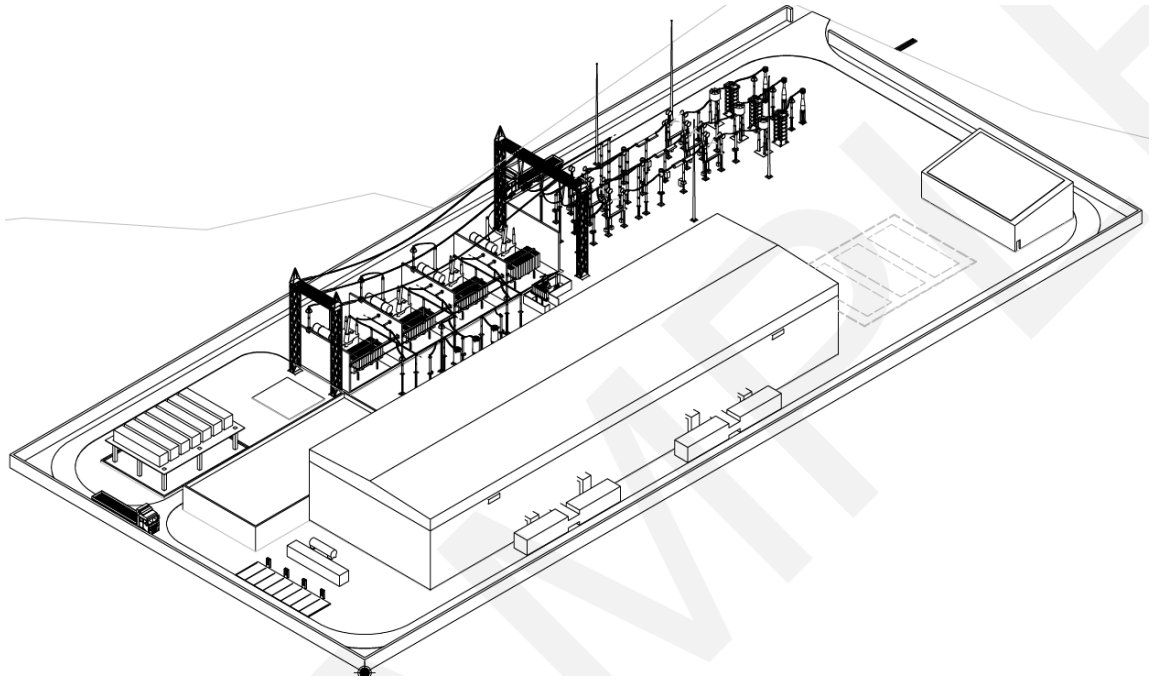


**Figure B-2. Typical Onshore Converter Station Layout**

The following appendices in this document provide further details on the converter stations:

- Appendix B – Converter Station Detailed Electrical Single-line Diagram
- Appendix C – Converter Station General Layout
- Appendix D – Siemens Technical Descriptions

## (b)(1)(i)(B) Operating Voltage and Frequency

The project will have an operating rating of 500 MW and a nominal rating of 700 MW. The HVDC side voltage is at ±320 kV, and the AC side will be at 230 kV (230-kV Mayagüez Substation in Puerto Rico, and 230-kV Quisqueya Substation in the Dominican Republic). DC frequency is zero, and high-voltage alternating current (HVAC) frequency is 60 hertz.

## (b)(1)(i)(C) Conductor Size, Type and Number of Conductors per Phase

Project Hostos includes the following transmission cabling systems:

- **Offshore/subsea**: Two crosslinked polyethylene (XLPE) HVDC cable runs, each rated at a voltage of +/-320 kV, with a size of 2,000 square millimeters ($mm^2$) (3.1 square inches) and copper or aluminum conductor. The subsea cables will be separately laid, spanning approximately 91 miles (147 kilometers), depending on which route alternative is selected.
- **Onshore cabling**: The onshore cable route in Puerto Rico consists of two sections:
  - HVDC: From landfall to converter station, which consists of two XLPE HVDC cable runs, each rated at a voltage of +/-320 kV, each with a size of 2,000 $mm^2$ (3.1 square inches) and copper or aluminum conductor.
  - HVAC: From converter station to point of interconnection which consists of two parallel three-phase XLPE HVAC cable runs, each rated at 230 kV, each with a size of 1,600 $mm^2$ (2.48 square inches) and aluminum conductor.

# (b)(1)(ii) Overhead Line Interconnection Description

Project Hostos does not currently incorporate any overhead transmission lines in Puerto Rico. If future designs require use of overhead transmission lines, associated engineering data will be provided accordingly. Project Hostos does consider, however, an HVDC overhead line section in the Dominican Republic to carry the power from the landing site at El Cabo, toward Quisqueya Substation, which is the 230-kv interconnection point at San Pedro de Macorís.

# (b)(1)(iii) Underwater and Underground Line Interconnection

## Underwater Line

As stated previously, the subsea transmission cable system proposed for Project Hostos consists of two XLPE HVDC cable runs, each rated at a voltage of +/-320 kV, each with a size of 2,000 $mm^2$ (3.1 square inches) and copper or aluminum conductor. The subsea cables are separately laid, spanning approximately 91 miles (147 kilometers), depending on which route alternative is selected. Figure B-3 shows preliminary subsea cable trench details with each HVDC pole separated by 2 meters.

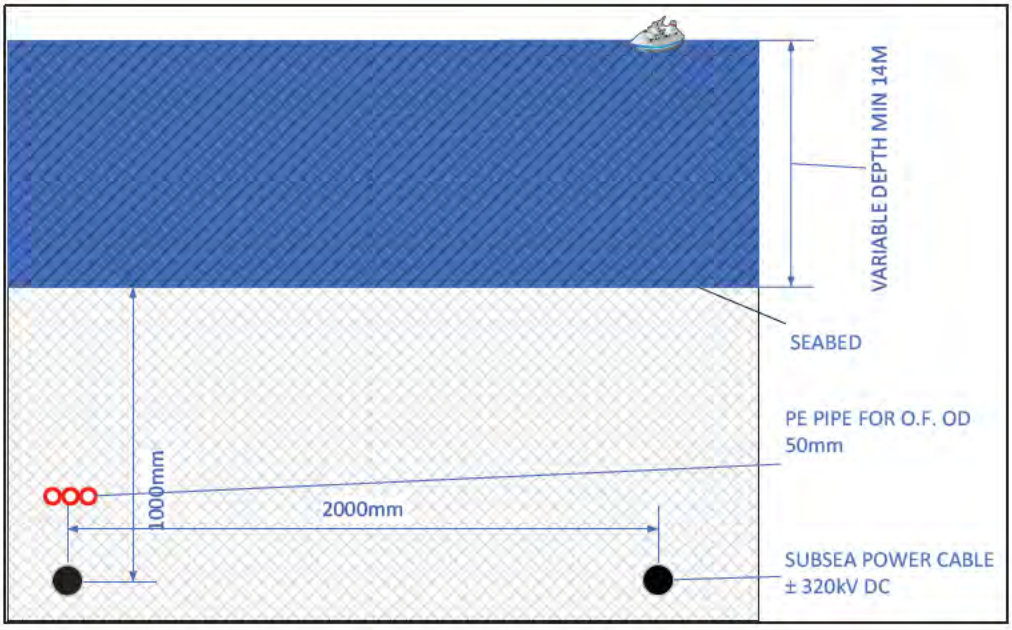



**Figure B-3. Subsea HVDC Cable Structure and Cross Section**

Details of subsea cable sizing and calculations can be found in Appendix E.

## Onshore/Underground

The onshore section of the transmission cabling in Puerto Rico consists of two sections:

- HVDC: From landfall to converter station, which consists of two XLPE HVDC cable runs, each rated at a voltage of +/-320 kV, each with a size of 2,000 $mm^2$ (3.1 square inches) and copper or aluminum conductor.
- HVAC: From converter station to point of interconnection which consists of two parallel three-phase XLPE HVAC cable runs, each rated at 230 kV, each with a size of 1,600 $mm^2$ (2.48 square inches) and aluminum conductor.

Figure B-4 and Figure B-5 illustrate typical onshore trench cross-sections and physical dimensions of HVDC and HVAC sections. Wherever trenching is proposed traversing or affecting existing road pavement, this will be repaired and replaced. HDD or other forms of trenchless technologies is expected to be used at landfall locations, not for onshore routing. Direct burial trenching will be used for onshore routing in Puerto Rico, though we anticipate aerial lines will be used in the Dominican Republic. More details can be found in Appendix E.

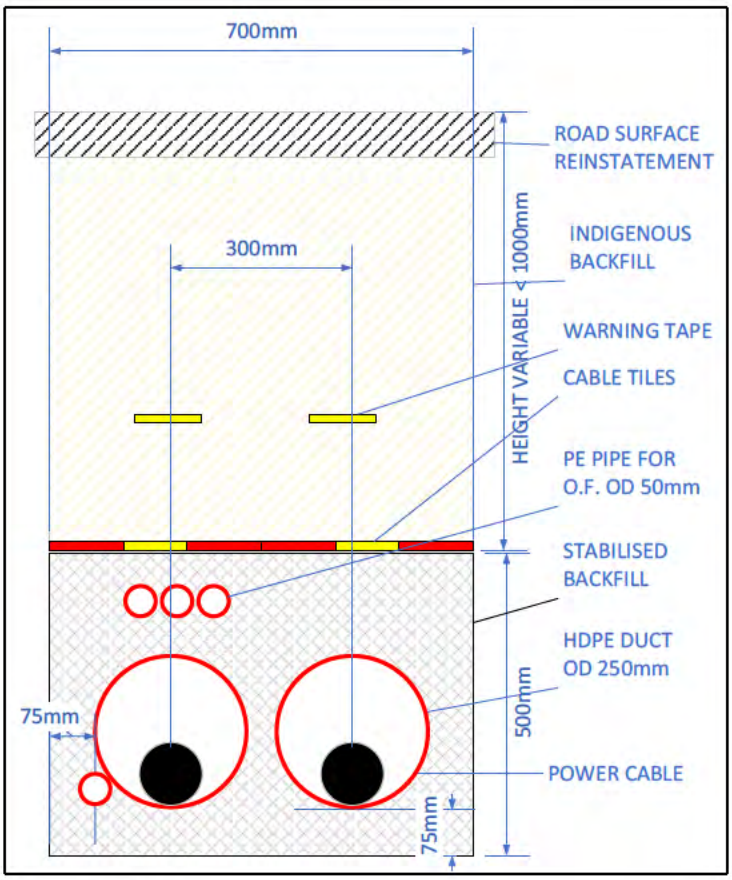



**Figure B-4. Onshore HVDC Cabling**

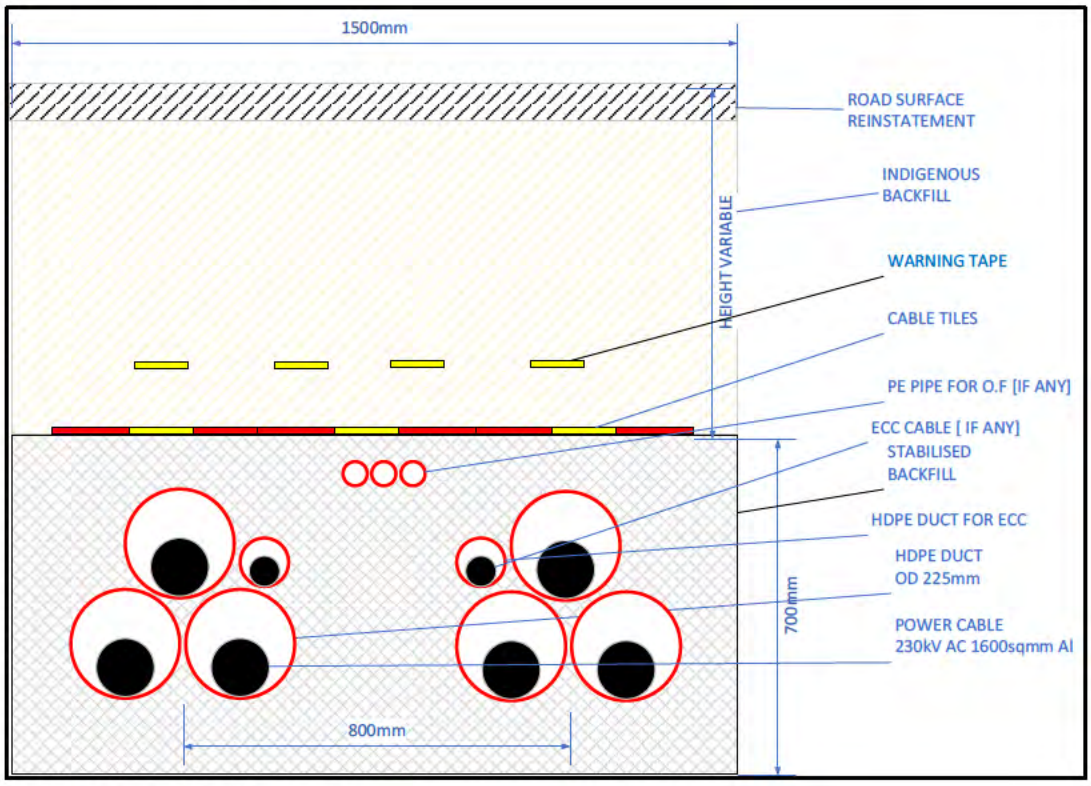



**Figure B-5. Onshore HVAC Cabling**

## (b)(1)(iii)(A) Burial Depth

### Underwater

The appropriate cable burial depth must be determined such that it satisfies the following criteria:

- Proper cable conductor size and current carrying capability
- Proper means of protection against external impacts such as shipping, anchoring, fishing activities, dredging, geological and other natural impacts

In order to determine the optimum cable burial depth, a Cable Burial Risk Assessment will be performed, which is typically based on the following criteria:

- Requirements from federal and state agencies (e.g., U.S. Army Corps of Engineers [USACE], in federally maintained shipping channels, requires a minimum 15-foot [4.6-meter] depth below authorized, maintained channel depth)
- Industry guidance from standards agencies such as DNV and experience from organizations such as the North American Submarine Cable Association

Offshore subsea HVDC cables are usually drilled into the earth through HDD from landing site off into the ocean about 20 meters in depth. At that point typical cable burial depths vary between 1 to 2 meters (3 to 6 feet), after exiting the HDD bore hole, to a depth of 100 meters. The placement of the cable at depths greater than 100 meters is by laying the cable directly onto the seafloor. The project-specific cable burial profile and Cable Burial Risk Assessment will be performed at later stages of project development and will be provided when completed.

Figure B-6 shows a profile view of a typical nearshore HDD, a technique that avoids impacts to surface resources and minimizes environmental impacts to both terrestrial and marine nearshore resources.

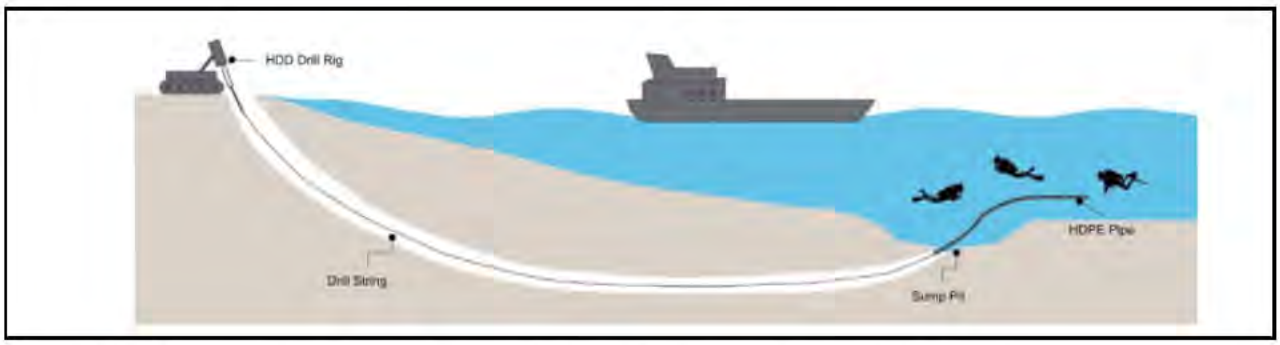



**Figure B-6. Typical Indicative Landfall HDD and Nearshore Cable Installation**

As shown on Figure B-7, the prospective project landfall (transition from nearshore to onshore) is proposed at the Mayagüez Port, named Sila Maria Calderón Port in 2015 (by Mayagüez Municipal Ordinance 23). The figure provides an overview of the concept, as actual survey measurements have not been taken at this stage of the project planning process. This is expected to be further completed and refined as the project progresses. Appendix E provides a more detailed description of the project landfall and HDD.

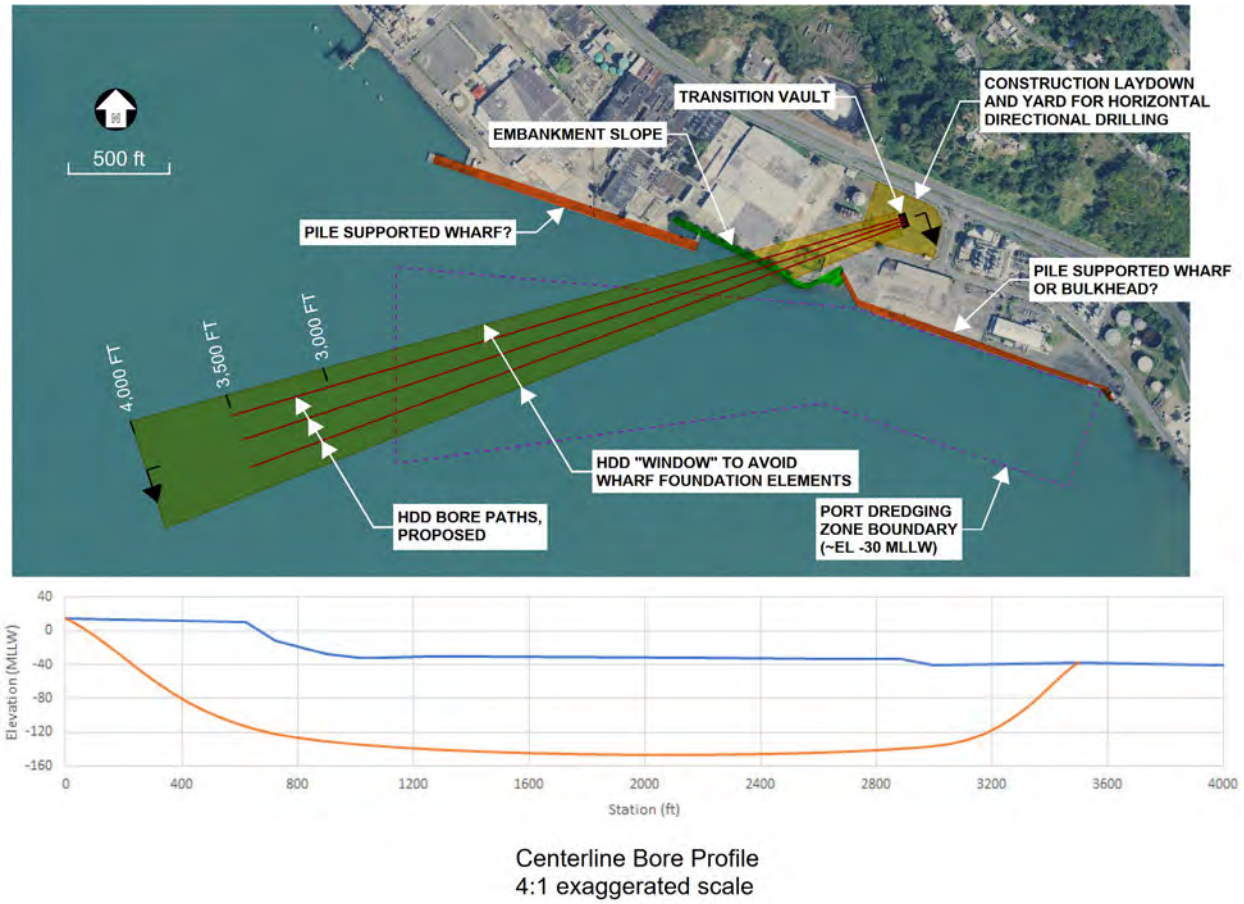



**Figure B-7. Project Nearshore and Landfall Options on Puerto Rico**

## Onshore/Underground

Burial depths and all dimensions can be found in Figure B-4 and Figure B-5.

## (b)(1)(iii)(B) Cable Type and Required Supporting Equipment

## Underwater

The polyethylene insulation in the XLPE cables eliminates the need for fluid insulation, enables the cables to operate at higher temperatures with lower dielectric losses, improves transmission reliability, and reduces risk of network failure. In general, aquatic transmission cables include a polyethylene sheath extruded over a lead-alloy sheath to provide superior mechanical and corrosion protection. An armored layer of galvanized steel wires embedded in bitumen provides additional protection for the aquatic transmission cables. The outer layer of the aquatic transmission cables consists of an asphaltic compound with polypropylene reinforcement. Exact specifications of the proposed subsea cable system installation would meet applicable standards such as National Electrical Safety Code, National Electrical Code, and other technical standards such as the Institute of Electrical and Electronics Engineers, International Electrotechnical Committee, and International Council on Large Electric Systems, detailed information of which will be included in subsequent filings.

### Onshore/Underground

The expected cable type for the onshore/underground sections of the transmission route will use the same structure and insulation material as in underwater section except for the cable armoring that provided additional mechanical protection for underwater cables.

Exact specifications of the proposed subsea cable system installation would meet applicable standards such as National Electrical Safety Code, National Electrical Code, and other technical standards such as the Institute of Electrical and Electronics Engineers, International Electrotechnical Committee, and International Council on Large Electric Systems, detailed information of which will be included in subsequent filings.

### (b)(1)(iii)(C) Cathodic Protection Scheme

Subsea cables are cathodically protected through the following means:

- Armor material:

  General corrosion might occur by the impact of salty seawater onto the armoring wires. The armoring wires are, in most cases, made from zinc-coated steel wires, as zinc layer is the primary corrosion protection of steel wires.

  The armoring can also be constructed from more corrosion-resistant metals. Copper, bronze, and brass wires have been used as armoring previously.

- Polymeric sheath over the armor:

  The armoring wires can also be corrosion-protected by an individual polymeric sheath. The direct contact to salty seawater is excluded if the sheath is not washed away by sand abrasion. The method can avoid much of the troublesome bitumen layer (explained in the following bullet).

- Bitumen:

  A secondary means of cathodic protection can be made by flushing the armoring with hot bitumen during manufacturing. The lifetime of the bitumen protection is much dependent on the mechanical impacts on the cable. The bitumen layer can be eroded during installation or later during service when the unburied cable is hit by water currents laden with sand. Where the bitumen layer is damaged, the zinc layer takes over the corrosion protection. The corrosion rate of zinc coatings in seawater depends on many factors such as salinity, temperature, and water exchange around the cable.

- Outer serving – outer jacket material (yarn):

  Scratches can deteriorate the anti-corrosion effect of bitumen and zinc layers. To avoid this, an outer serving protects the corrosion protection of the cable armoring during loading, laying, and burying of the submarine cable. Modern submarine power cables have either extruded polymeric outer servings or servings made from wound yarn layers. Cables with wound yarn layers are designed for the seawater penetrating into the armoring wires to the plastic inner serving (semi-wet design). The water exchange in the narrow interstices under the yarn layers is very limited and reduces corrosion rates considerably. The yarn layers play a sacrificial role, and small damages during handling or laying are not considered harmful.

## (b)(2) Project Mapping

The following maps show a project overview (Figure B-8), location of onshore facilities in Puerto Rico (Figure B-9), location of onshore facilities in the Dominican Republic (Figure B-10), and the preferred subsea cable routes (Figure B-11). Current structure considers CTDC as owner and operator of all facilities. Land facilities will be leased from [redacted]; negotiations are underway. For the Dominican Republic, CTDC is negotiating land lease to the government. None of the facilities are constructed yet. Route 01 is the preferred subsea cable route (refer to Figure B-8) whereas Alternative A is the preferred onshore route (refer to Figure B-9).

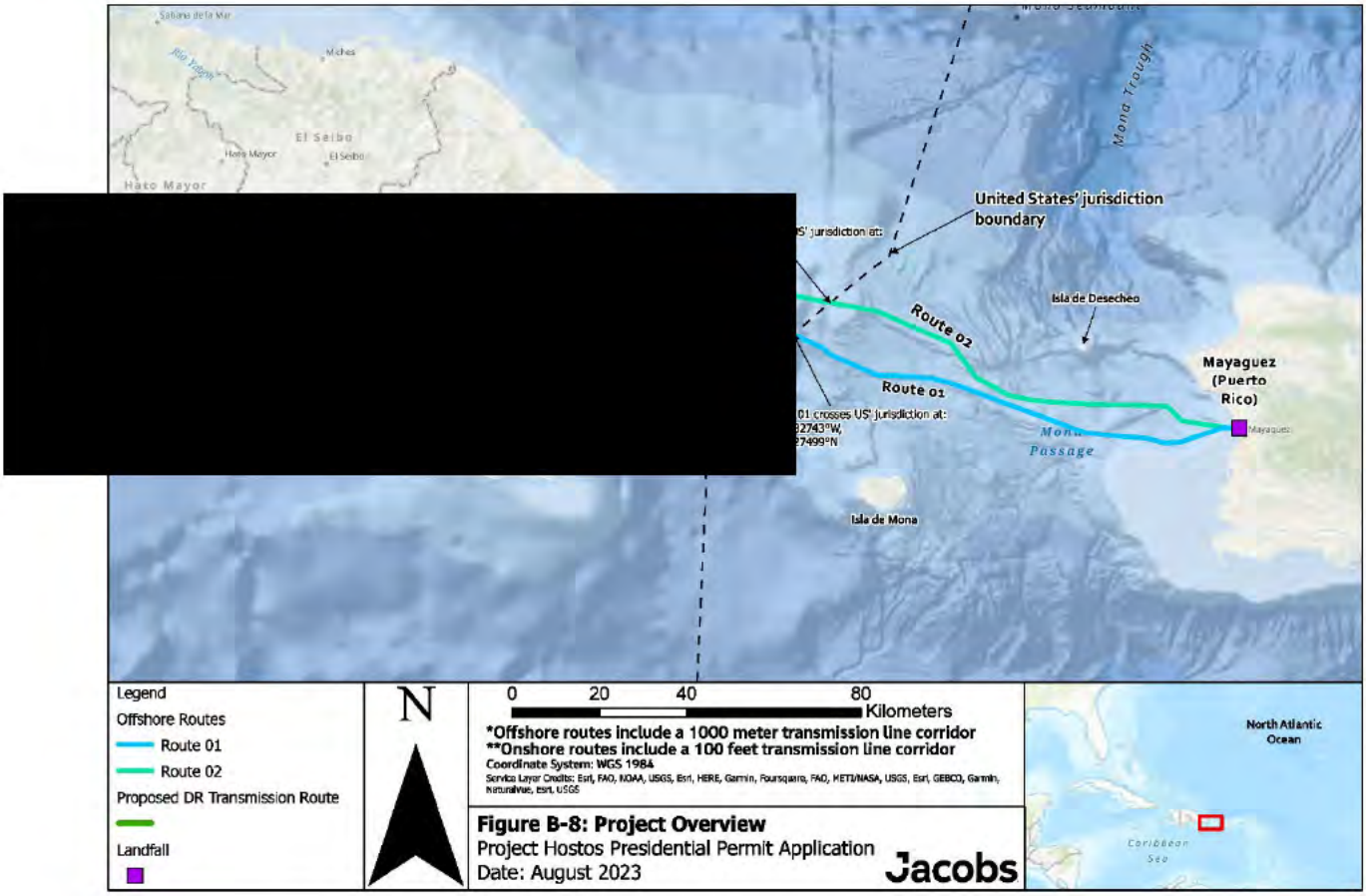



**Figure B-8. Project Mapping Overview**

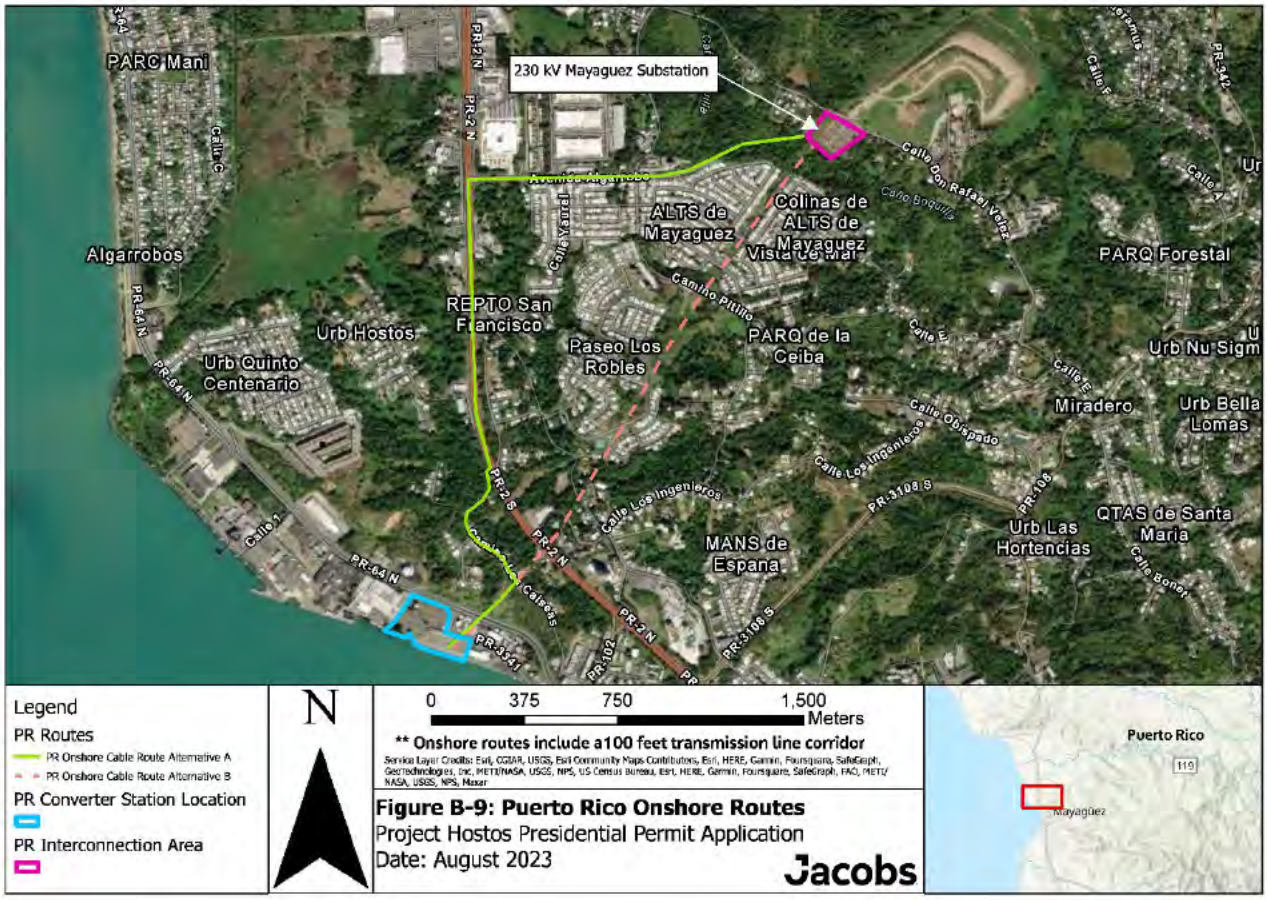



**Figure B-9. Location of Onshore Facilities in Puerto Rico**

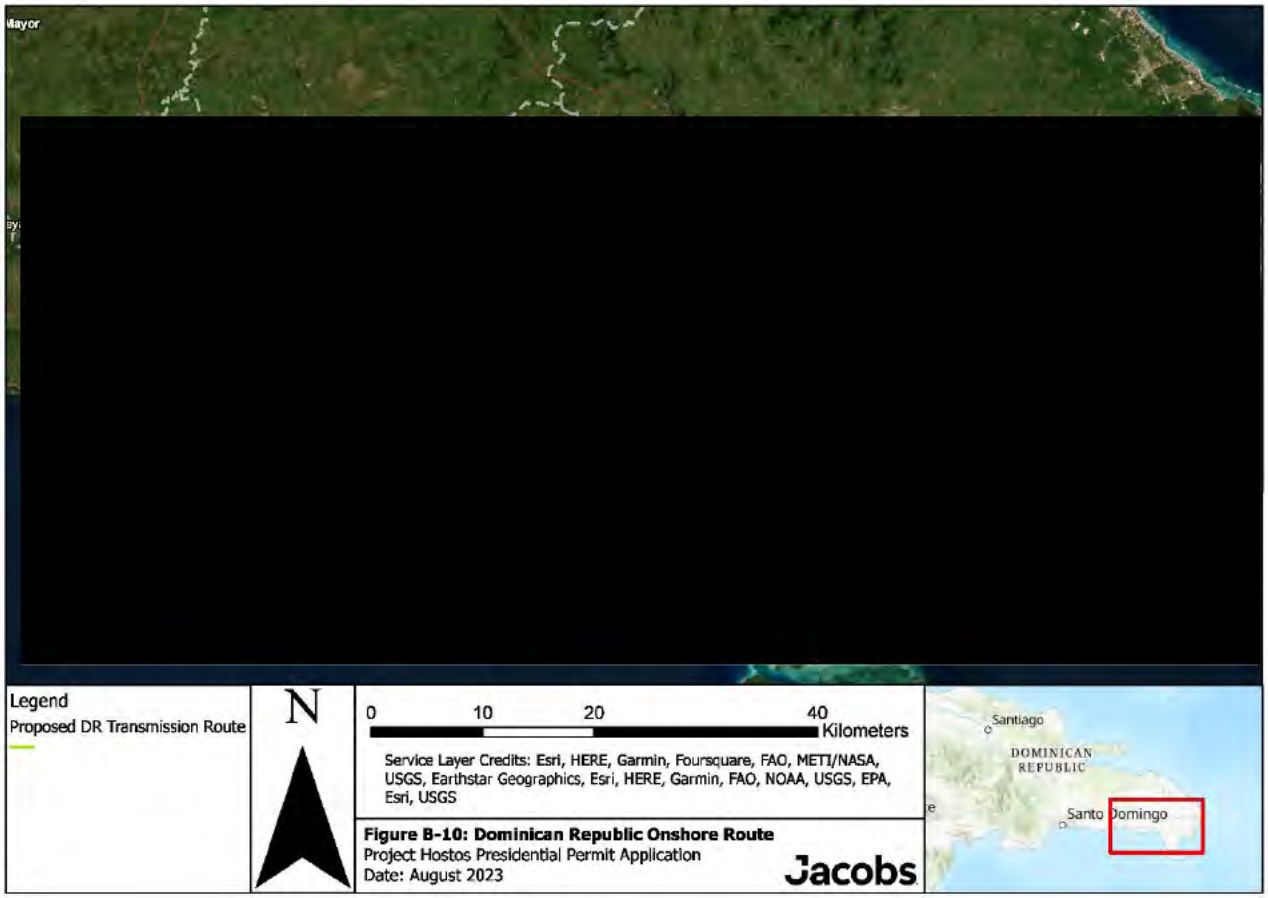



**Figure B-10. Location of Onshore Facilities in the Dominican Republic**

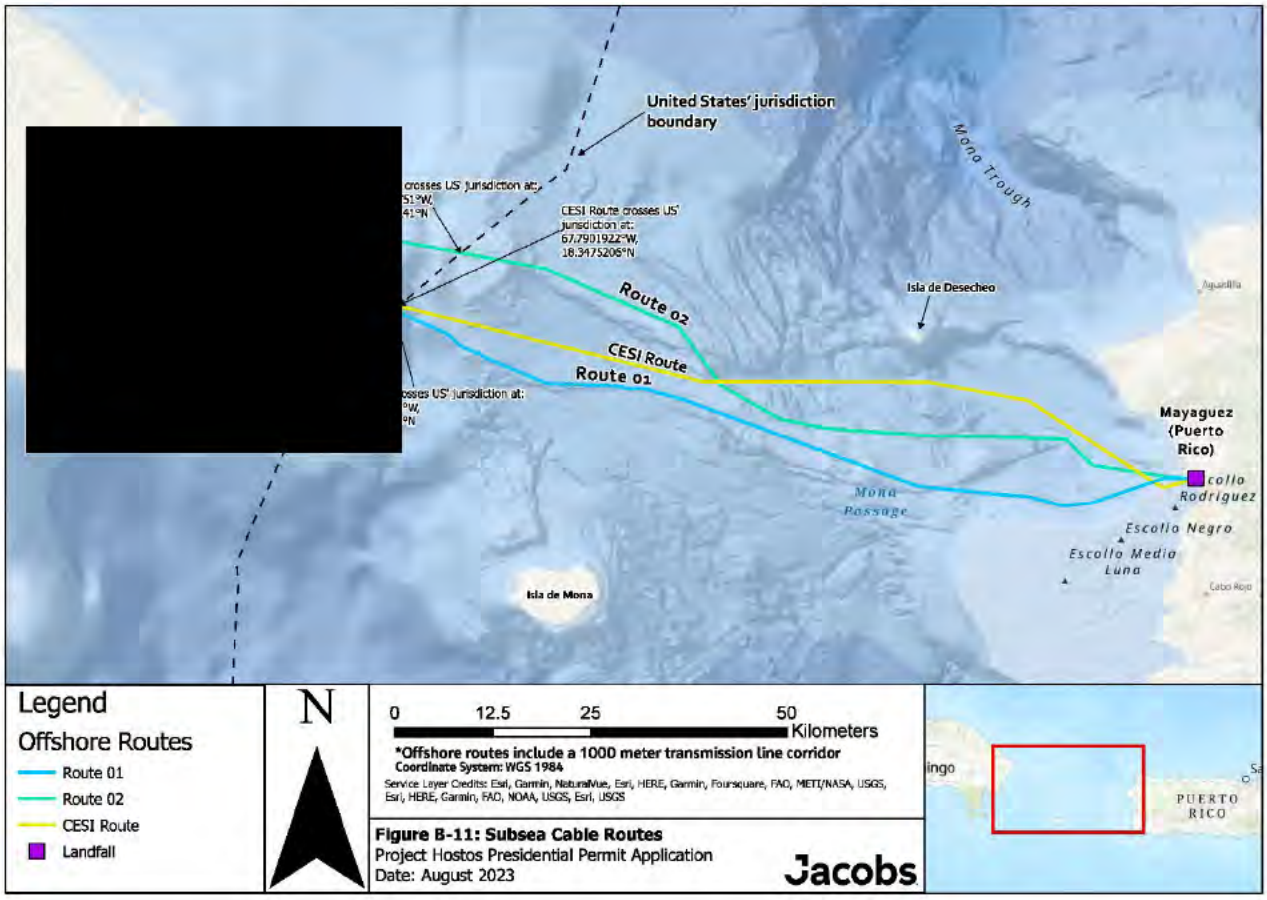



**Figure B-11. Preferred Subsea Cable Routes**

# (b)(3) Information for Facilities Operated at 138 kV or Higher

## (b)(3)(i) Data Regarding the Expected Power Transfer Capability, Using Normal and Short Time Emergency

Power flow analysis under normal and emergency (contingency N-1) of the Puerto Rico and Dominican Republic transmission networks for years 2030[4] and 2035[5], both with and without the interconnector project have been performed. This section provides a summary of the results. Complete details of the model development, assumptions, simulations, and power flow plots can be found in Appendix F.

The HVDC interconnector will connect the Puerto Rico and Dominican Republic transmission systems and operate in the following manner:

- Operating capability of 500 MW
- Nominal capability rating of 700 megavolt-amperes (MVA)
- Short-term emergency capability rating of 1,272 MVA
- HVDC voltage of ±320 kV and HVAC voltage of 230 kV
- Power will be imported from the Dominican Republic into Puerto Rico's system

[4] Modeling and results are valid up to the year 2033.

[5] Modeling and results are valid up to the year 2040.

- HVDC converter station on both Puerto Rico and the Dominican Republic will have black-start capability

The network modeling updates included:

- New/planned thermal and renewable power plants per latest generation queue list
- Decommissioning/retirement of existing power plants
- Modification of existing loads
- New/planned transmission line developments and reinforcements
- The new CTDC HVDC interconnector

Following model development, the following scenarios were considered to perform load flow under normal and contingency (N-1) analysis:

- Load: Heavy summer peak load and light spring off-peak scenario were considered.
- Active power: The power import from the Dominican Republic was considered from 100 MW to 500 MW in 100 MW steps.

The results of power flow analyses show that:

- Under normal conditions for years 2030[6] and 2035[7], no thermal overloads or voltage violations were observed following the addition of the HVDC interconnection.
- Under N-1 contingency for year 2030[8], no thermal overloads were observed due to the HVDC interconnection. However, N-1 resulted in undervoltage conditions at three 115-kV substations in Puerto Rico, which might conveniently be mitigated by increasing the AC voltage setpoint of HVDC.
- Under N-1 contingency for year 2035[9], three 115-kV lines in Puerto Rico might experience overloads and undervoltage issues due to the HVDC interconnection. By reducing the existing generation in Mayagüez region to accommodate power import from the Dominican Republic or upgrading the sub-transmission network in this region could resolve the overload issue and increasing the AC voltage setpoint of HVDC converter could resolve the undervoltage issue.

## (b)(3)(ii) System Power Flow Plots

All power flow plots under normal and contingency conditions are provided in Appendix F.

## (b)(3)(iii) Line Design Feature Data

In Puerto Rico, all transmission sections of this project are underground and subsea cables. No overhead portions are expected at this point. Analysis of project-related radio frequency or television interference is therefore not provided.

In the Dominican Republic, the subsea cable will make landfall at El Cabo area and then will continue overhead toward the converter station location closer to 230-kV Quisqueya Substation for a portion of approximately 64 miles. This overhead line will be DC at ±320 kV and expected to be monopole or lattice steel structure with a conductor of Aluminum Conductor Steel Reinforced (ACSR) type with size of 2167 MCM (Kiwi).

## (b)(3)(iv) Relay Protection Scheme

HVDC interconnector protection and control functions, preliminary diagrams, and concepts are provided in Appendix G.

[6] Modeling and results are valid up to the year 2033.

[7] Modeling and results are valid up to the year 2040.

[8] Modeling and results are valid up to the year 2033.

[9] Modeling and results are valid up to the year 2040.

## (b)(3)(v) System Stability Analysis

According to PPA 10 CFR Section 205.322 language, system stability analysis is not required at the time of permit submission and might be requested following the receipt and review of power flow plots. Therefore, this section will be completed if and when required.

# (c) Information Regarding Potential Environmental Impacts for Routing Alternatives

## (c)(1) Environmental Impact Statement

CTDC has completed a preliminary review of environmental resources within the project area. Additional information to be provided regarding potential environmental impacts of the proposed facilities will be based on the results of detailed onsite field investigations, where applicable, and provided in subsequent updates to this application. These additional investigations will be presented in an Environmental Assessment to satisfy the requirements of the National Environmental Policy Act. Most of the project's potential environmental impacts would occur during construction and site development. Potential environmental impacts from project construction would be related to the installation of the subsea transmission cable system, terrestrial transmission cable system, and HVDC converter station. Preliminary review of the potential effects and ranking criteria can be found in Appendix H.

### Subsea Cable Construction Impact Summary

As described in Section (b)(1)(iii)(a), once the cable is about 20 meters in depth, the subsea transmission cable system would be installed selectively in soft bottom sediments using a burial device and avoid hard bottom or sensitive benthic communities, if possible. To the extent that conditions permit, CTDC would install cable primarily using a jet plow/burial device, which uses high pressure water jets to create a trench. However, the burial strategy would be determined by the selected HVDC cable Original Equipment Manufacturer (OEM) and installer. The burial device would allow the cable system installation to proceed rapidly in a single pass of the device with a very limited disturbance footprint. The trench would be less than 2 feet wide, 3 to 6 feet (1 to 2 meters) deep and would be infilled immediately as the burial device installs the cables. The cables would be buried to a target depth of 3 to 6 feet (1 to 2 meters). Suspended sediment would be limited to the immediate installation area. The only direct impacts of the burial device installation to the marine environment are in the footprint of the trench and burial device, and these would be very short-term. The HVDC transmission line would have no significant environmental impacts during operation. Electromagnetic fields (EMFs) are used by some species to navigate and search for prey, and such species may experience temporary impacts as they adjust to the presence of a new magnetic field. Studies funded by the Bureau of Ocean Energy Management related to HVDC EMF demonstrate some species of elasmobranchs and some species of crustaceans may temporarily increase movement within the EMF, but this would not impact species ability to navigate or forage in the long term (Hutchison et al.).

The subsea cable crosses through estuarine and marine deep-water habitat that extends out from the shoreline for approximately 1 mile (1.6 kilometers). Nearshore segments of the cable system would be installed using the HDD installation technique where the cable system approaches the landfall locations in Puerto Rico and the Dominican Republic. HDD installation involves a guided drilling device that bores and reams a hole through the subsurface between a subsurface entry and exit location. The HDD construction would be a land-to-water installation (refer to Figure B-6 and Figure B-7), where the drilling device would penetrate the ground surface from a terrestrial starting point and exit the seafloor at a suitable location. The cable system would be attached to the drilling device and pulled back through the subsurface HDD path to the terrestrial starting point to complete the cable system landfall. The advantage of HDD installation is that the cables can be installed with minor disturbance to the seafloor, the terrestrial surface, and nearshore resources (i.e., beaches, seagrass beds, and coral reefs). The minor impacts generated by the HDD would be limited to where it enters and exits the ground or seafloor at the start and end points. This minimizes impacts to valued and protected coastal resources. Entry and exit points for the HDD operation will be carefully selected to avoid impacts to natural resources to the extent possible.

A potential risk of HDD installation is the inadvertent return of lubricating drilling mud (water and bentonite clay), pressurized within the bore hole, to the seafloor surface. This can create temporary turbidity in the water from suspended sediment. The risk would be mitigated by monitoring the pressure of the drilling mud in the HDD bore hole and through development and implementation of an approved HDD frac-out contingency plan to minimize and contain turbidity and sedimentation. The terrestrial cable would be installed using HDD to minimize impacts to potential corals and seagrass habitat. The subsea cable bore

hole would be made under the sea floor using HDD from an onshore landing point out to a maximum distance of 1 mile, which would minimize impacts to marine deep-water habitat.

The principal environmental impact risks related to subsea cable system construction are related to spawning habitat and Essential Fish Habitat (EFH) disturbance, harassment or injury to threatened, endangered, or protected marine species (e.g., marine mammals and sea turtles), offshore Marine Protected Areas (e.g., Habitats of Particular Concern [HAPCs] such as coral reefs), and cultural resources (i.e., potential shipwrecks and archaeological sites). All waters surrounding Puerto Rico are designated as EFH, and the work would therefore impact EFH. However, the proposed subsea transmission cable system route would be sited to avoid and minimize crossings of and impacts to designated Marine Protected Areas, HAPCs, and associated species (refer to Figure C-1). Resource impacts would be described in the environmental analysis.

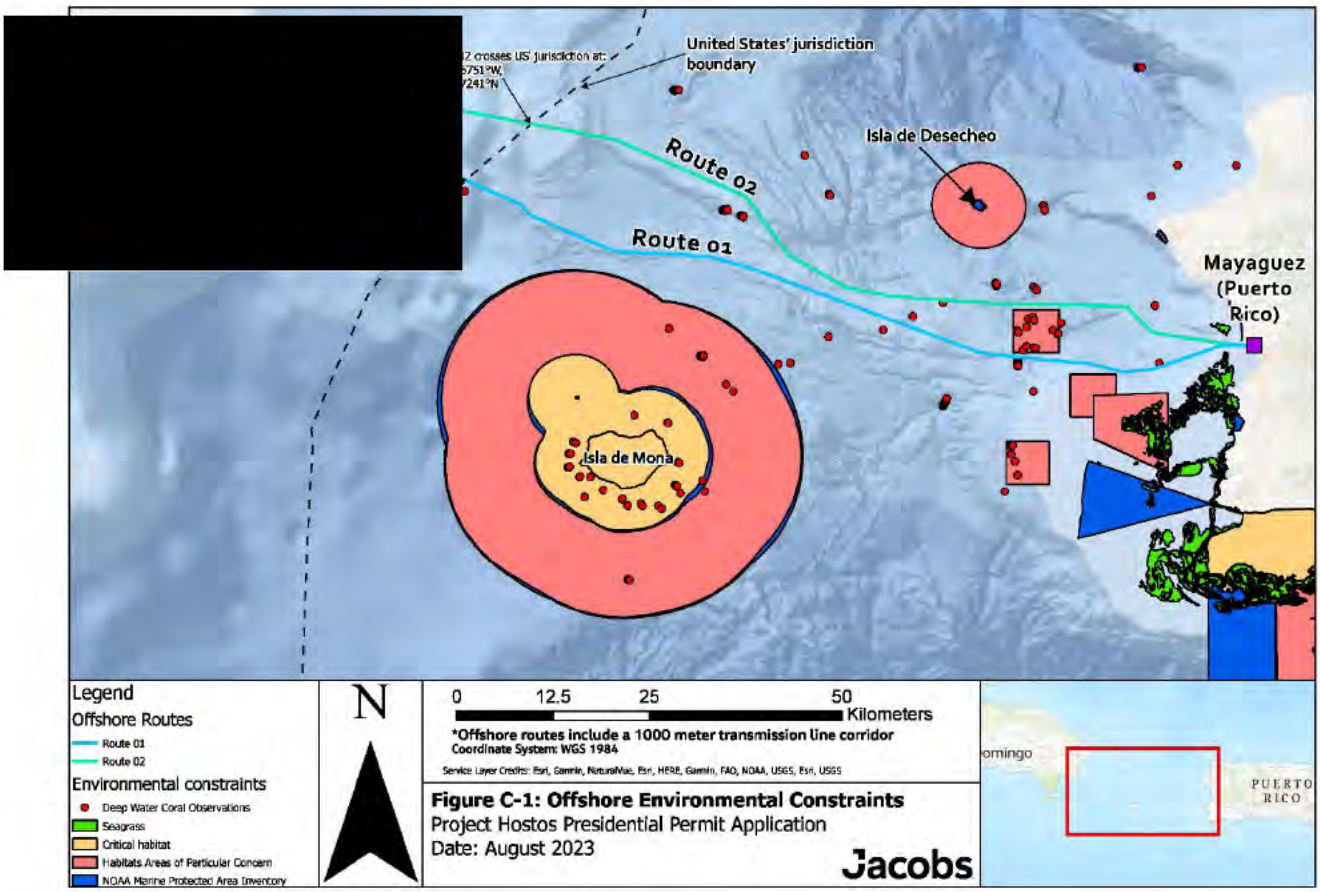



**Figure C-1. Offshore Environmental Constraints**

## Terrestrial Underground Transmission and HVDC Converter Station Construction Impact Summary

Terrestrial components of the project in Puerto Rico include underground HVDC and HVAC transmission cable system and HVDC converter stations. The location of the proposed facility in Puerto Rico is shown on Figure B-9. The converter station would be constructed within the developed port of Mayagüez, named Puerto Sila Maria Calderón), on land classified as Urban Land in the *Puerto Rico Land Use Plan* (Puerto Rico Planning Board 2015). The terrestrial cable route and point of interconnection in Puerto Rico includes land classified as Urban Land and Urbanizable Land (Puerto Rico Planning Board 2015). Construction of these elements of the project have the potential for short-term environmental impacts. The sequence of project construction would generally be as follows:

- Clearing and vegetation removal

- Grading and site preparation
- Construction
- Site restoration

The underground transmission construction ROW in Puerto Rico would occupy approximately 18 to 26 acres (considering a width of up to 100 feet along 1.5 to 2.1 miles [2.41 to 3.38 kilometers]), and in the Dominican Republic, it would occupy an area of approximately 836 acres (100 feet along 69 miles [111 kilometers]). The construction ROW includes 30 to 50 feet of temporary workspace also used for equipment and materials storage, and the permanent ROW which will be between 30 and 50 feet in width. Both will be restored following construction and the permanent ROW will be maintained for the life of the asset. Terrestrial transmission would require limited associated grading to facilitate equipment access during construction. Existing ROWs would be used as much as possible, limiting the need for any trenching or inland HDD to accomplish necessary crossings. The HVDC converter stations would each occupy approximately 4 acres and would require site grading and preparation and some subsurface disturbance depending on foundations needed. Following construction and in vegetated areas, the HVDC cable ROW would be maintained by regular mowing.

The HVDC converter stations on both Puerto Rico and the Dominican Republic sides would be permanently developed with electric transmission infrastructure. The Dominican Republic location of the proposed facility is shown on Figure B-10.

Potential construction-phase environmental impacts would be minimized by adhering to construction best management practices and permit conditions and implementing an Environmental Inspection program. Key elements of the best management practices and Environmental Inspection program would include implementation of erosion and sedimentation controls, a spill prevention and countermeasures plan, regular environmental inspections, and coordination between environmental compliance and construction personnel.

## Floodplains

The Federal Emergency Management Agency (FEMA) has developed flood maps, known officially as Flood Insurance Rate Maps, to identify areas of high- and moderate- to low-flood risk. The FEMA maps identify Special Flood Hazard Areas and are used by the National Flood Insurance Program (NFIP) to determine where the NFIP's floodplain management regulations must be enforced and flood insurance requirements apply.

Floodplains in the project area in Puerto Rico are shown on Figure C-2. The proposed location of the HVDC Converter Station in Mayagüez, Puerto Rico, is partially located within FEMA Flood Zone AE, with base flood elevations of 3 and 4 feet, and Flood Zone VE with a base flood elevation of 3 feet. Zone AE, a 100-year floodplain, is a high-risk area that present a 1% annual chance of flooding. Zone VE is also a 100-year flood zone that includes high-risk coastal areas and an additional hazard associated with storm waves. The terrestrial cable route/ROW is located in Zone X, which is an area of minimal flood hazard that is outside the 500-year flood level.

The subsea cable would pass through FEMA Flood Zone VE, with a base flood elevation of 4 feet, from the shoreline out to a distance of approximately 1,050 feet. The subsea cable would be buried via HDD through the FEMA Flood Zone VE.

Installation of permanent structures and foundations within floodplains can reduce flood storage capacity of the floodplain. Given that the proposed site of the HVDC converter station in Mayagüez is already paved and developed, the project is not expected to alter the existing flood storage capacity of the site. The project would comply with the requirements of the NFIP and obtain the necessary FEMA permits for floodplain development.

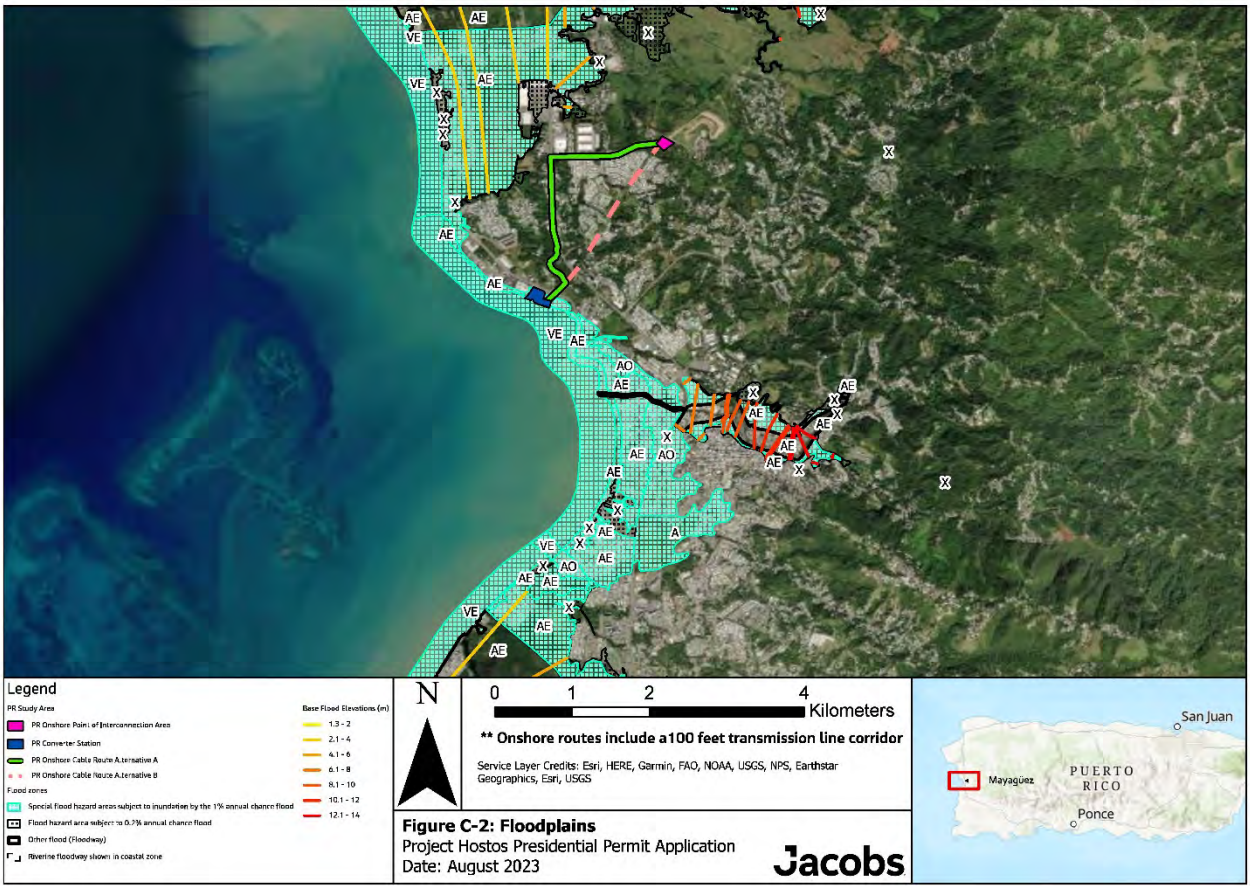



**Figure C-2. Floodplains**

## Wetlands

CTDC reviewed available National Wetlands Inventory (NWI) data (USFWS 2023a) to estimate potential impacts and project constraints due to the presence of NWI wetlands along the proposed cable route in Puerto Rico. Wetland delineation field work will be conducted before permit acquisition to verify and refine the wetland data.

Based on the review of the NWI, the proposed terrestrial cable route/ROW has potential to cross a freshwater palustrine emergent wetland, palustrine freshwater forested/shrub wetlands, and riverine waterways, one of which is the Caño Boquilla, as shown on Figure C-3. No NWI-mapped wetlands occur within the boundaries of the HVDC converter station in Puerto Rico.

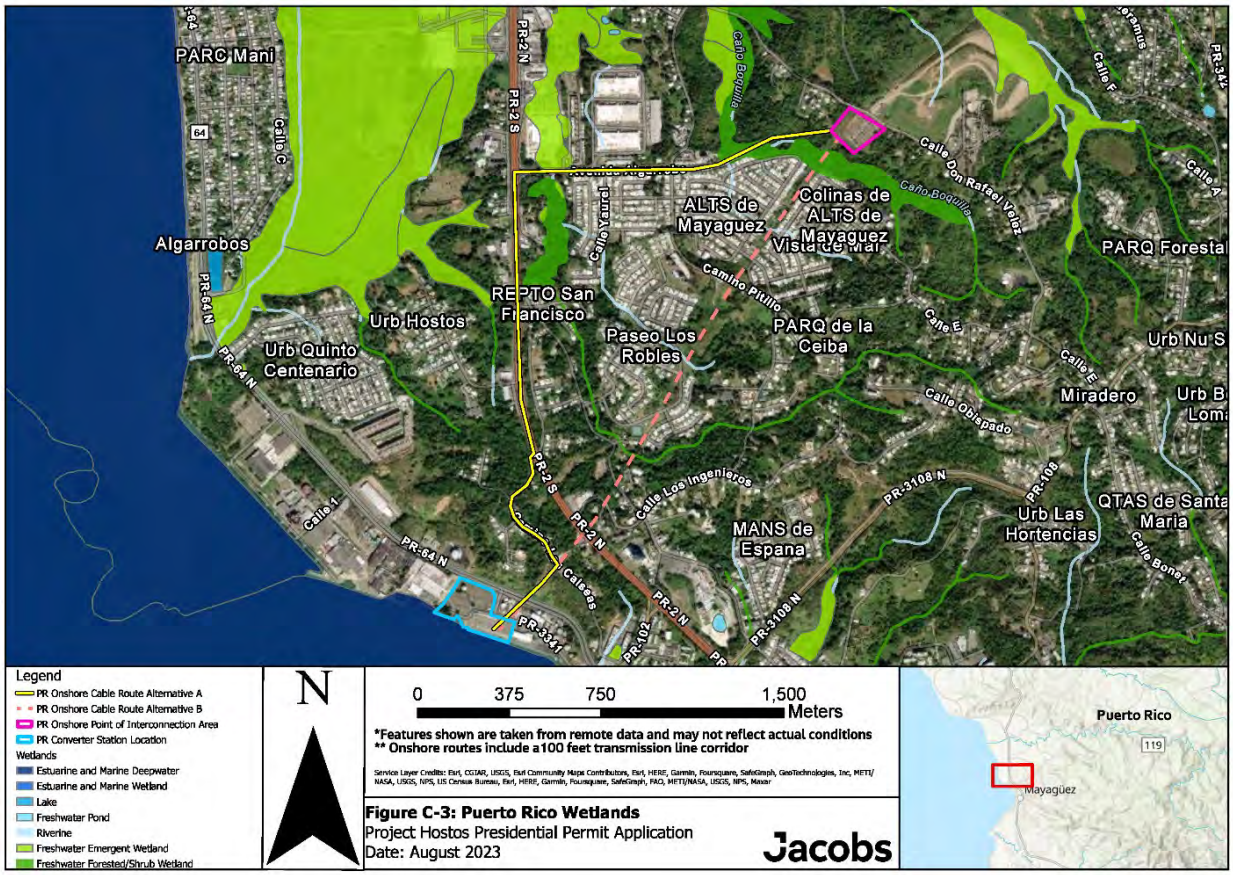



**Figure C-3. Puerto Rico Wetlands**

## Navigable Waterway Crossings

The subsea cable route crosses through navigable waters of the U.S., including coastal and ocean waters of the Caribbean Sea. It is assumed that a Rivers and Harbors Act Section 10 permit would be required as well as a Clean Water Act Section 404 permit, understanding that USACE considers the subsea cable transmission line and associated cable protection armor to be fill. Terms and conditions associated with those permits would be applied following conclusion of those consultations.

## Critical Habitat, Essential Fish Habitat, and Habitat Areas of Particular Concern

The terrestrial portion of the proposed project does not intersect any U.S. Fish and Wildlife Service (USFWS)-designated critical habitat.

The subsea cable route intersects National Marine Fisheries Service-designated critical habitat for the following species (NOAA Fisheries 2022):

- Lobed star coral (*Orbicella annularis*)
- Pillar coral (*Dendrogyra cylindrus*)
- Elkhorn coral (*Acropora palmata*)
- Staghorn coral (*Acropora cervicornis*)
- Rough cactus coral (*Mycetophyllia ferox*)
- Boulder star coral (*Orbicella franksi*)
- Mountainous star coral (*Orbicella faveolata*)

Critical habitat for these seven coral species encircles the entirety of the Puerto Rican archipelago, extending at some locations more than 15 miles (24 kilometers) from the shore. In the area of the proposed HDD from Puerto Rico, the critical habitat extends up to 3.5 miles (5.6 kilometers) from shore for rough cactus coral, mountainous star coral, and boulder star coral, and up to 2.75 miles (4.5 kilometers) for the remaining species. Impacts to nearshore critical habitat for coral species would be avoided by using HDD within the intertidal and subtidal zones. The risk of an inadvertent release of drilling mud to critical habitat would be mitigated by monitoring the pressure of the drilling mud in the HDD bore hole and through implementing an approved HDD frac-out contingency plan to minimize and contain turbidity and sedimentation. There are no coral protection areas within the proposed project area.

As illustrated on Figure C-1, deep-water coral observations have been made in marine waters west of Puerto Rico. Due the scale of the map, these observations appear to be proximal to the proposed routes, but the observation sites would be avoided during subsea cable siting/routing.

Proposed critical habitat for the Nassau grouper (*Epinephelus striatus*) is in the vicinity of the subsea cable route; however, the current subsea cable route does not intersect the proposed critical habitat areas. The subsea cable route would pass more than 8 miles (13 kilometers) north of designated critical habitat for hawksbill turtle (*Eretmochelys imbricata*). The proposed project route will cross through National Oceanic and Atmospheric Administration (NOAA) Fisheries-designated EFH for the species and life stages of these species listed in Table C-1. The installation methods for the subsea cable will be designed to minimize impacts to EFH to the extent practicable. HAPCs have been defined by the Caribbean Fishery Management Council in five discrete locations in the general project area and within U.S. Exclusive Economic Zone waters. All of these HAPCs and NOAA Marine Protected Areas will be avoided by the subsea cable (refer to Figure C-1).

**Table C-1. Essential Fish Habitat Crossed by the Proposed Project within Puerto Rico Waters**

| Common Name | Life Stage |
|---|---|
| Spiny Lobster (*Panulirus argus*) | Larvae, Post-Egg/Larval |
| Corals | Larvae, Post-Egg/Larval |
| Queen conch (*Aliger gigas*) | Larvae, Post-Egg/Larval |
| Reef fish | Larvae, Post-Egg/Larval |
| Yellowfin tuna (*Thunnes albacares*) | Spawning, Eggs, Larvae |
| White marlin (*Kajikia albida*) | Juvenile, Adult |
| Longbill spearfish (*Tetrapturus pfluegeri*) | All life stages |
| Oceanic whitetip shark (*Carcarhinus longimanus*) | All life stages |
| Caribbean reef shark (*Carcarhinus perezii*) | All life stages |
| Blue marlin (*Makaira nigricans*) | Spawning, Eggs, Larvae, Juvenile, Adult |
| Tiger shark (*Galeocerdo cuvier*) | Juvenile, Adult |
| Lemon shark (*Negaprion brevirostris*) | Juvenile |

Source: NOAA Fisheries 2021

**Indian Land**

There are no federally recognized tribal nations in Puerto Rico. Therefore, there would be no impacts to Indian land (tribal lands) from the proposed project.

**Historic Sites**

To identify historic properties that could be affected by the project, a consultant who meets the Secretary of the Interior's Professional Qualifications Standards reviewed information available from the Puerto Rico State Historic Preservation Office archives within a 1-mile (1.6-kilometer) radius of the project terrestrial sites, federal and territorial waters sites, and ROWs. The records search is to identify previously recorded historic properties and cultural resources as well as previous cultural resources surveys within the terrestrial sites, federal and territorial waters sites, ROWs, and their environs. The records search included a review of available information in the National Archives' National Register of Historic Places (NRHP) database of historic properties listed in the NRHP within the Mayagüez municipality.

***Terrestrial – Puerto Rico***

The records search did not identify any previously recorded properties listed in or eligible for listing in the NRHP within the project's terrestrial sites or the project's terrestrial sites' 100-foot-wide ROWs. There are 18 previously recorded properties listed in the NRHP within the Mayagüez municipality. Sixteen of them are approximately 2 miles (3.2 kilometers) from the project's terrestrial sites, and two properties in Mona Island, which is part of the Mayagüez municipality, approximately 13 miles (21 kilometers) from the water sites (National Park Service n.d.) (Figure C-4).

Five previously recorded cultural resources were identified within the 1-mile (1.6-kilometer) radius search area, comprised of four architectural resources (MY0200015, MY0200039, MY0200041, and MY0200042) and one archaeological site (MY0100012) (Figure C-4). Of the four architectural resources, three (MY0200039, MY0200041, and MY0200042) have been determined eligible for listing to the NRHP by the Puerto Rico State Historic Preservation Officer (PRSHPO). These historic properties are historic-era warehouses associated with the old port area (historically known as Marina Meridional) dating from the late nineteenth and early twentieth centuries. The fourth architectural resource (MY0200015) is Taller de Tranvia, dated between circa 1910 to 1930 and comprised of machines, equipment, and remnants of the electric Mayagüez Tramway. NRHP evaluation by the PRSHPO is pending for this resource. The previously recorded archaeological resource (MY0100012) is a pre-contact shell-midden archaeological site. NRHP evaluation by PRSHPO is pending for this archaeological site.

No previous cultural resources investigations or surveys have been completed within the project's terrestrial sites or the 100-foot-wide ROWs. Sixteen previously conducted cultural resources investigations have been completed within a 1-mile radius of the project's terrestrial sites. In 1993, a survey was conducted approximately half a mile south of the project's terrestrial sites to develop a residential complex project. No archaeological resources were found within the project area. Other cultural resources investigations were completed between 1989 and 2012 as part of road improvements, housing, industrial, sanitary system improvements, and military projects. The archaeological results for these surveys were negative.

The potential to encounter historic properties or archaeological sites eligible for listing on the NRHP within the project terrestrial sites and ROWs is low.

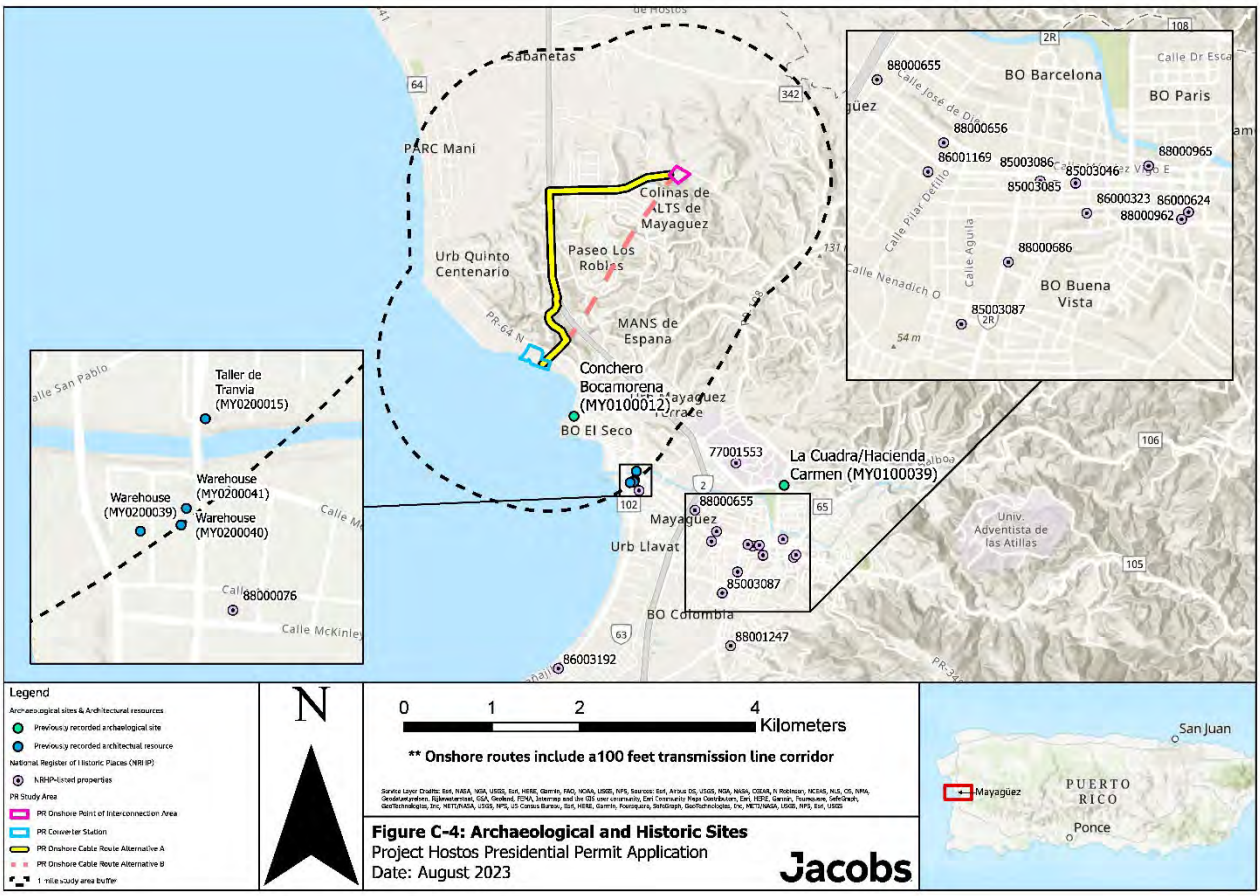



**Figure C-4. Archaeological and Historic Sites**

### *Marine/Aquatic – Puerto Rico*

The records search found that no previous underwater archaeological surveys have been completed within the subsea HVDC transmission cable system proposed routes or the 1,000-meter-wide ROWs, and there are no previously recorded underwater archaeological sites listed in or eligible for listing in the NRHP within the subsea HVDC transmission cable system proposed routes or the marine sites corridor (1,000-meter-wide) ROWs.

Two projects have been completed within a 1-mile radius of the project's marine sites corridor. In 1997, the Puerto Rico Environmental Quality Board submitted the New Deep Ocean Outfall for Regional Mayagüez Wastewater Treatment Plant project to the PRSHPO. The proposed project is north of the Mayagüez Harbor. Three alternative outfall alignments were considered. One proposed outfall site (Alignment B) included a southwest alignment approximately 215 degrees toward the principal entrance of the Mayagüez Harbor, about 152 meters north of the navigation channel. It veered west approximately 266 degrees into deep water. The project included a Submerged Cultural Resources Survey – Stage IA Archival Search and Sensitivity Survey by Dr. Jesus Vega. The report included a literature search, maritime archival research, historical cartography, interviews with local professional divers, beach inspection, and diving photo-inspection of the outfall transects. Among the report's conclusions was a high probability of historic shipwreck sites for Alignment B, which intersects the northern side of Mayagüez Bay. The survey also concluded "extensive historic maritime activity along the west coast of Puerto Rico, since early sixteenth century. Extensive shipping activity has occurred in the Bay of Mayagüez since the mid-eighteenth century." Dr. Vega recommended a Stage IB to complete the evaluation for submerged cultural resources for Alignment A. This alignment was more distant from the reefs and the historic harbor of Mayagüez. The

PRSHPO agreed with the recommendation. The project file does not include the final correspondence to complete the Section 106 undertaking.

The records search also identified a second project - the Mayagüez Port Berthing Areas Maintenance Dredging project that required a USACE permit and was sponsored by the Puerto Rico Planning Board. It included dredging of sediments from the Mayagüez Harbor port facilities' berthing zone. This project did not require an underwater survey of the harbor area. The PRSHPO agreed to review the project as technical assistance to the Puerto Rico Planning Board and provided a finding of no historic properties within the project's area of potential effects.

The potential to encounter marine archaeological sites eligible for the NRHP within federal and territorial waters sites and ROWs is medium. Geophysical, geotechnical, and underwater surveys will be undertaken before construction, which will identify the presence of marine archaeological resources within the project footprint. The results of the underwater surveys will be used to identify properties that may be eligible for listing to the NRHP, and the findings will be submitted to the PRSHPO for review and concurrence before construction. The project will avoid, minimize, or mitigate adverse effects on historic properties if any are identified, and further consultation with the PRSHPO and other consulting parties will occur.

***Terrestrial – Dominican Republic***

A review of available information from the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Sites List website and the Dominican Republic *Nuestro Patrimonio – Cultura* website was conducted to identify historic properties in the project terrestrial site and ROW. The records search did not identify any properties listed on the UNESCO World Heritage Sites list or on the UNESCO World Heritage Sites waiting list for the Dominican Republic within the project's terrestrial site or the ROW. In addition, the records search did not identify any historic properties in the Dominican Republic *Nuestro Patrimonio – Cultura* website.

# (c)(2) Known Historic Places

The records search did not identify any previously recorded properties listed in or eligible for listing in the NRHP within the project terrestrial sites, water sites, or ROWs. Within the 1-mile radius records search area, there are three previously recorded historic-era warehouses (MY0200039, MY0200041, and MY0200042) that were determined eligible for listing to the NRHP by the PRSHPO. There are 16 NRHP-listed properties within the Mayagüez municipality, approximately 2 miles (3.2 kilometers) from the project's terrestrial sites, and two NRHP-listed properties in Mona Island, which is part of the Mayagüez municipality, approximately 13 miles (21 kilometers) from the water sites (National Park Service n.d.). The properties within the Mayagüez municipality and Mona Island are included in Table C-2.

**Table C-2. NRHP-listed Properties in the Vicinity of Project**

| NRHP Number | Property | Address |
|---|---|---|
| 77001553 | Edificio José de Diego, (Administration Building) | Universidad de Puerto Rico, Recinto de Mayagüez, 00680 |
| 85003087 | Asilo de Pobres | Calle Post, Bloques 417, Lote 6 |
| 85003046 | Casa Consistorial (City Hall) | Calles Peral y McKinley |
| 85003085 | Plaza Publica, Plaza Colon | Calle McKinley |
| 85003086 | Teatro Yagüez | Calles McKinley y Basora |
| 86000323 | Logia Adelphia | Calle Sol 64E, Bloques 357, Lote 8 |
| 86000624 | Casa Solariega de José de Diego (Residencia Leria Esmoris) | Calle Liceo No. 52 |
| 86001169 | Correo y Corte Federal (U.S. Post Office and Courthouse) | Calles McKinley y Pilar Defilló |

**Table C-2. NRHP-listed Properties in the Vicinity of Project**

| NRHP Number | Property | Address |
|---|---|---|
| 86003192 | Residencia Ramírez de Arellano en Guanajibo | Carretera Estatal No. 102 |
| 88000076 | Aduana de Mayagüez (US Custom House) | Avenida González Clemente esquina calle McKinley |
| 88000656 | Residencia Gómez | Calle Méndez Vigo No. 60 |
| 88000962 | Residencia Heyliguer | Calle Liceo No. 51 |
| 88000965 | Residencia Ramírez Fuentes | Calle Méndez Vigo No. 117 |
| 88001247 | Cementerio Municipal de Mayagüez (Old Cemetery) | Located south at the end of Calle Post |
| 88000655 | Residencia Duran Esmoris | Calle Méndez Vigo Bloque 204, Lote 204 |
| 88000686 | Residencia Nazario Rivera | Calle Post No. 105 |
| 81000689 | Faro de la Isla de Mona | Located east side of Mona Island |
| 93001398 | Amona, Mona Island | N/A |
| N/A Determined eligible for listing to the NRHP | MY0200039 – Warehouse | Calle Unión #3 |
| N/A Determined eligible for listing to the NRHP | MY0200041- Warehouse | Calle Comerio (Ave. González Clemente) #8 |
| N/A Determine eligible for listing to the NRHP | MY02200042- Warehouse | Calle Comerio (Ave. González Clemente) #10 |

Source: National Park Service n.d.; Puerto Rico State Historic Preservation Office archives

# (c)(3) Minimum ROW Width

The subsea HVDC transmission cable system would connect to an approximate 1.5- to 2.1-mile-long (2.41- to 3.38-kilometer-long) terrestrial ROW in Mayagüez, Puerto Rico, and an approximate 68-mile-long (109-kilometer-long) terrestrial ROW in the Dominican Republic. The terrestrial ROWs in both Puerto Rico and the Dominican Republic would be sited within existing utility ROWs to the extent practicable. The extent of land clearing required for the terrestrial ROWs and converter stations will be calculated as the final project design is prepared based on engineering, applicable requirements, and discussions with stakeholders. However, land clearing is expected to be minimized by collocating with existing ROWs. The proposed terrestrial ROW in Puerto Rico includes the HVDC subsurface land cable system, which would be located within a 100-foot-wide ROW.

A 1,000-meter-wide (500 meters from each side of the proposed centerline) corridor will be assessed for the proposed subsea HVDC transmission cable system ROW. Assessment of a larger area around the proposed subsea cable route will allow flexibility to microroute around sensitive resources and other constraints that may be discovered during the geologic and geophysical surveys. CTDC will complete additional field studies to verify existing conditions along the proposed route, ensure constructability, and establish a final ROW.

# (c)(4) Protected Species

## Terrestrial

Threatened and endangered terrestrial species with potential to occur within Mayagüez Municipality in Puerto Rico, as indicated by the USFWS Information for Planning and Consultation report prepared for this project, are presented in Table C-3.

**Table C-3. Threatened and Endangered Terrestrial Species with Potential to Occur within Project in Puerto Rico**

| Scientific Name | Common Name (English) | Common Name (Spanish) | Federal Status |
|---|---|---|---|
| ***Birds*** | | | |
| *Accipiter striatus venator* | Puerto Rican sharp-shinned hawk | Azor Rojizo | FE |
| *Amazona vittate* | Puerto Rican parrot | Cotorra Puertorriqueña | FE |
| *Buteo platypterus brunnescens* | Puerto Rican broad-winged hawk | Gavilán de Alas Anchas | FE |
| ***Reptiles*** | | | |
| *Chilabothrus inornatus* | Puerto Rican Boa | Culebrón de Puerto Rico | FE |
| ***Plants*** | | | |
| *Aristida portoricensis* | | Pelos Del Diablo | FE |
| *Cordia bellinis* | Serpentine manjack | | FE |
| *Crescentia portoricensis* | Calabash tree | Higuero De Sierra | FE |
| *Gesneria pauciflora* | | Yerba maricao de cueva | FT |

Source: USFWS 2023b

Federal Status: FE = federally endangered, FT = federally threatened

International Union for Conservation of Nature (IUCN) Red List species identified as having potential to occur within the proposed terrestrial project areas in the Dominican Republic are presented in Table C-4.

**Table C-4. IUCN Red List Terrestrial Species with Potential to Occur within Project in the Dominican Republic**

| Scientific Name | Common Name (English) | Common Name (Spanish) | IUCN Status |
|---|---|---|---|
| ***Mammals*** | | | |
| *Natalus major* | Hispaniolan greater funnel-eared bat | | NT |
| ***Birds*** | | | |
| *Antrostomus carolinensis* | Chuck-will's-widow | Guabairo de la Carolina | NT |
| *Buteo ridgwayi* | Ridgway's hawk | Guaraguaito de la Española | |
| *Calidris canutus* | Red knot | Playero Gordo | NT |
| *Charadrius nivosus* | Snowy plover | Chorlito Blanco | NT |
| *Dendrocygna arborea* | West Indian whistling-duck | Chiriría Caribeña | NT |

**Table C-4. IUCN Red List Terrestrial Species with Potential to Occur within Project in the Dominican Republic**

| Scientific Name | Common Name (English) | Common Name (Spanish) | IUCN Status |
|---|---|---|---|
| *Laterallus jamaicensis* | Black rail | Gallito Negro | EN |
| *Loxia megaplaga* | Hispaniolan crossbill | Periquito | EN |
| *Patagioenas leucocephala* | White-crowned pigeon | Paloma Cabeciblanca | NT |
| *Pterodroma hasitata* | Black-capped petrel | Petrel Antillano | EN |
| **Reptiles** | | | |
| *Aristelliger lar* | Hispaniolan giant gecko | Gecko gigante de la Hispaniola | NT |
| *Chilabothrus gracilis* | Hispaniola boa | | NT |
| *Cyclura cornuta* | Hispaniolan rhinoceros iguana | Iguana rinoceronte | EN |
| *Cyclura ricordii* | Ricord's rock iguana | Iguana de ricord | EN |
| *Ialtris dorsalis* | Brown fanged snake | | NT |
| *Ialtris parishi* | Parish's fanged snake | | CR |
| *Sphaerodactylus darlingtoni* | Darlington's least gecko | | NT |
| *Tropidophis haetianus* | Haitian dwarf boa | | NT |
| *Typhlops schwartzi* | Schwartz' worm snake | | NT |
| **Amphibians** | | | |
| *Eleutherodactylus flavescens* | Yellow split-toed frog | | NT |
| *Eleutherodactylus inoptatus* | Hispaniolan giant frog | | NT |
| *Eleutherodactylus nortoni* | Spiny giant frog | Rana verde espinosa | CR |
| *Eleutherodactylus paralius* | Coastal red-rumped frog | Rana de grupas rojas costera | NT |
| *Eleutherodactylus probolaeus* | Boca de Yuma frog | Rana de Boca de Yuma | EN |
| *Eleutherodactylus ruthae* | Eastern burrowing frog | Rana excavadora oriental | EN |
| **Insects** | | | |
| *Anetia briarea* | Lesser false fritillary | | NT |
| *Anetia jaegeri* | Jaeger's anetia | Mariposa leopardo | NT |
| *Anetia pantheratus* | False fritillary | | NT |
| *Danaus cleophile* | Jamaican monarch | | NT |
| *Hypolestes hatuey* | Hispaniolan flatwing | | NT |

**Table C-4. IUCN Red List Terrestrial Species with Potential to Occur within Project in the Dominican Republic**

| Scientific Name | Common Name (English) | Common Name (Spanish) | IUCN Status |
|---|---|---|---|
| *Papilio aristor* | Scarce Haitian swallowtail | | NT |
| *Phylolestes ethelae* | Hispaniolan malachite | | EN |
| *Progomphus tennesseni* | Bristle-tipped sanddragon | | EN |
| *Progomphus zephyrus* | Elusive sanddragon | | EN |
| ***Plants*** | | | |
| *Abarema glauca* | | Caracolí | NT |
| *Acianthera compressicaulis* | | | EN |
| *Dendropanax selleanus* | | Bois négresse | EN |
| *Calycorectes dominicanus* | | | CR |
| *Cassine lanceolata* | | | EN |
| *Chionanthus dictyophyllus* | | | EN |
| *Cleyara orbicularis* | | | CR |
| *Clusia plumieri* | | | EN |
| *Coccothrinax ekmanii* | | | EN |
| *Coffea arabica* | Arabica coffee | | EN |
| *Diospyros domingensis* | | Cocuyo | NT |
| *Ekmanianthe longiflora* | | | EN |
| *Eugenia neibensis* | | | EN |
| *Guaiacum officinale* | | | EN |
| *Guettarda tortuensis* | | | EN |
| *Jacaranda selleana* | | | EN |
| *Juniperus gracilior* | Hispaniolan juniper | Sabina | EN |
| *Lonchocarpus ellipticus* | | | CR |
| *Lonchocarpus monophyllus* | | | CR |
| *Miconia abscondita* | | | EN |
| *Miconia coniophora* | | | EN |
| *Pavonia aurantia* | | | EN |
| *Podocarpus buchii* | | Tacheula | EN |
| *Miconia limoides* | | | EN |
| *Pinus occidentalis* | Hispaniolan pine | | EN |
| *Podocarpus hispaniolensis* | | | EN |
| *Psuedophoenix ekmanii* | | | CR |
| *Rondeletia feketeana* | | | CR |
| *Salvia lachnaioclada* | | Sosúa sage | CR |
| *Sideroxylon rubiginosum* | | | CR |

**Table C-4. IUCN Red List Terrestrial Species with Potential to Occur within Project in the Dominican Republic**

| Scientific Name | Common Name (English) | Common Name (Spanish) | IUCN Status |
|---|---|---|---|
| *Stahlia monosperma* | | | EN |
| *Symplocos hotteana* | | | EN |
| *Ternstroemia selleana* | | | EN |
| *Tillandsia paniculate* | | | NT |

Source: IUCN 2023

IUCN Status: CR = Critically Endangered, EN = Endangered, NT = Near Threatened, VU = Vulnerable

Preconstruction surveys would be conducted before the initiation of construction activities to identify and avoid/minimize impacts to protected species. Installation of the parts of the terrestrial route via HDD would also help minimize impacts to protected terrestrial species and their habitats. Consultations, as required, will be conducted with the appropriate resource agencies to avoid and minimize impacts to the listed terrestrial resources.

## Marine/Aquatic

Threatened and endangered marine species with potential to occur within the proposed project areas, as indicated by the USFWS Information for Planning and Consultation report prepared for this project (USFWS 2023b), NOAA Fisheries list of threatened and endangered species in Puerto Rico (NOAA Fisheries 2023) and IUCN Red List (IUCN 2023) are presented in Table C-5.

**Table C-5. Threatened and Endangered Marine Species with Potential to Occur within Project Area**

| Scientific Name | Common Name (English) | Common Name (Spanish) | Federal Status | IUCN Status |
|---|---|---|---|---|
| ***Mammals*** | | | | |
| *Balaenoptera borealis* | Sei whale | | FE | EN |
| *Trichechus manatus* | West Indian Manatee[a] | Manatí | FT | VU |
| *Physeter macrocephalus* | Sperm whale[b] | | FE | VU |
| *Pseudorca crassidens* | False killer whale | | FE | NT |
| ***Fish*** | | | | |
| *Aetobatus narinari* | Whitespotted eagle ray | Chucho | – | EN |
| *Anguilla rostrata* | American eel | Anguila | – | EN |
| *Albula vulpes* | Bonefish | Conejo | – | NT |
| *Balistes vetula* | Queen triggerfish | | – | NT |
| *Carcharhinus acronotus* | Blacknose shark | | – | EN |
| *Carcharhinus longimanus* | Oceanic whitetip shark[b] | | FT | CR |
| *Carcharhinus perezi* | Caribbean reef shark | | – | EN |
| *Carcharhinus plumbeus* | Sandbar shark | | – | EN |
| *Carcharhinus signatus* | Night shark | | – | EN |
| *Cetorhinus maximus* | Basking shark | | – | EN |
| *Diploria labyrinthiformis* | Grooved brain coral | | – | CR |
| *Epinephelus striatus* | Nassau grouper[b] | Mero batata | FT | CR |
| *Galeocerdo cuvier* | Tiger shark | Tiburón tigre | – | NT |

**Table C-5. Threatened and Endangered Marine Species with Potential to Occur within Project Area**

| Scientific Name | Common Name (English) | Common Name (Spanish) | Federal Status | IUCN Status |
|---|---|---|---|---|
| *Hypanus americanus* | Southern stingray | Raya | – | NT |
| *Hypanus guttatus* | Longnose stingray | | – | NT |
| *Hypanus say* | Bluntnose stingray | | – | NT |
| *Isurus paucus* | Longfin mako | Tiburón carite | – | EN |
| *Limia zonata* | Striped limia | | – | NT |
| *Lupinoblennius vinctus* | Mangrove blenny | | – | NT |
| *Lutjanus synagris* | Lane snapper | Rayado | – | NT |
| *Manta birostris* | Giant manta ray[b] | Manta | FT | EN |
| *Mobula birostris* | Oceanic manta ray | Manta | – | EN |
| *Mobula hypostoma* | Atlantic pygmy devil ray | | – | EN |
| *Mobula thurstoni* | Bentfin devil ray | | – | EN |
| *Mustelus canis* | Dusky smoothhound | | – | NT |
| *Mycteroperca bonaci* | Black grouper | Mero | – | NT |
| *Mycteroperca venenosa* | Yellowfin grouper | Mero | – | NT |
| *Poecilia dominicensis* | Titile | | – | NT |
| *Prionace glauca* | Blue shark | Tiburón azul | – | NT |
| *Scarus guacamaia* | Rainbow parrotfish | | – | NT |
| *Sphyrna lewini* | Scalloped hammerhead shark[b] | Tiburón martillo | FT | CR |
| *Sphyrna mokarran* | Great hammerhead | Cornuda | – | CR |
| *Styracura schmardae* | Atlantic chupare | | – | EN |
| ***Reptiles*** | | | | |
| *Caretta caretta* | Loggerhead sea turtle[a, b] | Caguamo | FT | VU |
| *Chelonia mydas* | Green sea turtle[a, b] | Tortuga verde | FT | EN |
| *Dermochelys coriacea* | Leatherback sea turtle[a, b] | Tinglar | FE | VU |
| *Eretmochelys imbricata* | Hawksbill sea turtle[a, b] | Carey | FE | CR |
| *Lepidochelys olivacea* | Olive Ridley sea turtle[a] | | FT | VU |
| ***Corals*** | | | | |
| *Acropora cervicornis* | Staghorn coral[b] | Cuernos de ciervo | FT | CR |
| *Acropora palmata* | Elkhorn coral[b] | Pata de ñame | FT | CR |
| *Agaricia grahamae* | Graham's sheet coral | | – | NT |
| *Agaricia humilis* | Lowrelief lettuce coral | | – | CR |
| *Agaricia lamarcki* | Lamarck's sheet coral | | – | CR |
| *Agaricia tenuifolia* | Thin leaf lettuce coral | | – | CR |
| *Colpophyllia breviserialis* | | | – | CR |
| *Dendrogyra cylindrus* | Pillar coral[b] | Coral pilar | FT | CR |
| *Eusmilia fastigiata* | Smooth flower coral | | – | CR |
| *Helioseris cucullata* | Sunray lettuce coral | | – | CR |

**Table C-5. Threatened and Endangered Marine Species with Potential to Occur within Project Area**

| Scientific Name | Common Name (English) | Common Name (Spanish) | Federal Status | IUCN Status |
|---|---|---|---|---|
| *Madracis decactis* | Ten-ray star coral | | – | CR |
| *Madracis formosa* | Eight-ray finger coral | | – | NT |
| *Millepora complanata* | Blade fire coral | | – | CR |
| *Millepora squarrosa* | Crustal fire coral | | – | CR |
| *Mycetophyllia danaana* | Lowridge cactus coral | | – | CR |
| *Meandrina jacksoni* | Whitevalley maze coral | | – | CR |
| *Meandrina meandrites* | Maze coral | | – | CR |
| *Mussa angulosa* | Spiny flower coral | | – | NT |
| *Mycetophyllia ferox* | Rough cactus coral[b] | | FT | CR |
| *Orbicella (Montastraea) annularis* | Lobed star coral[b] | Coral Estrella | FT | EN |
| *Orbicella (Montastraea) faveolata* | Mountainous star coral[b] | Coral Estrella | FT | EN |
| *Orbicella (Montastraea) franksi* | Boulder star coral[b] | Coral Estrella | FT | EN |
| *Pseudodiploria clivosa* | Knobby brain coral | | – | NT |
| *Pseudodiploria strigosa* | Symmetrical brain coral | | – | CR |
| *Scolymia cubensis* | Artichoke coral | | – | CR |
| *Scolymia lacera* | Atlantic mushroom coral | | – | CR |
| *Siderastrea siderea* | Massive starlet coral | | – | CR |
| *Stephanocoenia intersepta* | Blushing star coral | | – | NT |
| ***Mollusks*** | | | | |
| *Conus cardinalis* | Cardinal cone | | – | NT |

Source: USFWS 2023b; NOAA Fisheries 2023; IUCN 2023

[a] Species indicated in Information for Planning and Consultation report prepared for the project

[b] Species indicated in NOAA Fisheries Threatened and Endangered List Puerto Rico (NOAA Fisheries 2023)

Federal Status: FE = federally endangered, FT = federally threatened

IUCN Status: CR = Critically Endangered, EN = Endangered, NT = Near Threatened, VU = Vulnerable

Impacts to threatened and endangered marine species would be minimized to the extent practicable within the project area (intertidal, subtidal, and benthic areas). HDD will be used at both transmission line landing locations (Puerto Rico and the Dominican Republic) near the shoreline. “Daylighting” of the HDD bore will occur at water depths greater than 60 feet to minimize impacts to listed coral reef and other nearshore species. Listed coral species in Table C-5 typically occur at depths shallower than the “daylighting” location of the HDD.

The subsea component of the proposed project will route around HAPCs, seagrasses, deep-water coral observation sites, and NOAA Marine Protected Area to avoid impacts to these resources. The installation methods for the subsea cable will be designed to minimize impacts to EFH to the extent practicable. The west coast of Puerto Rico is not known to provide suitable nesting habitat for Endangered Species Act -listed sea turtle species, so no impact is anticipated to turtle nesting areas. Seagrass, coral, and other benthic habitats will be avoided to the maximum extent practicable when routing the transmission line to ensure that impacts to special status species and their associated habitats are minimized during construction activities. Protected Species Observers will be deployed on pre- and post-vessel surveys and during construction activities to mitigate any potential impacts to special status species (i.e., marine mammals and turtles). Protected Species Observers will collect special status species sighting data and advise survey vessel operators if a marine mammal or sea turtle is sighted to avoid vessel strikes.

The proposed HVDC cable will emit EMFs and, therefore, will have temporary and localized impacts to listed shark, ray, or fish species within the proposed project area.

## Migratory Birds

Birds protected by the Migratory Bird Treaty Act that occur in Puerto Rico (USFWS 2021) and with potential to occur in the proposed project areas in Puerto Rico are presented in Table C-6.

**Table C-6. Migratory Bird Treaty Act Species that Occur in Puerto Rico**

| Scientific Name | Common Name (English) | Common Name (Spanish) |
|---|---|---|
| *Dendrocygna arborea* | West Indian whistling-duck | Chiriría caribeña |
| *Anas bahamensis* | White-cheeked pintail | Pato quijada colorada |
| *Nomonyx dominicus* | Masked duck | Pato dominico |
| *Oxyura jamaicensis* | Ruddy duck | Pato chorizo |
| *Patagioenas leucocephala* | White-crowned pigeon | Paloma cabeciblanca |
| *Geotrygon mystacea* | Bridled quail-dove | Paloma perdiz de Martinica |
| *Cypseloides niger* | Black swift | Vencejo negro |
| *Anthracothorax dominicus* | Antillean mango | Mango Antillano |
| *Fulica americana* | American coot | Gallinazo Americano |
| *Porzana flaviventer* | Yellow-breasted crake | Gallito amarillo |
| *Aramus guarauna* | Limpkin | Carrao |
| *Haematopus palliatus* | American oystercatcher | Ostrero |
| *Charadrius wilsonia* | Wilson's plover | Chorlito marítimo |
| *Charadrius nivosus* | Snowy plover | Chorlito blanco |
| *Calidris pusilla* | Semipalmated sandpiper[nb] | Playero gracioso |
| *Tringa flavipes* | Lesser yellowlegs[nb] | Playero guineílla pequeño |
| *Tringa semipalmata* | Willet[nb] | Playero aliblanco |
| *Sternula antillarum* | Least tern | Gaviota chiquita |
| *Phaethon lepturus* | White-tailed tropicbird | Chirre |
| *Phaethon aethereus* | Red-billed tropicbird | Chirre piquirrojo |
| *Puffinus lherminieri* | Audubon's shearwater | Pampero de Audubon |
| *Fregata magnificens* | Magnificent frigatebird | Tijereta |
| *Sula dactylatra* | Masked booby | Boba enmascarada |
| *Sula sula* | Red-footed booby | Boba patirroja |
| *Pelecanus occidentalis* | Brown pelican | Pelícano pardo |
| *Megascops nudipes* | Puerto Rican screech-owl | Múcaro común |
| *Vireo latimeri* | Puerto Rican vireo | Bienteveo |
| *Icterus portoricensis* | Puerto Rican oriole | Turpial Puertorriqueño |
| *Setophaga discolor* | Prairie warbler[nb] | Reinita galana |

Source: USFWS 2021

nb = non-breeding

Appropriate measures will be taken during project activities to avoid impacts to birds covered under the Migratory Bird Treaty Act. Some of these measures may include completing certain activities only during certain times of year, and identifying and avoiding nesting birds, bird nests, eggs, and fledglings.

# (d) Practical Alternatives Considered

This section includes alternatives considered for implementing the proposed Project Hostos and a discussion of the general environmental impacts of each alternative.

## Onshore Cable Route Alternatives

Figure D-1 shows the locations considered for the onshore cable route and ROW in Puerto Rico and applicable environmental constraints.

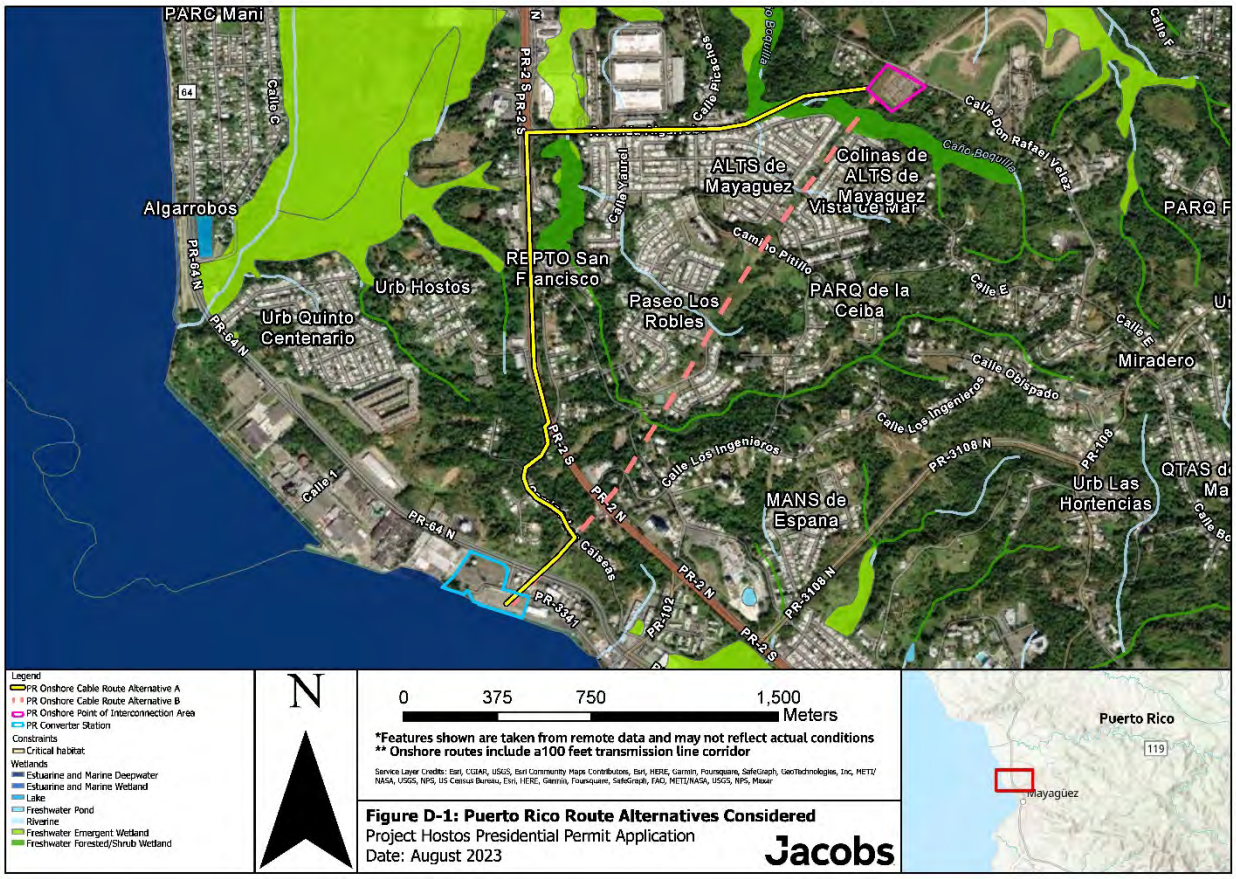



**Figure D-1. Puerto Rico Route Alternatives Considered**

## Puerto Rico Onshore Cable Route Alternative A

Under Alternative A, the cable route connecting the HVDC converter station in the port of Mayagüez to the 230-kV Mayagüez Substation would follow existing roadways to minimize impacts to residential areas. HDD would be used to install the cable underground. The Alternative A route crosses NWI-mapped wetland and riverine features; however, with the use of HDD, impacts to these features would be avoided. There is no USFWS-designated critical habitat in the vicinity of Alternative A. HDD installation would minimize potential impacts to threatened and endangered species.

## Puerto Rico Onshore Cable Route Alternative B

Under Alternative B, the cable route connecting the HVDC converter station in the port of Mayagüez to the 230-kV Mayagüez Substation would be located within an existing powerline ROW. HDD would be used to install the cable underground. Alternative B passes through a high-density residential area that would constrain the width of the ROW and is therefore slightly less favorable than Alternative A. The Alternative B route crosses NWI-mapped wetland and riverine features; however, with the use of HDD, impacts to

these features would be avoided. There is no USFWS-designated critical habitat in the vicinity of Alternative B. HDD installation would minimize potential impacts to threatened and endangered species.

## Subsea Cable Route Alternatives

CESI, an international firm based in Italy, is an energy consultant and designer. CTDC contracted CESI in July 2022 to perform a series of initial feasibility studies and a desktop evaluation of routes, resulting in the "CESI Route" as shown below. Jacobs performed subsequent analyses and developed Routes 01 and 02. The complete report and route assessment conducted by Jacobs (*Mona Passage HVDC Cable Route Assessment Report*) is included in Appendix I.

Figure D-2 shows the location of subsea cable routes considered and applicable environmental constraints. For all considered subsea cable routes, a 500-meter buffer on either side of the centerline is assumed to define the cable corridor. A summary of the subsea cable routes is provided in Table D-1.

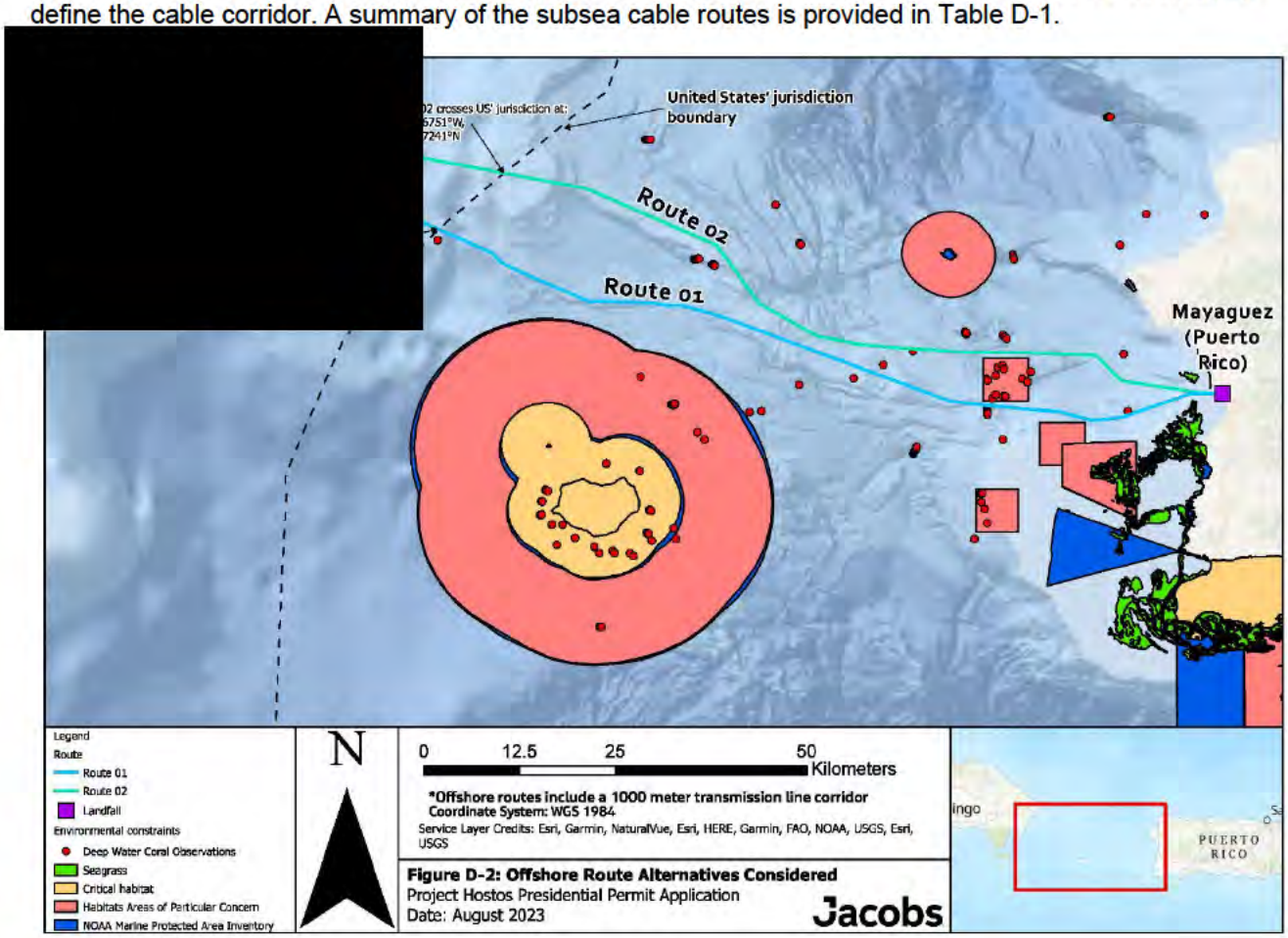



**Figure D-2. Offshore Route Alternatives Considered**

**Table D-1. Summary of Subsea Cable Routes**

| Analysis | | Route Corridors | | |
|---|---|---|---|---|
| | | **CESI Route** | **Route 01** | **Route 02** |
| | Route Length (kilometers) | 141.26 | 147.73 | 145.52 |
| Water Depth Analysis | Average Water Depth (meters) | -430.19 | -256.49 | -263.59 |
| | Max Water Depth (meters) | -930.34 | -478.09 | -556.54 |
| Crossings | Seabed slopes >20 degrees | 9 | 7 | 7 |
| | Existing cables crossings | 2 | 2 | 2 |
| | Disposal sites | 1 | 0 | 0 |
| | EFH | 3 | 4 | 3 |
| | Navigation channels | 1 | 0 | 0 |
| | HAPCs | 0 | 0 | 0 |
| | Marine Protected Areas | 0 | 0 | 0 |
| | Seagrass | 1 | 0 | 0 |
| | UXO[a] | 0 | 0 | 0 |
| | Soft ground | 41% | 65% | 52% |
| | Hard ground | 59% | 35% | 48% |
| | Anchorages | 0 | 0 | 0 |

Source: Jacobs. 2023. *Mona Passage HVDC Cable Route Assessment Report.* August 16. (Refer to Appendix I of this document)

[a] No unexploded ordinance (UXO) is anticipated within the project area upon review of the Bureau of Ocean Energy Management marine cadastre map viewer. If UXO is identified during geophysical and geotechnical surveys, the transmission line would be routed around the UXO.

## CESI Route

The route on Figure D-2 route has a length of 88 miles (141 kilometers), a maximum water depth of 3,051 feet (-930 meters), and an average water depth of -1,411 feet (-430 meters). The CESI cable corridor intersects HAPCs, crosses an ocean disposal site, has the highest number of fault scarps/steep slopes encountered, and crosses at least two existing submarine cable crossings. The CESI route was eliminated from further consideration due to significantly greater average and maximum water depths and interfaces with significant constraints.

## Route 01

Route 01 has a length of 92 miles (148 kilometers), a maximum water depth of -1,568 feet (478 meters), and an average water depth of -840 feet (-256 meters). This route has the shortest length across hard ground (35% hard and 65% soft) and the fewest fault scarps/steep slopes encountered. The route crosses at least two existing submarine cable crossings but avoids all other known environmental constraints. Route 01 is less deep and has fewer constraints and will be carried forward for reconnaissance geophysical and geotechnical survey.

## Route 02

Route 02 has a length of 91 miles (146 kilometers) and a maximum water depth of -1,827 feet (557 meters). This route crosses at least two existing submarine cable crossings but avoids all other known environmental constraints. Route 02 will be carried forward for reconnaissance geophysical and geotechnical survey.

# (e) Verification

The original of each application shall be signed and verified under oath by an officer of the applicant, having knowledge of the matters therein set forth.

As discussed in detail above, granting the requested Presidential Permit is consistent with the public interest: it provides the benefits of a new supply of energy and increases resilience of power deliveries to Puerto Rico and will provide related economic benefits of constructing, operating and maintaining a major infrastructure asset, while utilizing an environmentally-sensitive project route and design that will not adversely impact electric reliability in the region; instead, it will enhance electric reliability by interconnecting two existing power grids and providing black-start capability in the event of a complete loss of power. This increased electric reliability is crucial to restoring electricity to the residents of Puerto Rico, particularly after extreme weather events like Hurricane Maria, the damaging impacts of which on the power system of Puerto Rico are described in detail above. Interconnection of the grids between Puerto Rico and the Dominican Republic would provide much needed resilience, contributing to the Caribbean's energy security.

WHEREFORE, CTDC respectfully requests that the DOE approve CTDC's Presidential Permit Application authorizing the construction, connection, operation and maintenance for the facilities described herein for the transmission of electric energy at the international boundary between the United States and the Dominican Republic.

Respectfully,

Tirso Selman, Project Director
Caribbean Transmission Development Co. LLC

_____

Date

Before me appeared Tirso Selman, who, being duly sworn, did testify that the foregoing was true and correct to the best of his knowledge and belief.

_____

# References

Hutchison, Zoë L., David H. Secor, and Andrew B. Gill. 2020. The Interaction Between Resource Species and Electromagnetic Fields Associated with Electricity Production by Offshore Wind Farms.

International Union for Conservation of Nature (IUCN). 2023. “The IUCN Red List of Threatened Species.” Version 2022-2. https://www.iucnredlist.org.

Jacobs. 2023. Mona Passage HVDC Cable Route Assessment Report. August 16.

National Park Service. n.d. “Search Properties Listed in the National Register of Historic Places.” National Register of Historic Places. Accessed July 18, 2023. https://www.nps.gov/subjects/nationalregister/database-research.htm#table.

NOAA Fisheries. 2021. Essential Fish Habitat Mapper. Last updated on 07/22/2021. https://www.fisheries.noaa.gov/resource/map/essential-fish-habitat-mapper.

NOAA Fisheries. 2022. National ESA Critical Habitat Mapper. Last updated on 11/10/2022. https://www.fisheries.noaa.gov/resource/map/national-esa-critical-habitat-mapper.

NOAA Fisheries. 2023. “Threatened and Endangered Species List Puerto Rico.” https://www.fisheries.noaa.gov/southeast/consultations/threatened-and-endangered-species-list-puerto-rico.

Puerto Rico Planning Board. 2015. *Puerto Rico Land Use Plan*. November. https://www.sciencebase.gov/catalog/item/576bfe89e4b07657d1a26ee5

U.S. Fish and Wildlife Service (USFWS). 2021. *Birds of Conservation Concern 2021*. Migratory Bird Program. https://www.fws.gov/sites/default/files/documents/birds-of-conservation-concern-2021.pdf.

U.S. Fish and Wildlife Service (USFWS). 2023a. National Wetlands Inventory Wetlands Mapper. https://www.fws.gov/program/national-wetlands-inventory/wetlands-mapper.

U.S. Fish and Wildlife Service (USFWS). 2023b. *Information for Planning and Consultation*. https://ipac.ecosphere.fws.gov/.

# Appendix A
# Opinion of Counsel

DLA Piper (Puerto Rico) LLC
500 Calle de la Tanca, Suite 401
San Juan, Puerto Rico 00901-1969
www.dlapiper.com

CONFIDENTIAL

September 20, 2023

Ms. Maria Robinson
Department of Energy
Grid Deployment Office
1000 Independence Avenue, S.W.
Washington, DC 20585
electricity.exports@hq.doe.gov

**Re: Submarine Cable Presidential Permit Application**

Dear Ms. Robinson:

We have acted as special legal counsel to CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC, a Puerto Rico limited liability company ("***Applicant***"), in connection with the filing of the required application for Presidential Permit ("***Presidential Permit Application***" or "***Application***") for the project to develop, install and operate a subsea, 300-to-500-megawatt, high voltage direct current (HVDC) transmission cable system to transmit energy at the international border between the United States (Puerto Rico) and the Dominican Republic (the "***Project***"). The Presidential Permit is required under the authority granted to the Department of Energy ("DOE") pursuant to Executive Order (EO) 10485, as amended by EO 12038, which entails the issuance of a Presidential Permit for the construction, operation, and connection of electric transmission facilities at the United States international border, and the implementing regulations at 10 C.F.R. § 205.322(a)(6)(2022) (the "***Actions***"). Applicant has requested that we provide the opinions below in connection with the Application.

In rendering the opinions expressed below, we have examined originals (or copies presented to us as being true and correct copies of originals) of (i) the Application of which this opinion is part, (ii) the organizational documents of Applicant identified in Schedule I attached hereto (the "***Organizational Documents***") and (iii) certain other confidential business records and representations of the Applicant identified in Schedule II as delivered and certified to us pursuant to a certificate as complete, duly adopted and currently in effect, and certain other documents of the Applicant (collectively, the ***"Other Documents***").

In connection with the opinions set forth below, we have also examined originals, or copies, certified or otherwise identified to our satisfaction, of such documents, limited liability company records, certificates and other instruments as we have deemed necessary or appropriate for the purpose of this opinion letter. In our examination, we have assumed the genuineness of all signatures, the authenticity of all documents submitted to us as originals, the conformity to original documents of all documents submitted to us as certified or photostatic copies, telecopies or

electronic copies, including portable document files, and the authenticity of the originals of all such documents.

Insofar as this opinion letter relates to factual matters, we have relied (without independent investigation) upon the truth and accuracy of the factual representations and warranties contained in the Application, the Organizational Documents and the Other Documents.

In rendering the opinions set forth herein, whenever an opinion or other statement herein is qualified by "our knowledge" (or words of like import), the words "our knowledge" (or words of like import) signify that, in the course of our representation of the Applicant in connection with the Application, no information has come to the attention of Andrea Chambers, Miriam Figueroa, Juan Aquino or Laura Rozas, who are the individual lawyers within our firm who have devoted significant attention to the Application process, that would give us actual knowledge or notice that any such opinions or statements are not accurate or that any of the documents, certificates, reports, and information on which we have relied are not accurate and complete. We have undertaken no independent investigation or verification of such matters. We do not accept any liability whatsoever for any knowledge of any other persons, including the other attorneys, legal assistants or employees of this firm, or imputed knowledge regarding such matters or any matters about which we should have known except as noted above. No opinion is being expressed as to the effect of any event, fact or circumstance of which we have no actual knowledge.

Assumptions:

In reaching the opinions set forth below, we have assumed the following:

(a) each natural person acting for Applicant in connection with the Application is legally competent, and has the legal capacity, to do so;

(b) all public records and other documents reviewed by us and all statements therein are accurate and complete;

(c) there are no oral or written modifications of, or amendments to, any of the Application, Organizational Documents and the Other Documents, and nothing has rendered the factual certifications delivered to us by any officer/director of Applicant inaccurate; and

(d) the Application shall be duly filed and all applicable filing fees and charges have been or shall be paid on a timely basis.

We express no opinion as to the laws of any state or jurisdiction other than (i) the pertinent internal laws of the Commonwealth of Puerto Rico (the "***Commonwealth***") and (ii) the pertinent federal laws of the United States. The pertinent laws are those laws, which, in the experience of our attorneys who have devoted significant time to the Application process and who are members of the bar in Washington, District of Columbia and Puerto Rico in the exercise of customary professional diligence are normally pertinent to the types of activities described by Applicant in the Application in connection with construction, operation, maintenance and interconnection of electrical facilities authorized under Presidential Permit applications such as the laws referenced in the Application, in each case in effect on the date hereof (collectively, "***Pertinent Laws***"). Moreover, our opinion letter is based upon the current interpretation of the Pertinent Laws and

facts existing on the date hereof. Except as otherwise expressly indicated herein, the opinions expressed are given as of the date hereof and are based on our professional knowledge and judgment at this time; and we disclaim any obligation to advise you of any developments or changes either in the Pertinent Laws, other applicable laws or facts that may occur after the date of this opinion letter or if additional information is brought to our attention.

Opinions:

Based on our review of the foregoing and subject to the assumptions and qualifications set forth herein, our opinions are:

1. Based solely on our review of a Good Standing Certificate for Applicant dated September 12, 2023, obtained from the office of the Secretary of State of the Commonwealth, Applicant is validly existing and in good standing as a limited liability company under Pertinent Laws.

2. Applicant has all requisite limited liability company power and authority to file the Application and construct, operate and maintain the proposed Project as described in the Application.

3. To the best of our knowledge and belief based on Applicant's representations and covenants and our review of the Other Documents, the Applicant has directed its officers and employees to take all necessary steps to comply with Pertinent Laws in connection with the Actions to be taken under the Application.

This opinion letter is rendered to you in connection with the Application submittal and may be relied upon only by the addressee hereof. This opinion letter may not be relied upon by you for any other purpose or relied upon by, or furnished to, any other person, agency, firm or corporation without our prior written consent.

Very truly yours,

DLA Piper (Puerto Rico) LLC

## SCHEDULE I

1. Certificate of Organization filed with the Puerto Rico State Department on August 24, 2022; and

2. Certificate of Good Standing issued by the Puerto Rico State Department dated September 12, 2023.

Government of Puerto Rico
Department of State

Transaction Date: 24-Aug-2022
Register No: 492850
Order No: 2339184

# Certificate of Formation of a Limited Liability Company

## Article I - Limited Liability Company Name

**The name of the Domestic Limited Liability Company is: CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**

**Desired term for the entity name is: LLC**

## Article II - Principal Office and Resident Agent

Its principal office in the Government of Puerto Rico will be located at:

| | |
|---|---|
| Street Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Mailing Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Phone | **(787) 754-9696** |

The name, street and mailing address of the Resident Agent in charge of said office is:

| | |
|---|---|
| Name | **CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC** |
| Street Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Mailing Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Email | **rvelez@atabeycapital.com** |
| Phone | **(787) 754-9696** |

## Article III - Nature of Business

This is a For Profit entity whose nature of business or purpose is as follows:

**The Company shall be authorized to conduct any lawful business for which a limited liability company may be organized under the laws of the Commonwealth of Puerto Rico and the Puerto Rico General Corporations Act of 2009, as amended.**

## Article IV - Authorized Persons

The name, street and mailing address of each Authorized Person is as follows:

| | |
|---|---|
| Name | **Magraner Ortiz, David Manuel** |
| Street Address | **500 Calle de la Tanca, Suite 401, SAN JUAN, PR, 00901** |
| Mailing Address | **500 Calle de la Tanca, Suite 401, SAN JUAN, PR, 00901** |
| Email | **sanjuanfilings@us.dlapiper.com** |

## Article V - Administrators

If the faculties of the Authorized Persons will end upon the filing of the Certificate of Formation of a Limited Liability Company, the names, physical and mailing address of the persons who will act as Administrators until the first annual meeting of the members or until their successors replace them are as follows:

| | |
|---|---|
| Name | **Velez Dominguez, Rafael** |
| Title | **Manager** |
| Street Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Mailing Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Email | **rvelez@atabeycapital.com** |
| Expiration Date | **Indefinite** |

## Article VI - Terms of Existence

The term of existence of this entity will be: **Perpetual**

The date from which the entity will be effective is: **24-Aug-2022**

## Supporting Documents

| Document | Date Issued |
|---|---|

## STATEMENT UNDER PENALTY OF PERJURY

IN WITNESS WHEREOF, I/We Magraner Ortiz, David Manuel, the undersigned, for the purpose of forming a limited liability company pursuant to the laws of Puerto Rico, hereby swear that the facts herein stated are true. This 24th day of August, 2022.

# CERTIFICATE OF GOOD STANDING

I, **Omar J. Marrero Díaz, Secretary of State** of the Government of Puerto Rico,

**CERTIFY:** That, pursuant to Puerto Rico's General Law of Corporations, **CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**, register number **492850**, a **for profit domestic** Limited Liability Company organized under the laws of Puerto Rico on **August 24, 2022**, has complied with the payment of its Annual Fees.

**IN WITNESS WHEREOF**, the undersigned by virtue of the authority vested by law, hereby issues this certificate and affixes the Great Seal of the Government of Puerto Rico, in the City of San Juan, Puerto Rico, today, **September 12, 2023.**

**Omar J. Marrero Díaz**
Secretary of State

To validate this certificate go to: https://estado.pr.gov/

This certificate is valid for one (1) year from issue date (Regulation 8688, Art. 26). However, it is subject to faithful compliance with the provisions of Chapter XV and Chapter XXI of Act 164-2009, as applicable.

Certificate Validation Number: **589693-83919248**

## SCHEDULE II

Secretary's Certificate of Caribbean Transmission Development Co., LLC issued by Rafael Vélez Domínguez in his capacity as Secretary of Caribbean Transmission Development Co., LLC, dated September 20, 2023, and Exhibits thereto including the Limited Liability Company Operating Agreement of Caribbean Transmission Development Co., LLC dated as of September 7, 2022, and other internal corporate documentation and certifications.

**SECRETARY'S CERTIFICATE**
**OF**
**CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**

**September 20, 2023**

The undersigned, being the Secretary of CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC (the "**Company**"), hereby delivers this Certificate ("**Certificate**") on behalf of the Company, in his capacity as the Secretary thereof, and not in any individual capacity, hereby certifies that:

1. Certified Copy of the Articles of Organization of the Company. Attached hereto as Exhibit A is a true, correct and complete copy of the articles of organization of the Company and all amendments thereto, in effect on the date hereof. Except as reflected in Exhibit A, such certificate of formation has not otherwise been amended, modified, superseded, rescinded or revoked, and remains in full force and effect on the date hereof and no proceedings for the amendment, rescission, revocation, supersession or modification of the certificate of formation are pending or contemplated by the Company.

2. Limited Liability Company Agreement of the Company. Attached hereto as Exhibit B is a true, correct and complete copy of the Limited Liability Company Agreement of [redacted]aribbean Transmission Development Co., LLC (the "**LLCA**") and all amendments thereto in [redacted]ffect on the date hereof. Except as reflected in Exhibit B, the LLCA has not otherwise been [redacted]mended, modified, superseded, rescinded or revoked, and remains in full force and effect on the [redacted]ate hereof and no proceedings for the amendment, rescission, revocation, supersession or modification of the LLCA are pending or contemplated by the Company.

3. Certificate of Good Standing of the Company. Attached hereto as Exhibit C is a true, correct and complete copy of the certificate of good standing issued by the Secretary of State of the Commonwealth of Puerto Rico on September 12, 2023, certifying the existence of the Company under the laws of the Commonwealth of Puerto Rico, and no event has occurred since the date of such certificate which could reasonably be expected to affect the good standing thereunder. No proceeding for the dissolution or liquidation of the Company is pending or contemplated as of the date hereof.

4. Resolutions. Attached hereto as Exhibit D is a true, correct and complete copy of the Action by Unanimous Written Consent of the Sole Member of Caribbean Transmission Development Co., LLC (the "**Resolutions**"), relating to the documents to which the Company is or will be a party, the execution, delivery and performance thereof and the transactions contemplated thereby, which have been duly adopted in writing by the sole member of the Company, and such actions have not been amended, modified, superseded, rescinded or revoked in any respect and are in full force and effect on the date hereof.

5. Incumbency. Each of the persons named on Exhibit E hereto (i) is a duly elected or appointed and qualified officer and/or duly designated authorized representative of the of the Company and (ii) now holds the respective office(s) or designation set forth beside his or her name on such Exhibit. The signature appearing opposite each person's name on Exhibit E is the true and authentic signature or a true copy or PDF scan thereof.

6. Certification Regarding Compliance with Applicable Laws. Attached hereto as Exhibit F is a true, correct and complete copy of the Certification from Caribbean Transmission Development Co., LLC Regarding Compliance with Applicable Laws (the "**DOE Certification**") relating to the application for a Presidential Permit before the United States Department of Energy. The DOE Certification has not been amended, modified, superseded, rescinded or revoked in any respect and is in full force and effect on the date hereof.

7. Confirmations. The undersigned hereby further confirms and acknowledges, that DLA Piper LLP (US) is relying on the truth and accuracy of the above certifications in delivering a legal opinion and the undersigned, on behalf of the Company, hereby consents to such reliance.

*[Signature Page Follows]*

IN WITNESS WHEREOF, the undersig
Certificate as of the date first set forth above.

[redacted]

[redacted]

**Exhibit A**

ARTICLES OF ORGANIZATION OF

CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC

[Attached]

Government of Puerto Rico
Department of State

Transaction Date: 24-Aug-2022
Register No: 492850
Order No: 2339184

# Certificate of Formation of a Limited Liability Company

## Article I - Limited Liability Company Name

**The name of the Domestic Limited Liability Company is: CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**

**Desired term for the entity name is: LLC**

## Article II - Principal Office and Resident Agent

Its principal office in the Government of Puerto Rico will be located at:

| | |
|---|---|
| Street Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Mailing Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Phone | **(787) 754-9696** |

The name, street and mailing address of the Resident Agent in charge of said office is:

| | |
|---|---|
| Name | **CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC** |
| Street Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Mailing Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Email | **rvelez@atabeycapital.com** |
| Phone | **(787) 754-9696** |

## Article III - Nature of Business

This is a For Profit entity whose nature of business or purpose is as follows:

**The Company shall be authorized to conduct any lawful business for which a limited liability company may be organized under the laws of the Commonwealth of Puerto Rico and the Puerto Rico General Corporations Act of 2009, as amended.**

## Article IV - Authorized Persons

The name, street and mailing address of each Authorized Person is as follows:

| | |
|---|---|
| Name | **Magraner Ortiz, David Manuel** |
| Street Address | **500 Calle de la Tanca, Suite 401, SAN JUAN, PR, 00901** |
| Mailing Address | **500 Calle de la Tanca, Suite 401, SAN JUAN, PR, 00901** |
| Email | **sanjuanfilings@us.dlapiper.com** |

## Article V - Administrators

If the faculties of the Authorized Persons will end upon the filing of the Certificate of Formation of a Limited Liability Company, the names, physical and mailing address of the persons who will act as Administrators until the first annual meeting of the members or until their successors replace them are as follows:

| | |
|---|---|
| Name | **Velez Dominguez, Rafael** |
| Title | **Manager** |
| Street Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Mailing Address | **Urb. Costa de Oro, D76 Calle C, DORADO, PR, 00646** |
| Email | **rvelez@atabeycapital.com** |
| Expiration Date | **Indefinite** |

## Article VI - Terms of Existence

The term of existence of this entity will be: **Perpetual**

The date from which the entity will be effective is: **24-Aug-2022**

## Supporting Documents

| Document | Date Issued |
|---|---|

## STATEMENT UNDER PENALTY OF PERJURY

IN WITNESS WHEREOF, I/We Magraner Ortiz, David Manuel, the undersigned, for the purpose of forming a limited liability company pursuant to the laws of Puerto Rico, hereby swear that the facts herein stated are true. This 24th day of August, 2022.

**Exhibit B**

LIMITED LIABILITY COMPANY AGREEMENT OF

CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC

[Attached]

**LIMITED LIABILITY COMPANY OPERATING AGREEMENT**
***of***
**CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**

This Limited Liability Company Operating Agreement (the "***Agreement***") of CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC (the "***Company***"), effective as of September 7th, 2022, is entered into by Atabey Capital LLC, a Puerto Rico limited liability company, duly registered and existing in the Commonwealth of Puerto Rico, as the Sole Member (the "***Sole Member***") of the Company.

## ARTICLE I
## ORGANIZATIONAL MATTERS

**Section 1.1** **Formation**. The Company was formed as a Puerto Rico limited liability company in accordance with the Puerto Rico General Corporations Act of 2009, as amended, (the "***Act***") on August 24, 2022 (the "***Commencement Date***"). The Sole Member hereby agrees to continue the Company as a Puerto Rico limited liability company under and pursuant to the Act and agrees that except as expressly provided and permitted herein to the contrary, the rights and obligations of the Sole Member and the administration and termination of the Company shall be governed by the Act.

**Section 1.2** **Name**. The name of the Company shall be, and the business of the Company shall be conducted under the name of CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC. The Company's business may be conducted under any other name or names approved by the Sole Member.

**Section 1.3** **Registered Office and Principal Office of Company**. The Company established a registered office and a designated and duly qualified agent for service of process on the Company in the Commonwealth of Puerto Rico at Urb. Costa de Oro, D76 Calle C, Dorado, Puerto Rico 00646. The Company pursuant to the Act and the provisions herein, may maintain offices at such other locations as the Sole Member deems advisable.

**Section 1.4** **Term**. The existence of the Company commenced on the Commencement Date, and the Company shall be perpetual unless a dissolution event occurs pursuant to the express provisions of Article IX hereof.

**Section 1.5** **Limits of Company**. The Sole Member intends that the Company shall be treated as a limited liability company in accordance with the Act for all purposes under Puerto Rico law and this Agreement shall not be construed to provide otherwise.

**Section 1.6** **Authorized Person; Certificate**. The Sole Member hereby confirms that David M. Magraner Ortiz was an "authorized person" under the Act at the time that he executed, delivered, and filed the Certificate of Formation in such capacity. The Sole Member may execute, deliver and file any other certificates (and any amendments and/or restatements thereof) necessary for the Company to do business in Puerto Rico and in any other jurisdiction in which the Company may wish to conduct business.

## ARTICLE II
## DEFINITIONS

The following definitions shall for all purposes, unless otherwise clearly indicated to the contrary, apply to the terms used in this Agreement.

"Accounting Period" means the accounting year of the Company for accounting and tax purposes, which shall initially be the calendar year.

"Additional Contribution" means any Capital Contribution to the Company other than the Initial Contribution made to the Company pursuant to Section 4.2 hereof.

"Agreement" shall have the meaning set forth in the preamble hereto.

"Capital Contribution" means any Initial Contribution or Additional Contribution to the capital of the Company in cash when and as such contribution is actually made to the Company by the Sole Member.

"Capital Gain" means, for each Accounting Period of the Company, the Company's net income or gain resulting from all sales or other dispositions (including any deemed dispositions under the Code) of capital assets during such Accounting Period with respect to which income, gain or loss is recognized for income tax purposes, taking into account in the computation thereof all capital gains reportable by the Company for such Accounting Period.

"Capital Loss" means, for each Accounting Period of the Company, the Company's net loss resulting from all sales or other dispositions (including any deemed dispositions under the Code) of capital assets during such Accounting Period with respect to which income, gain or loss is recognized for income tax purposes, taking into account in the computation thereof all capital losses reportable by the Company for such Accounting Period.

"Certificate" means a certificate issued by the Company evidencing ownership of Company Membership Interests.

"Certificate of Formation" means the Certificate of Formation of the Company filed with the Department of State of Puerto Rico, as it may be amended or restated from time to time.

"Code" means the Puerto Rico Internal Revenue Code, Puerto Rico Law No. 1 of January 30, 2011, as amended, and in effect from time to time. All references herein to the Code shall include any corresponding provision or provisions of succeeding law.

"Commencement Date" shall have the meaning set forth in Section 1.1 hereto.

"Company" shall have the meaning set forth in the preamble hereto.

"Dissolution Event" has the meaning set forth in Section 9.1.

"Distributable Cash" means the amount by which the aggregate amount of all cash and cash equivalents from time to time held by the Company on hand or in bank accounts or other temporary investments pending distribution, exceeds the aggregate of all amounts to be paid or set aside by the Company for: (i) when due, all principal and interest payments on indebtedness of the Company and all other sums payable to lenders; (ii) all cash expenditures to be incurred in the normal operations of the business of the Company; and (iii) such cash reserves as the Sole Member may deem reasonably necessary for the proper operation of the business of the Company.

"Fair Market Value" means the price in cash, or its equivalent, that an asset would bring considering its highest and most profitable use, if then offered for sale in the open market, in competition with other similar assets at or near the same location, with a reasonable time allowed to find a purchaser.

"Initial Contribution" means the initial Capital Contribution to the Company deemed to have been made by the Sole Member.

"Losses" means, for each Accounting Period of the Company, losses of the Company as determined for income tax purposes, and each item of income, gain, loss or deduction entering into the computation thereof, except that any income, gain or loss taken into account in determining the Capital Gain or the Capital Loss of the Company for such Accounting Period shall not enter into such computations.

"Sole Member" means Atabey Capital LLC, or any other Person who succeeds the Sole Member in such capacity.

"Manager" means Rafael Vélez Domínguez, or any other Person who succeeds such Manager in that capacity.

"Membership Interest" means a Company Membership Interest, or any other class of membership interest to be created pursuant to the provisions of Section 4.2 of this Agreement.

"Membership Interest Percentage" has the meaning set forth in Section 4.1 of this Agreement.

"Person" means any individual, corporation, partnership, joint venture, limited liability company, limited liability partnership, association, joint stock company, trust, unincorporated organization, or other organization, whether or not a legal entity, and any governmental authority.

"Profits" means, for each Accounting Period of the Company, the profits of the Company, calculated according to Generally Accepted Accounting Principles (GAAP), as determined for income tax purposes, and each item of income, gain, loss or deduction entering into the computation thereof, excluding from such computation the items described as being excluded from the computation of Losses in the definition thereof.

## ARTICLE III
## PURPOSE, MEMBER AND SHARES

**Section 3.1** **Purposes and Scope**. The purpose of the Company is to conduct any licit business, purpose or activity permitted by the Act.

**Section 3.2** **Sole Member**. The Sole Member of the Company is Atabey Capital LLC, who has, subject to the provisions of Section 4.1 hereof, the entire Membership Interest of the Company as shown on **Exhibit A** of this Agreement

**Section 3.3** **Restrictions on the Disposition of a Membership Interest.** Except as expressly set forth herein, the Sole Member will have the right to sell, transfer, encumber or assign all or any portion of its Membership Interest in the Company.

**Section 3.4** **Sole Member's Information**. The mailing address of the Sole Member is set forth on **Schedule A** attached hereto.

**Section 3.5** **Dissolution**. In the event of the Sole Member's resignation or dissolution, the Company shall dissolve in accordance with Article IX hereof.

## ARTICLE IV
## CAPITAL CONTRIBUTIONS

**Section 4.1** **Initial Capital Contribution**. Concurrently with the adoption of this Agreement, the Sole Member is deemed to have contributed to the capital of the Company that capital of the Company in existence as of the date of this Agreement (the "***Initial Contribution***") and will receive the percentage of the total Membership Interests set forth on **Exhibit A** of this Agreement (the "***Membership Interest Percentage***").

**Section 4.2** **Additional Contributions**. The Sole Member may, in its sole and absolute discretion, make Additional Contributions in such amounts as it deems appropriate.

**Section 4.3** **Capital Accounts.** A capital account shall be established and maintained by and for the Sole Member.

**Section 4.4** **Limited Liability of Sole Member**. The Sole Member will not be liable for the debts, obligations, or liabilities of the Company beyond such Sole Member's Capital Contribution to the Company.

## ARTICLE V
## ALLOCATIONS AND DISTRIBUTIONS

**Section 5.1** **Allocation of Profits and Losses**. All Profits and Losses of the Company for each fiscal quarter and each Accounting Period (or portion thereof) will be allocated entirely to the Sole Member as set forth in this Agreement and applicable law. Any credit available for income tax purposes will be allocated entirely to the Sole Member in the same manner.

**Section 5.2** **Cash Distributions**. Distributable Cash will be distributed to the Sole Member at such time as the Sole Member may approve.

**Section 5.3** **Distributions on Termination**. Upon the dissolution and winding-up of the Company, its assets will be distributed in the manner prescribed in Article IX of this Agreement.

**Section 5.4** **Limitation on Distributions**. Any other provision of this Agreement to the contrary notwithstanding, no cash distribution or distribution on termination to the Sole Member of the Company will be declared and paid unless, (a) after the distribution is made, the Fair Market Value of all of the assets of the Company is in excess of all liabilities of the Company, other than liabilities to the Sole Member on account of its Capital Contributions; and (b) such distribution is in conformity with any outstanding loan agreements of the Company.

## ARTICLE VI
## MANAGEMENT OF THE COMPANY

**Section 6.1** **Management of the Company**.

(a) Manager. The business and affairs of the Company shall be managed by or under the direction of the Manager. For the avoidance of doubt, the Manager shall have all of the powers associated with a board of directors and officers of a corporation. The Manager shall hold office until its resignation or the Company's dissolution.

(b) Agents. To the extent of its powers set forth in this Agreement, the Manager may designate officers and agents of the Company for the purpose of the Company's business, and the actions of such officers and agents taken in accordance with such powers set forth in this Agreement shall bind the Company.

(c) Action by Members. Any action required by the Act to be taken by the Manager at any management meeting, or any action that may be taken at any management meeting, may be taken without a meeting, without prior notice, and without a vote, if a written consent, setting forth the action so taken, is signed by the Manager.

**Section 6.2 Powers.**

(a) The Company and the Manager, on behalf of the Company, (i) shall have and exercise all powers necessary, convenient or incidental, statutory or otherwise, to accomplish its purposes as set forth in Section 3.1 and (ii) shall have and exercise all of the powers and rights conferred upon limited liability companies formed pursuant to the Act. The Manager shall have the power to request and approve Additional Contributions and authorize the issuance of Membership Interests in exchange for Additional Contributions. Manager and the agents and officers designated by it have the authority to bind the Company.

(b) The Manager will perform, or arrange for the performance of, certain administrative services necessary for the operation of the Company. These administrative services include, among other things, providing facilities and personnel to the Company in the performance of certain services, including maintaining and preserving the books and records of the Company, assisting in the preparation and filing of the Company's income tax returns, payment of the Company's expenses, assisting in the preparation, printing and dissemination of reports and other communications to the Sole Member and providing regulatory compliance services.

(c) The Manager shall serve without compensation and will be entitled to reimbursement from the Company for its reasonable out-of-pocket expenses incurred in the performance of its duties.

(d) The Company shall pay all other expenses incurred in its operation.

(e) The Manager shall be exempted from liability for monetary damages to the Company or its Sole Member for violations of the duty of care, to the fullest extent permitted by the Act.

**Section 6.3 Indemnification.**

(a) The Company shall indemnify the Manager and the agents and officers designated by it for the Company's business to the fullest extent permitted by the Act.

(b) The Company shall advance reasonable expenses incurred by the Manager and such agents and officers in connection with any civil, criminal, administrative or investigative action, suit or proceeding to the fullest extent permitted by the Act.

(c) The Company shall have the power to purchase and maintain insurance on behalf of any person who is a Sole Member or Manager, officer, employee or agent of the Company to the fullest extent permitted by the Act.

## ARTICLE VII
## MEMBERSHIP INTERESTS

**Section 7.1** **Certificates Representing Membership Interests**. No Certificates will be issued to the Sole Member.

## ARTICLE VIII
## ACCOUNTING AND TAX MATTERS

**Section 8.1** **Books and Records**. The Sole Member will maintain such books and records of the operations and expenditures of the Company as the Sole Member shall determine.

**Section 8.2** **Income Tax**. The Sole Member shall determine whether or not to make elections or file returns for income tax purposes for the Company.

## ARTICLE IX
## DISSOLUTION AND LIQUIDATION

**Section 9.1** **Dissolution**. The Company will be dissolved upon the earliest to occur of the following events (each such event is referred to as a "***Dissolution Event***"):

(a) an election to dissolve the Company is approved in writing by the Sole Member; or

(b) any other event occurs that, under the Act, would cause the Company's dissolution.

**Section 9.2** **Effect of Dissolution**. Upon the dissolution of the Company, the Company will cease to carry on its business, except insofar as may be necessary for the winding up of its business, and the assets of the Company will be determined and valued effective as of the day on which the event occurs that results in such dissolution, but the Company will not terminate until there has been a winding-up of the Company's business and affairs and the assets of the Company have been liquidated and distributed as provided in this Agreement.

**Section 9.3** **Winding Up Procedures**. Upon the dissolution of the Company, the Company will (a) proceed to collect its assets; (b) convey and dispose of such of its properties as are not to be distributed in kind to the Sole Member; (c) pay, satisfy, and discharge its liabilities, or make adequate provision for payment and discharge of such liabilities; and (d) do all other acts required to liquidate its business and affairs.

**Section 9.4** **Distribution of Assets Upon Dissolution**. In settling the accounts of the Company after its dissolution, the assets of the Company will be applied and distributed in the following order of priority:

(a) First, to the extent permitted by law, and in accordance with the priorities, if any, established by applicable law, to creditors in satisfaction of liabilities of the Company, including liabilities of the Company to its Sole Member as a creditor (other than for distributions and Capital Contributions), whether by payment or establishment of reserves;

(b) Second, to its Sole Member.

**Section 9.5** **Distributions in Kind**. If any assets of the Company are distributed in kind, such assets will be distributed in accordance with the provisions of Section 9.4 above to the Sole Member.

**Section 9.6** **Articles of Dissolution**. When all liabilities and obligations of the Company have been paid or discharged, or adequate provision has been made for such liabilities, or in case its property and assets are not sufficient to satisfy and discharge all of the liabilities and obligations of the Company, then when all the property and assets of the Company have been applied to the extent available to the bona fide liabilities and obligations of the Company, and all of the remaining property and assets of the Company have been distributed to its Sole Member, the Company shall cause the Certificate of Formation to be cancelled and will take such other actions as are necessary or appropriate to reflect the dissolution and termination of the Company.

## ARTICLE X
## GENERAL PROVISIONS

**Section 10.1** **Captions and Headings**. The captions and headings used in this Agreement are for convenience of reference only and will not be taken into account in construing the meaning or intent of this Agreement.

**Section 10.2** **Amendment of Certificate of Formation**. The Certificate of Formation may be amended, supplemented or restated by written consent of the Sole Member. Upon executing the necessary consent with respect to such amendment, supplement, or restatement of the Certificate of Formation, the Sole Member will cause a Certificate of Amendment to be prepared, executed, and filed in accordance with the Act.

**Section 10.3** **Amendment of this Agreement**. This Agreement may only be amended, supplemented, or restated by the Sole Member.

**Section 10.4** **Number and Gender**. Where the context so indicates, the singular will include the plural, and the use of any gender will include all other genders.

**Section 10.5** **Binding Agreement**. Notwithstanding any other provision of this Agreement, the Members agree that this Agreement, constitutes a legal, valid and binding agreement of the Members, and is enforceable against the Members, in accordance with its terms.

**Section 10.6** **Severability**. If any one or more of the provisions contained in this Agreement for any reason are held to be invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability will not affect any other provisions of this Agreement and this Agreement will be construed as if such invalid, illegal, or unenforceable provisions had never been contained in this Agreement.

**Section 10.7** **Governing Law**. This Agreement and the construction interpretation will be governed exclusively by the Act and other applicable laws of the Commonwealth of Puerto Rico.

*[Signature Page Follows]*

**IN WITNESS WHEREOF**, the Sole Member has executed this Operating Agreement as of the date first set forth above.

**ATABEY CAPITAL LLC,**
***as Sole Member of the Company***

By: _____
Name: Rafael Vélez Domínguez
Title: Manager

**LIMITED LIABILITY COMPANY OPERATING AGREEMENT**
***of***
**CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**

**SCHEDULE A**

Address of Sole Member:

ATABEY CAPITAL LLC
Urb. Costa de Oro, D76 Calle C
Dorado, P.R. 00646

**Exhibit C**

CERTIFICATE OF GOOD STANDING OF

CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC

[Attached]

# CERTIFICATE OF GOOD STANDING

I, **Omar J. Marrero Díaz, Secretary of State** of the Government of Puerto Rico,

**CERTIFY:** That, pursuant to Puerto Rico's General Law of Corporations, **CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**, register number **492850**, a **for profit domestic** Limited Liability Company organized under the laws of Puerto Rico on **August 24, 2022**, has complied with the payment of its Annual Fees.

**IN WITNESS WHEREOF**, the undersigned by virtue of the authority vested by law, hereby issues this certificate and affixes the Great Seal of the Government of Puerto Rico, in the City of San Juan, Puerto Rico, today, **September 12, 2023.**

**Omar J. Marrero Díaz**
Secretary of State

To validate this certificate go to: https://estado.pr.gov/

This certificate is valid for one (1) year from issue date (Regulation 8688, Art. 26). However, it is subject to faithful compliance with the provisions of Chapter XV and Chapter XXI of Act 164-2009, as applicable.

Certificate Validation Number: **589693-83919248**

**Exhibit D**

RESOLUTIONS

[Attached]

**ACTION BY UNANIMOUS WRITTEN CONSENT OF**
**THE SOLE MEMBER OF**
**CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC**

**September 13, 2023**

**THE UNDERSIGNED**, being the Sole Member of **CARIBBEAN TRANSMISSION DEVELOPMENT CO., LLC** (the "**Company**"), acting pursuant to applicable statutory requirements and in accordance with the provisions of Section 6.1(C) of the Limited Liability Company Agreement of Caribbean Transmission Development Co., LLC, does hereby consent to and adopt the following actions and resolutions by this Written Consent (the "**Written Consent**"):

**WHEREAS,** the Company desires to develop, install and operate a subsea, 300-to-500-megawatt, high voltage direct current (HVDC) transmission cable system to transmit energy at the international border between the United States (Puerto Rico) and the Dominican Republic (the "**Project**");

**WHEREAS,** as a condition precedent to the commencement of the Project, in addition to obtaining other permits and authorizations, the Company must file and obtain a Presidential Permit ("**Presidential Permit Application**" or "**Application**") under the authority granted to the Department of Energy ("DOE") pursuant to Executive Order(EO) 10485, as amended by EO 12038, which requires the issuance of a Presidential permit for the construction, operation, and connection of electric transmission facilities at the United States international border, and the implementing regulations at 10 C.F.R. §205.322(a)(6)(2022;

[redacted]**WHEREAS,** the substantially final draft of the Presidential Permit Application was presented to [redacted]ole Member before the date of this Written Consent, which the Sole Member carefully reviewed and [redacted]idered; and

**WHEREAS,** the Sole member has deemed it advisable and in the best interest of the Company that the Company files the Presidential Permit Application and performs its obligations to develop the Project as described therein.

**NOW, THEREFORE, BE IT RESOLVED,** that the Presidential Permit Application, substantially in the form presented to the Sole Member on or about the date of this Written Consent, is hereby approved, and each of the Authorized Representatives (as defined below) is hereby authorized and empowered to finalize and deliver, on behalf of the Company, the final forms, terms and provisions of the Presidential Permit Application and to execute all related documentation to complete such filing in accordance with applicable laws and regulations, in each case, as such Authorized Representative deem it advisable. The execution, delivery and performance of the Presidential Permit Application, the payment of fees, costs and expenses in connection therewith, and the performance by the Company of its obligations arising thereunder, are hereby approved, authorized and adopted; and be it

**RESOLVED FURTHER,** that the Company is hereby authorized and instructed to execute, deliver and perform all necessary actions to undertake the Project and comply with any and all obligations, including applicable laws described in the Presidential Permit Application and related documentation; and be it

**RESOLVED FURTHER,** that Rafael Vélez Domínguez and Tirso Selman (collectively, the "**Authorized Representatives**") are, and each of them acting alone is, on behalf of the Company, authorized, empowered and directed to complete and file on behalf of the Company, the Presidential Permit Application and all its final forms and related documentation to complete such filing in accordance with

applicable laws and regulations in the name and on behalf of the Company and to perform all obligations of the Company under the Presidential Permit Application and applicable laws in connection with it and the Project; and be it

**RESOLVED FURTHER**, that the Authorized Representatives are hereby severally authorized and directed to do and perform or cause to be done and performed, in the name and on behalf of the Company, all other acts, to pay or cause to be paid on behalf of the Company all related costs and expenses, and to execute and deliver or cause to be executed such other notices, certificates, requests, demands, supplements, amendments, affidavits, reaffirmations, further assurances or other communications of any kind in the name and on behalf of the Company, as any of them may deem necessary, advisable or appropriate to effect the intent of the foregoing resolutions or to comply with the requirements of the Presidential Permit Application and applicable law, as authorized by the foregoing resolutions; and be it

**RESOLVED FURTHER**, that the actions taken by each of the Authorized Representatives in [redacted]eparing, causing to be prepared and filing the Presidential Permit Application, and all other documents [redacted]ated thereto be, and they hereby are, ratified, confirmed and approved in all respects; and be it

**RESOLVED FURTHER,** that the authority given hereunder shall be deemed retroactive and any and all actions previously taken by any of the Authorized Representatives in connection with the transactions contemplated by the foregoing resolutions are hereby adopted, ratified, confirmed and approved in all respects.

[Signature Page Follows]

**IN WITNESS WHEREOF**, the undersigned have hereunto affixed their signature and adopted the above resolutions as of the date first written above and hereby direct that a signed copy of this Action by Unanimous Written Consent of the Sole member of Caribbean Transmission Development Co., LLC be filed with the minutes of the proceedings of Caribbean Transmission Development Co., LLC.

**SOLE MEMBER:**

**ATABEY CAPITAL LLC**

By: _____
Name: Rafael Vélez Domínguez
Title: Manager

**Exhibit E**

INCUMBENCY

| Name | Title | Specimen Signature |
| --- | --- | --- |
| Rafael Vélez Domínguez | President, Secretary and Treasurer | |
| Tirso Selman | Project Director | |

**Exhibit F**

CERTIFICATION FOR PRESIDENTIAL PERMIT APPLICATION

CARIBBEAN
TRANSMISSION

**Certification from Caribbean Transmission Development Co, LLC**
**Regarding Compliance with Applicable Laws**

Caribbean Transmission Development Co., LLC ("CTDC"), a Puerto Rico limited liability company, is the proponent of a project to develop, install and operate a subsea, 500-to-700-megawatt, high voltage direct current (HVDC) transmission cable system to transmit energy between the Dominican Republic and the Commonwealth of Puerto Rico (territory of the United States) and crossing the international border between the United States (Puerto Rico) and the Dominican Republic (the "Project"), for which CTDC is submitting an application for a Presidential Permit before the United States Department of Energy (the "Application"). In connection with the Application, the undersigned, officer of CTDC, certifies and represents the following:

1. CTDC has complied with, and has directed all of its officers and employees to take all necessary steps for CTDC to comply with, all pertinent federal laws of the United States ("Federal Laws") and the internal laws of the Commonwealth of Puerto Rico ("Commonwealth Laws") including any rules, regulations, orders or other legal provisions having the force of law promulgated thereunder (collectively "Implementing Regulations", and collectively with the [redacted]ederal Laws and the Commonwealth Laws, the "Pertinent Laws")), as applicable to the Project [redacted]nd CTDC. In addition to the legal provisions governing Presidential Permit applications (*i.e.*, [redacted]residential Executive Order ("EO") 10485, as amended by EO 12038, and 10 C.F.R. §205.322 *et seq.*), these Pertinent Laws, include, but are not limited to, those listed below, including all amendments or modifications thereto, which could potentially apply with respect to CTDC's actions (e.g., impose prohibitions or requirements). The list below includes laws governing energy, land use, zoning, environment and natural resources permits and requirements reasonably expected to be applicable to the Project based on the preliminary design and information developed in connection with the Project by or on behalf of CTDC as of the date of the Application; it is clarified that some of these Pertinent Laws are only binding on the government agencies involved in the permitting process for the Project but with respect to which CTDC may have to take action during the permitting process so that these agencies may act upon:

> Outer Continental Shelf Lands Act, as amended, 43 U.S.C. §§1331 *et seq.*, Federal Power Act, as amended, 16 U.S.C. §§791 *et seq.*; the Federal Water Pollution Control Act of 1948, as amended (also known as the Clean Water Act), 33 U.S.C. §§1251 *et seq.*; the Rivers and Harbors Act of 1899, as amended (also known as the Rivers and Harbors Act), 33 U.S.C. §§401 *et seq.*; the Endangered Species Act, as amended, 16 U.S.C. §§1531 *et seq.*; the Migratory Bird Treaty Act of 1918, as amended, 16 U.S.C. §§703 *et seq.*; the Marine Mammal Protection Act of 1972, as amended, 16 U.S.C. §§1361 *et seq.*; the National Historic Preservation Act, as amended, 54 U.S.C. §§300101 *et seq.*; the Ports and Waterways

Safety Act of 1972, as amended, 33 U.S.C. §§1221 *et seq.*; the Magnuson-Stevens Fishery Conservation and Management Act, as amended, 16 U.S.C. §§1801 *et seq.*; the Coastal Zone Management Act of 1972, as amended, 16 U.S.C. §§1451 *et seq.*; the Marine Protection, Research and Sanctuaries Act of 1972, 16 U.S.C. §§1431 *et seq.*; the National Environmental Policy Act of 1969, as amended, 42 U.S.C. §§4321 *et seq.*; the Clean Air Act, as amended, 42 U.S.C. §§7401 *et seq.*; the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, 42 U.S.C. §§6901 *et seq.*; the Comprehensive Environmental Response, Compensation and Liability Act, as amended, 42 U.S.C. §§ 9601 *et seq.*; the Puerto Rico Energy Public Policy Act (*Ley de Política Pública Energética*), Act No. 17-2019; the Puerto Rico Energy Transformation and RELIEF Act (*Ley de Transformación y ALIVIO Energético de Puerto Rico*), Act No. 57-2014, as amended; the Environmental Public Policy Act (*Ley sobre Política Pública Ambiental*), Act No. 416-2004, as amended; the Public Policy on Energy Diversification by Means of Sustainable and Alternative Renewable Energy in Puerto Rico Act (*Ley de Política Pública de Diversificación Energética por Medio de la Energía Renovable Sostenible y Alterna en Puerto Rico*), Act No. 82-2010, as amended; the Puerto Rico Permit Process Reform Act (*Ley para la Reforma del Proceso de Permisos*), Act 161-2009, as amended; the Planning Board Organic Act (*Ley Orgánica de la Junta de Planificación*), Act 75 of June 24, 1975, as amended; the Organic Act of the Puerto Rico Department of Natural and Environmental Resources (*Ley Orgánica del Departamento de Recursos Naturales y Ambientales*), Act No. 133 of June 20, 1972, as amended; the New Wildlife Act of Puerto Rico (*Nueva Ley de Vida Silvestre de Puerto Rico*), Act No. 241 of August 15, 1999, as amended; the Act to Regulate the Extraction of Sand, Gravel and Stone (*Ley para Reglamentar la Extracción de Arena, Grava y Piedra*), Act No. 132 of June 25, 1968, as amended; the Puerto Rico Forest Act (*Ley de Bosques de Puerto Rico*), Act No. 133 of July 1, 1975, as amended; the Act for the Protection, Conservation, and Study of the Underwater Archaeological Sites and Resources (*Ley de Protección, Conservación y Estudio de Sitios y Recursos Arqueológicos Subacuáticos*), Act No. 10 of August 7, 1987, as amended; the Act for the Protection of Archaeological Lands Patrimony of Puerto Rico (*Ley de Protección del Patrimonio Arqueológico Terrestre*), Act No. 112 of July 20, 1988, as amended; Act for the Reduction and Recycling of Solid Wastes (*Ley para la Reducción y Reciclaje de Desperdicios Sólidos*), Act 70 of September 18, 1992, as amended; Puerto Rico Dock and Harbor Act of 1968 (*Ley de Muelles y Puertos de Puerto Rico*), Act Number 151 of June 28, 1968; and the Excavation and Demolition Center Act of Puerto Rico, Act 267 of September 11, 1998, as amended.

CARIBBEAN TRANSMISSION

2. The undersigned, as well as other officers of CTDC, has reviewed and discussed the list of Pertinent Laws with counsel and hereby represents that they understand the applicability, or potential applicability, of each such Pertinent Laws to the Project and the relevant scope thereof and, thus, is making the representations herein on an informed basis.

3. The undersigned has the authority to execute this Certification and make the representations hereunder on behalf of CTDC.

Certified by Rafael Velez, Manager of Caribbean Transmission Development Co., LLC, on this 19 of September 2023.

Name: Rafael Velez
Title: Manager

CARIBBEAN TRANSMISSION

September 21, 2023

Mr. Steven Blazek
Department of Energy
Grid Deployment Office
1000 Independence Avenue, S.W.
Washington, DC 20585
electricity.exports@hq.doe.gov

**Re: Caribbean Transmission Development Co. LLC, Supplement to the Submarine Cable Presidential Permit Application, Docket Number PP-502**

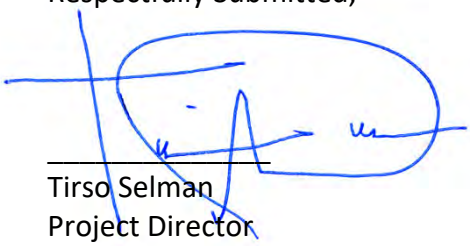
Dear Mr. Blazek :

Caribbean Transmission Development Co. LLC, the Applicant in the above-referenced Presidential Permit Application docket, is filing to supplement its Application submitted on September 14, 2023, to include the attached the Opinion of Counsel.

In connection therewith, Applicant herein **requests confidential treatment** be applied to the Opinion of Counsel in its entirety, as it contains information that the Applicant treats confidentially and is not disclosed to competitors or the general public. Therefore, Applicant has marked the Opinion of Counsel document Confidential.

Please contact the undersigned if you have any questions or concerns with this Supplement.

Respectfully Submitted,



Tirso Selman
Project Director
Caribbean Transmission Development Co. LLC

# Appendix B
# Converter Station Detailed Electrical Single-line Diagram

#HS10

CONNECTION TO AC SUBSTATION

3 AC 50Hz 400kV / DC ±320kV

-DA10

-Q01

-XB09

-FA09 (A, nx)

-FA01

-BA01

-QC04

-QB01

-QC01

-QA01

-BC01 P1 P2

-RA01

-QB05

-QC01

-BA02

AUX-POWER

refer to AUX-Power SLD

-TA01 Single Phase Transformers

-FA01 (A, nx)

-TA01

-BC01 P1 P2

-BC41 P2 P1

-BC03 P2 P1

-BC02 P1 P2

-RA01

-FA06 (ST, nx)

-QB06

-QC06

-RA61

-RA62

-BC06 IdSG (1 Box / 2x SH)

-FA02 (T1, nx)

-TD10

-DB10

SUPPLIED BY SIEMENS ENERGY

SUPPLIED BY OTHERS

-TB01

-BA01 UC_Lx

-RA03

Converter Hall

(1x DH) ICP_Lx -BC02 P2 P1

-GD01

-QC03

-WB03

-FA02 (CB, nx)

-RA01

(1x DH) IC_Lx -BC01 P2 P1

-WB01

-QC01

3

-FA01 (T2, nx)

-GD02

(1x DH) ICN_Lx -BC03 P1 P2

-QC04

-WB04

-FA03 (CB, nx)

-RA02

Reactor and DC Hall

-QB09-1

OPTION

-FA01-1 (DB, nx)

-BA01-1

-QC01-1

-QC09-1

UdHP

-FA09-1 (DL, nx)

-XB09-1

SUPPLY BY SIEMENS ENERGY

UdHP -BC09-1 P2 -1 -2 P1

(1x DH) (1x DH) Spare Installed

DC CABLE (+)

-QB09-2

-FA01-2 (DB, nx)

-BA01-2

-QC01-2

-QC09-2

UdHN

-FA09-2 (DL, nx)

-XB09-2

SUPPLY BY SIEMENS ENERGY

UdHN -BC09-2 P1 -1 -2 P2

(1x DH) (1x DH) Spare Installed

DC CABLE (-)

CONNECTION TO STATION B

## LEGEND:

SYMBOLS ACCORDING TO: IEC 60617

| | |
|---|---|
| CIRCUIT BREAKER | |
| DISCONNECTOR MOTORISED | |
| GROUNDING SWITCH, MOTORISED | |
| INTERFACE TRANSFORMER | |
| CONVERTER MODULE (HALF BRIDGE) | |
| REACTOR | |
| SURGE ARRESTER | |
| CURRENT TRANSFORMER | |
| CURRENT TRANSDUCER (ZERO FLUX TYPE) | |
| INDUCTIVE VOLTAGE TRANSFORMER | |
| BUSHING | |
| CABLE SEALING END | |
| CABLE PLUG & SOCKET | |
| RESISTIVE-CAPACITIVE VOLTAGE DIVIDER | |
| CAPACITIVE VOLTAGE TRANSFORMER | |
| RESISTOR | |
| CHANGE FROM 3 TO 1 PH | |
| CAPACITOR | |

Note 1:
Type of Arrester and Number of Housings are indicated as follows:
(Type, nx)

Note 2:
Type and number of Zero Flux Measuring Devices are indicated as follows:
(n x SH) Single Head Zero Flux Type
(n x DH) Double Head Zero Flux Type
(n x VZF) Vertical Zero Flux Type

LIMIT OF BUILDING

LIMIT OF OBJECT

LIMIT OF COMPONENT

OPTION/ALTERNATIVE TO BE CHECKED



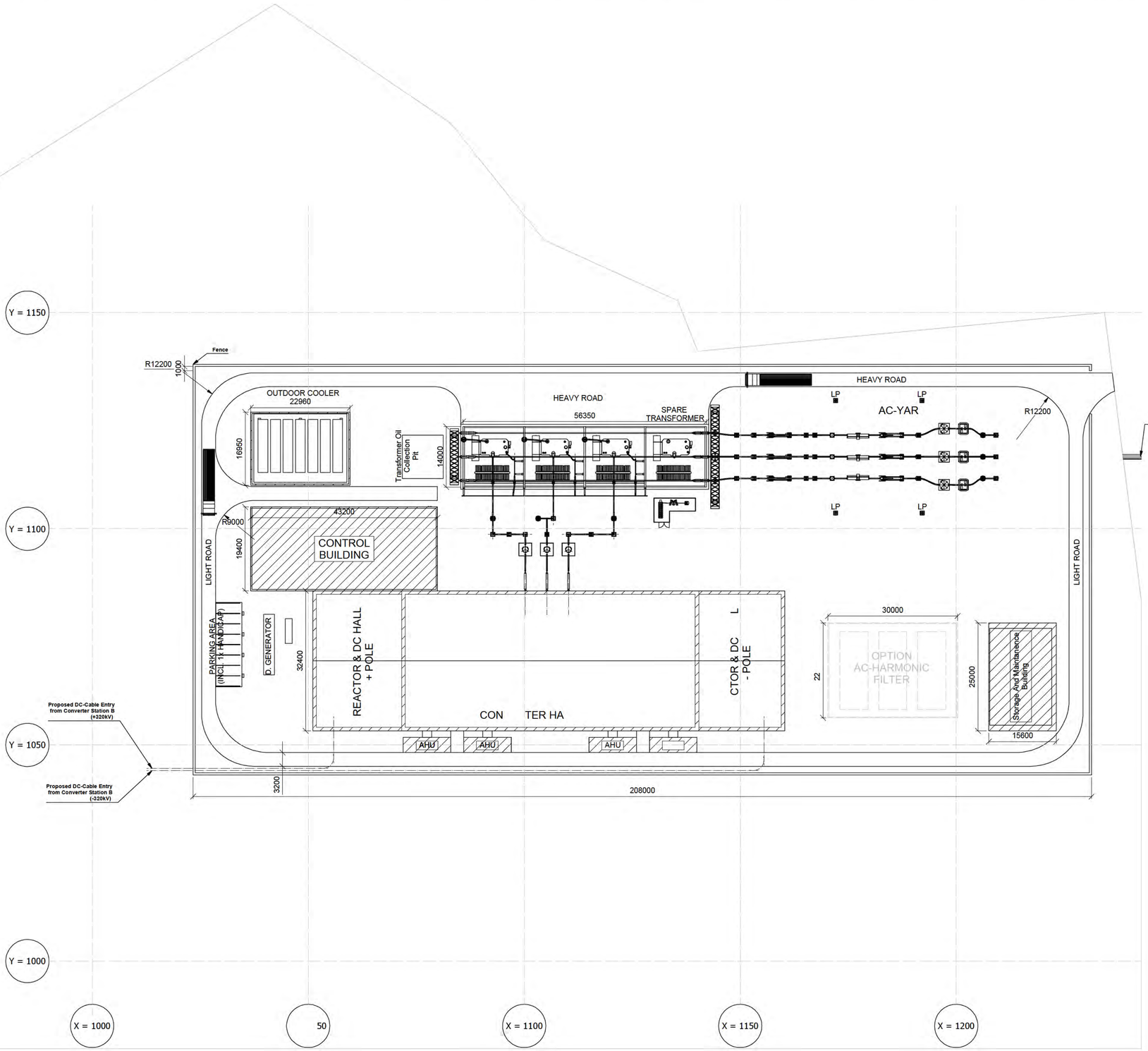
DESTINATION CONTROL STATEMENT
These items are controlled by the U.S. Government (when labeled with "ECCN" value) is "N" and authorized for export only to the country of ultimate destination for use by the ultimate consignee or end-user(s) herein identified. They may not be resold, transferred, or otherwise disposed of, to any other country or to any person other than the authorized ultimate consignee or end-user(s), either in their original form or after being incorporated into other items, without first obtaining approval from the U.S. Government or as otherwise authorized by U.S. law and regulations. Export and re-export is subject to European / national export authorization. Items without label, with label "AL:N" / "ECCN:N" or label "AL:9X999Y" / "ECCN:9X999Y" may require authorization from responsible authorities depending on the final end-use, or the destination.

| | | | |
|---|---|---|---|
| 01 | 2023-07-03 | First Issue | N. Oeztuerk |
| Rev. | Date | Remark | Created By |

| | | | | |
|---|---|---|---|---|
| Project ID: P-XXXXXX | Doc. Key: E | Aspect: P | Customer Document Number: - | Plant Type / Voltage: HVDC PLUS xxx MW / ± 320kV DC |
| Customer: HOSTOS | | | | |
| Project: HOSTOS HVDC | | | | Location(s): CONVERTER STATION A |

| | | | | |
|---|---|---|---|---|
| Scale: NTS | | | Export Control Classification: ECCN:N | AL: N |
| Responsible Dept.: SE PE EN ID | Technical Reference: B. Regnier | Document Designation: 30011#HS10 &EFA010 /001 | | Paper Size: A1 |
| Siemens Energy | Created By: N. Oeztuerk | Document Type: Overview Diagram | Document ID: - | |
| SIEMENS energy | Approved By: S. Shanmugalingam | Title, Supplementary Title: Single Line Diagram | Rev.: 01 / Release Date: 2023-07-03 / Language: en / Page: 1/1 | |

# Appendix C
# Converter Station General Layout




AC: 3 ~ 60 Hz, Un = - kV, Um = - kV, I"k3 = - kA
DC: Un = ±320 kV, In = - A, Ik < - kA

## Signs and Symbols

- General
- Reference Point
- Lightning Protection Tower

## Notes

All shown dimensions are in millimeters.
± X.XX = XX.XX m ü NN
Converter Hall is not accessible during operation.
All electrical equipments and technical installations are shown schematically only.
Dimensions and structure may change.



DRAFT_01, 2023.07.03

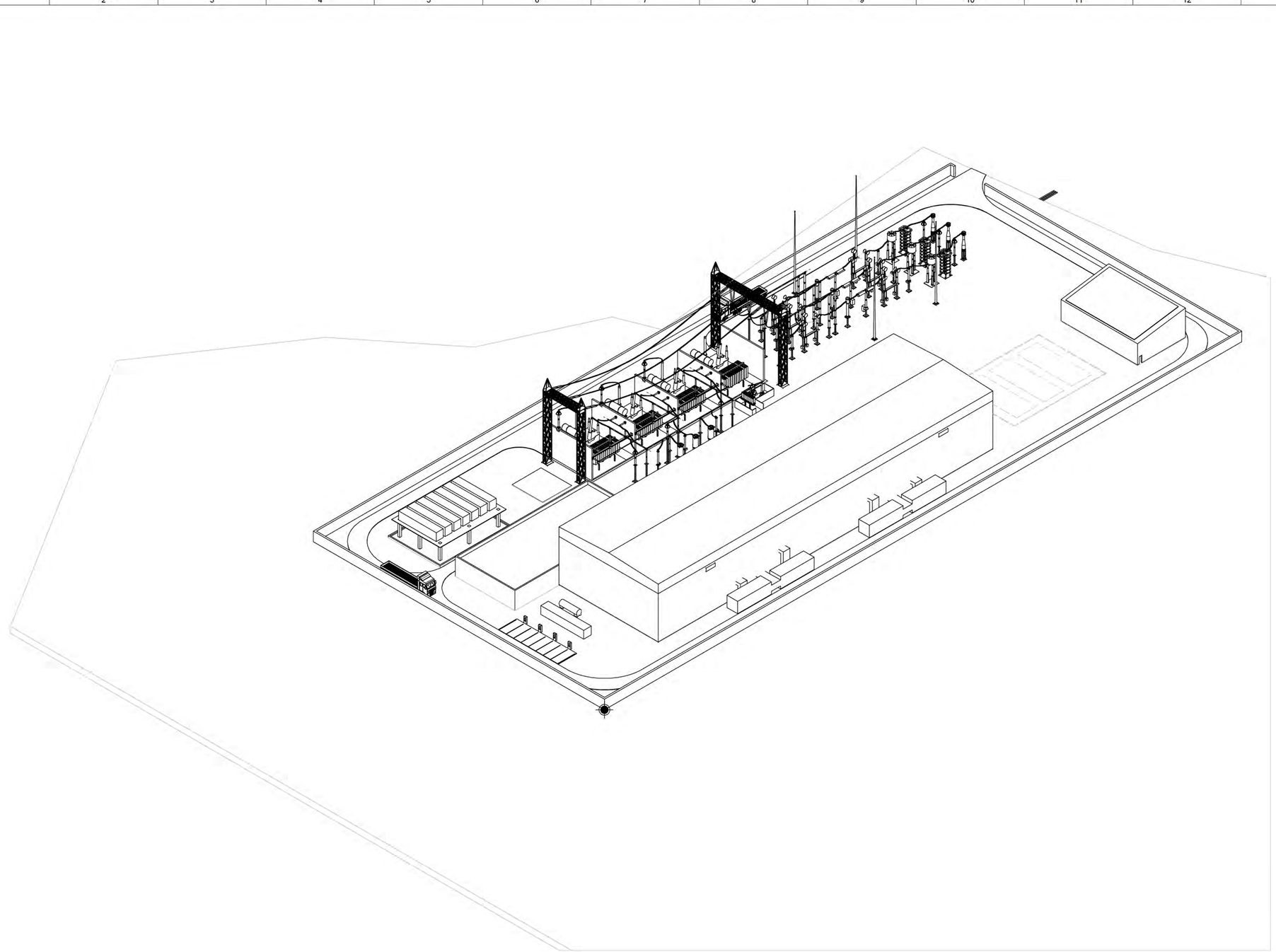
For tender purpose and information only

IFI

IFA = Issued for approval
IFI = Issued for information
IFC = Issued for construction
IFIM = Issued for implementation (Design Input)
IFM = Issued for manufacture
AB = As built (Documentation)

| Rev. | Date | Remark | Created by |
|---|---|---|---|
| 00 | 2023-07-03 | First Issue | N. Oeztuerk |

| | | | | | |
|---|---|---|---|---|---|
| Project ID: P-XXXXXX | Doc. Key: E | Aspect: C | Customer Document Number: SIEMENS ENERGY | Plant Type/Voltage: HVDC VSC Symmetrical Monopole<br>±320 kV DC, 230 kV AC, 60Hz<br>XX MW | |
| Customer: HOSTOS | | | | | |
| Project: HOSTOS HVDC | | | | Location(s): Converter Station A | |
| Scale: 1 : 500 | | | | Export Control Classification: ECCN: N AL: N | |
| Responsible Dept.: SE PE EN ID | Technical Reference: B. Regnier | | Document Designation: 32101#HS10 &BLD020 | | Paper Size: A1 |
| Siemens Energy | Created By: N. Oeztuerk | | Document Type: Arrangement Drawing | Document ID: - | |
| SIEMENS energy | Approved By: S. Shanmugalingam | | Title, Supplementary Title: General Layout Plan View | Rev.: 00 / Release Date: 2023-07-03 / Language: EN / Page: 1/3 | |



AC: 3 ~ 60 Hz, Un = - kV, Um = - kV, I"k3 = - kA
DC: Un = ±320 kV, In = - A, Ik < - kA

## Signs and Symbols

Reference Point

DRAFT_01, 2023.07.03

## For tender purpose and information only

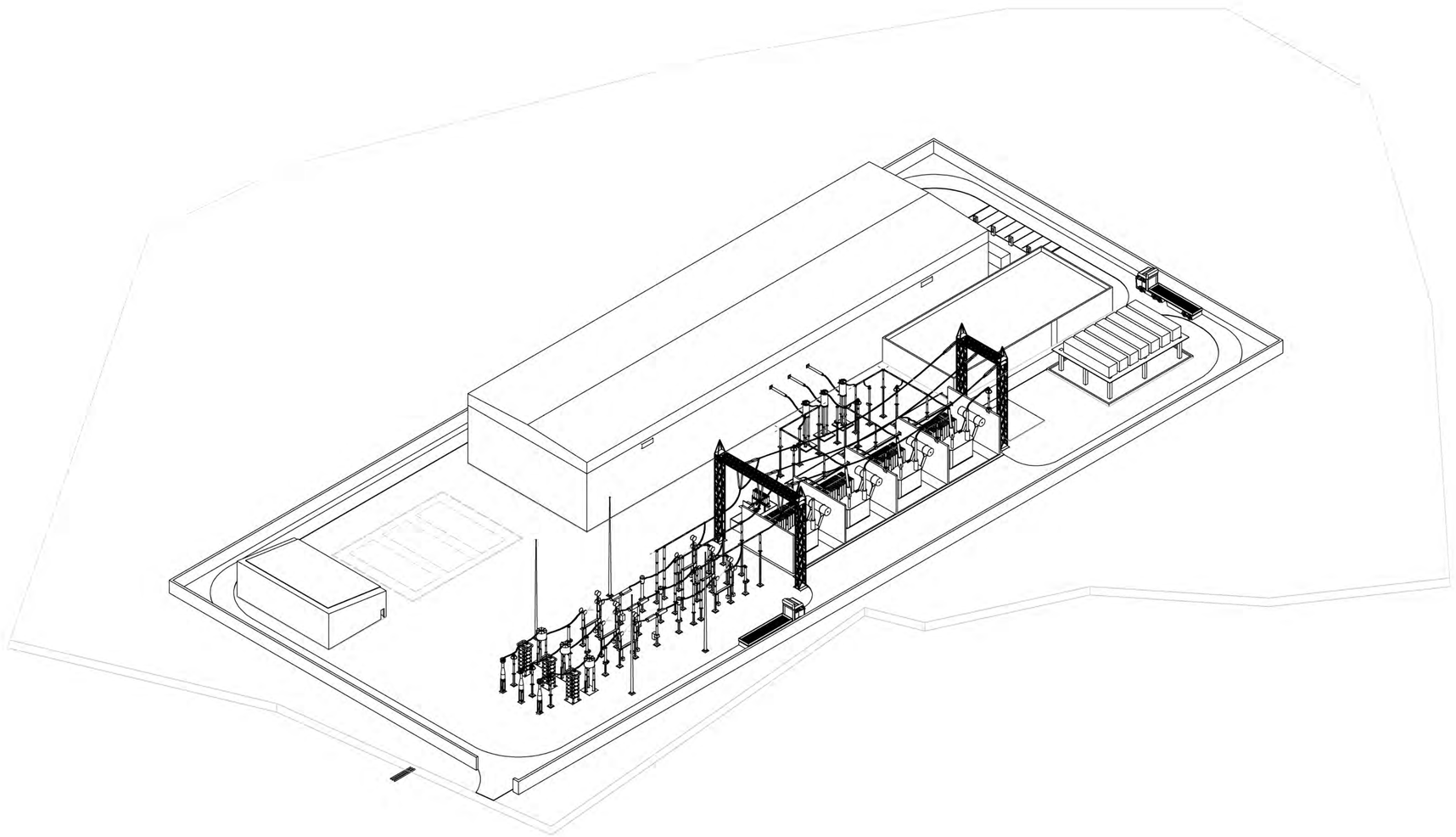
IFI

IFA = Issued for approval
IFI = Issued for information
IFC = Issued for construction
IFIM = Issued for implementation (Design Input)
IFM = Issued for manufacture
AB = As built (Documentation)

| Rev. | Date | Remark | Created by |
|---|---|---|---|
| 00 | 2023-07-03 | First Issue | N. Oeztuerk |

| Project ID | Doc. Key | Aspect | Customer Document Number | Plant Type/Voltage |
|---|---|---|---|---|
| P-XXXXXX | E | C | SIEMENS ENERGY | HVDC VSC Symmetrical Monopole ±320 kV DC, 230 kV AC, 60Hz XX MW |
| Customer: HOSTOS | | | | |
| Project: HOSTOS HVDC | | | | Location(s): Converter Station A |

| | | | | |
|---|---|---|---|---|
| Scale: 1 : 500 | | | Export Control Classification: ECCN: N | AL: N |
| Responsible Dept.: SE PE EN ID | Technical Reference: B. Regnier | Document Designation: 32101#HS10 | | Paper Size: A1 |
| Siemens Energy | Created By: N. Oeztuerk | Document Type: Arrangement Drawing | Document ID: - | |
| SIEMENS energy | Approved By: S. Shanmugalingam | Title, Supplementary Title: General Layout ISO View | Rev.: 00 / Release Date: 2023-07-03 / Language: EN / Page: 2/3 | |



AC: 3 ~ 60 Hz, Un = - kV, Um = - kV, I"k3 = - kA
DC: Un = ±320 kV, In = - A, Ik < - kA

## Signs and Symbols

DRAFT_01, 2023.07.03

## For tender purpose and information only

IFI

IFA = Issued for approval
IFI = Issued for information
IFC = Issued for construction
IFIM = Issued for implementation (Design Input)
IFM = Issued for manufacture
AB = As built (Documentation)

| Rev. | Date | Remark | Created by |
|---|---|---|---|
| 00 | 2023-07-03 | First Issue | N. Oeztuerk |

| Project ID | Doc. Key | Aspect | Customer Document Number | Plant Type/Voltage |
|---|---|---|---|---|
| P-XXXXXX | E | C | SIEMENS ENERGY | HVDC VSC Symmetrical Monopole<br>±320 kV DC, 230 kV AC, 60Hz<br>XX MW |

| Customer | Location(s) |
|---|---|
| HOSTOS | Converter Station A |
| Project | |
| HOSTOS HVDC | |

| Scale | | | Export Control Classification: |
|---|---|---|---|
| 1 : 500 | | | ECCN: N AL: N |

| Responsible Dept. | Technical Reference | Document Designation | Paper Size |
|---|---|---|---|
| SE PE EN ID | B. Regnier | 32101#HS10 &BLD020 | A1 |
| Siemens Energy | Created By: N. Oeztuerk | Document Type: Arrangement Drawing | Document ID: - |
| SIEMENS energy | Approved By: S. Shanmugalingam | Title, Supplementary Title: General Layout Iso View | Rev. 00 / Release Date 2023-07-03 / Language EN / Page 3/3 |

# Appendix D
# Siemens Technical Descriptions

This appendix has been redacted in its entirety.

# Appendix E
# Subsea, Onshore, and Landfall Cabling

This appendix has been redacted in its entirety.

# Appendix F
# Power Systems Analysis and Power Flow Plots

This appendix has been redacted in its entirety.

# Appendix G
# HVDC Interconnector Protection and Control

# 5.7 Control & Protection

## 5.7.1 General

The WIN-TDC Control and Protection System plays an important role in the successful implementation of HVDC transmission systems. High reliability is guaranteed with a redundant and fault tolerant design. Flexibility (through choice of optional control centres) and high dynamic performance were the prerequisites for the development of our control and protection system. Knowledge gained from over 30 years of operational experience and parallel use of similar technology in related fields has been built into the sophisticated technology we can offer today.

Main objectives for the implementation of the HVDC control system are reliable energy transmission which operates highly efficient and flexible energy flow that responds to sudden changes in demand thus contributing to network stability.

All WIN-TDC components from the Human Machine Interface (HMI) workstations, the control and protection systems down to the state of the art measuring equipment for DC current and voltage quantities have been upgraded to take advantage of the latest software and hardware developments. These control and protection systems are based on standard products with a product life cycle for the next 25 years.

The control is divided into the following hierarchical levels:

- Operator control level (WIN CC)
- Control and protection level (SimaticTDC)
- Field level (I/Os, time tagging, interlocking)

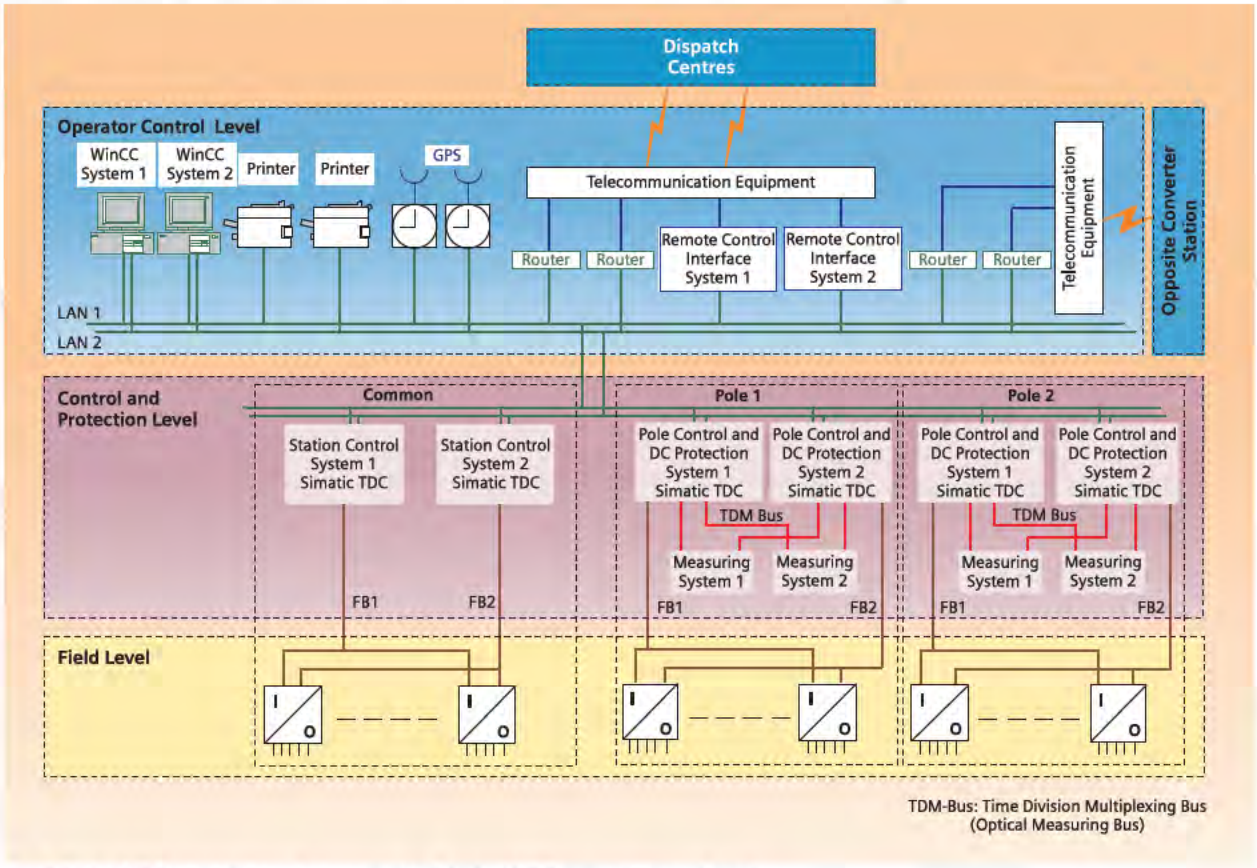



*Fig. 5.7.1-1: HVDC control hierarchy, one station (bipolar HVDC transmission scheme)*

In the following section, functions, tasks and components are described to provide an overview.

### 5.7.1.1 High Availability

The main design criteria for Siemens HVDC systems is to achieve maximum energy availability. This applies to the design of the control and protection systems as well. A single fault of any piece of equipment in the control and protection systems may not lead to a loss of power. Therefore, the primary control and protection components are configured as redundant systems.

### 5.7.1.2 Self-Testing Features

All control and protection systems are equipped with self-diagnostic features that allow the operator to quickly identify and replace the defective part to recover redundancy as soon as possible.

### 5.7.1.3 Low Maintenance

With today's digital systems there is no requirement for routine maintenance. However, should it be necessary to replace single modules, the design is such that there is no operational impact on the HVDC system. This is achieved by designing all primary components as redundant systems, where one system can be switched off without impact on the other system.

### 5.7.1.4 Best Support – Remote Access

As an optional feature, the control system can be accessed remotely via point-to-point telephone connection or via Internet. This allows remote plant monitoring and fault detection including diagnostics. To ensure the data security, a VPN (Virtual Private Network) encrypted connection is used. Furthermore, a password protected access ensures that only authorized personnel have access.

With the use of a standard web browser, main diagnosis data can be monitored. Expert access to the control components is also possible. This remote access feature provides flexible support for the commissioning and maintenance personnel by our design engineers.

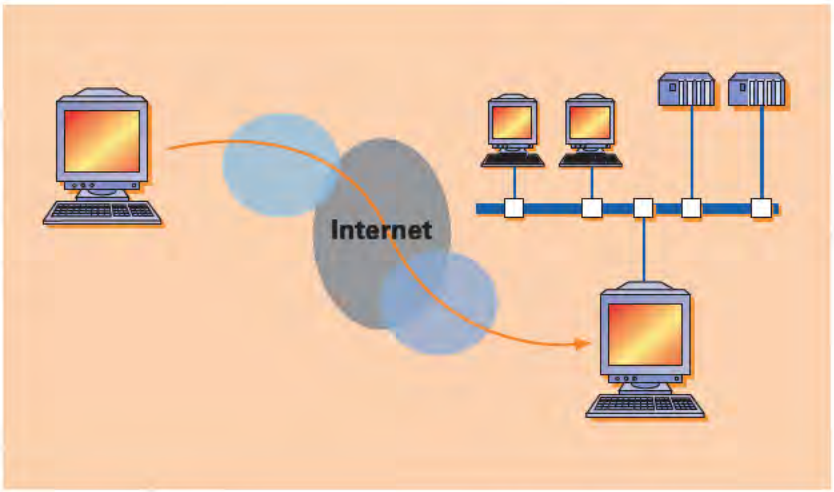



*Fig. 5.7.1-2: Remote access connection*

### 5.7.1.5 Modular Design

The control and protection systems use multiprocessor hardware. This means that the computing capacity can be scaled according to the requirements.

Therefore, the most economic solution can be found at the start. Additional computing capacity can be added at any time later, if required.

### 5.7.1.6 Communication Interfaces

The control and protection systems as well as the operator control system communicate via Ethernet or Profibus. For remote control interfacing, a number of standard protocols are available. Custom protocols can be implemented as an option.

# 5.7 Control & Protection

## 5.7.2 Control Components

### 5.7.2.1 Operator Control System

The tasks of a modern operation and monitoring system within the HVDC control system include the following:

- Status information of the system
- Operator guidance to prevent maloperation and explain conditions
- Monitoring of the entire installation and auxiliary equipment
- Graphic display providing structural overview of the entire system

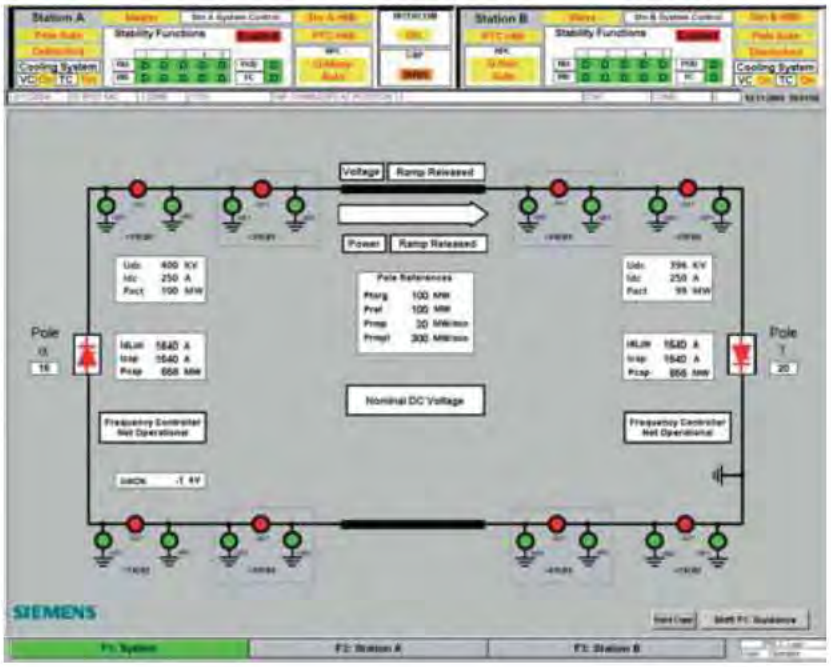



*Fig. 5.7.1-3: Operator workstation, typical screen layout for a monopolar HVDC system overview*

- Troubleshooting support with clear messages to quickly resume operation
- Display and sorting of time tagged events (time is synchronised via GPS clock)
- Display and archiving of messages
- Automatic generation of process reports

**WinCC™ Alarm Logging - RT - Sequence archive report**



\\WINCCPC101\WinCC50_Project_XYZ\XYZ.mcp

| Date | Time | Number | Device | Message text | Class | Status | Duration |
|---|---|---|---|---|---|---|---|
| 04/11/18 | 14:56:26.575 | 224297 | 21VR01-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | COME | 0:00:00 |
| 04/11/18 | 14:56:26.577 | 224937 | 21VR02-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | COME | 0:00:00 |
| 04/11/18 | 14:56:26.581 | 124297 | 11VR01-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | COME | 0:00:00 |
| 04/11/18 | 14:56:26.581 | 224297 | 21VR01-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | GO | 0:00:00 |
| 04/11/18 | 14:56:26.582 | 124937 | 11VR02-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | COME | 0:00:00 |
| 04/11/18 | 14:56:26.592 | 223565 | 21VR00 | DC LINE FAULT | WRN | COME | 0:00:00 |
| 04/11/18 | 14:56:26.592 | 224937 | 21VR02-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | GO | 0:00:00 |
| 04/11/18 | 14:56:26.597 | 124297 | 11VR01-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | GO | 0:00:00 |
| 04/11/18 | 14:56:26.598 | 124937 | 11VR02-A1:DCP | TRAVELLING WAVEFRONT WFPOL/REC REQ | WRN | GO | 0:00:00 |
| 04/11/18 | 14:56:26.591 | 123565 | 11VR00 | DC LINE FAULT | WRN | COME | 0:00:00 |
| 04/11/18 | 14:56:26.631 | 104360 | 11LX00 | AC FILTER OFF INHIBIT BY HARMONIC PERF | STAT | GO | 0:13:36 |
| 04/11/18 | 14:56:26.633 | 224852 | 21VR01-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | COME | 0:00:00 |
| 04/11/18 | 14:56:26.651 | 225122 | 21VR02-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | COME | 0:00:00 |
| 04/11/18 | 14:56:26.653 | 124852 | 11VR01-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | COME | 0:00:00 |
| 04/11/18 | 14:56:26.653 | 125122 | 11VR02-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | COME | 0:00:00 |
| 04/11/18 | 14:56:26.691 | 104360 | 21LX00 | AC FILTER OFF INHIBIT BY HARMONIC PERF | STAT | GO | 0:13:36 |
| 04/11/18 | 14:56:26.707 | 223565 | 21VR00 | FREQUENCY CONTROL ACTIVE | STAT | COME | 0:00:00 |
| 04/11/18 | 14:56:26.748 | 224852 | 21VR01-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | GO | 0:00:00 |
| 04/11/18 | 14:56:26.751 | 225122 | 21VR02-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | GO | 0:00:00 |
| 04/11/18 | 14:56:26.753 | 124852 | 11VR01-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | GO | 0:00:00 |
| 04/11/18 | 14:56:26.757 | 125122 | 11VR02-A1:DCP | LINE FAULT LOCATION OVERHEAD LINE | INFO | GO | 0:00:00 |
| 04/11/18 | 14:56:26.762 | 300815 | 21SS1+M1 | TFR IS RECORDING | STAT | COME | 0:00:00 |
| 04/11/18 | 14:56:26.821 | 300815 | 11SS1+M1 | TFR IS RECORDING | STAT | COME | 0:00:00 |
| 04/11/18 | 14:56:26.838 | 223565 | 21VR00 | DC LINE FAULT | WRN | GO | 0:00:00 |
| 04/11/18 | 14:56:26.840 | 123565 | 11VR00 | DC LINE FAULT | WRN | GO | 0:00:00 |
| 04/11/18 | 14:56:27.070 | 204360 | 21LX00 | AC FILTER OFF INHIBIT BY HARMONIC PERF | STAT | COME | 0:00:00 |
| 04/11/18 | 14:56:27.079 | 104360 | 11LX00 | AC FILTER OFF INHIBIT BY HARMONIC PERF | STAT | COME | 0:00:00 |
| 04/11/18 | 14:56:27.439 | 104360 | 11LX00 | AC FILTER OFF INHIBIT BY U-LIMITATION | WRN | COME | 0:00:00 |
| 04/11/18 | 14:56:27.776 | 104360 | 11LX00 | AC FILTER OFF INHIBIT BY U-LIMITATION | WRN | GO | 0:00:00 |
| 04/11/18 | 14:56:51.937 | 300815 | 21SS1+M1 | TFR IS RECORDING | STAT | GO | 0:00:25 |
| 04/11/18 | 14:56:51.980 | 300815 | 11SS1+M1 | TFR IS RECORDING | STAT | GO | 0:00:25 |

11/18/2004 02:59:18 PM Page 1 / 1

Layout: @CCAlgRtSequenceArchive.RPL \\WINCCPC101\WinCC50_Project_XYZ\XYZ.mcp

*Fig. 5.7.1-4: Sequence of events recording (SER), report layout for SER information*

- Analysis of operating mode based on user-defined and archived data (trend system)
- Generation of process data reports


*Fig. 5.7.1-5: Trend system, example for trend display*

### 5.7.2.2 Control and Protection System Level

The primary tasks in this level are:
- Measuring
- Control of Power Transmission
- Protection

Measuring

DC values are measured by means of the hybrid optical DC measuring system. This system measures the voltage drop over a shunt or a voltage divider, converts this voltage into a telegram and transfers it to the measurement cubicle via fibre optics.

The scheme is designed to be completely redundant, therefore loss of a signal does not lead to an impact on power transmission. This measuring principle contributes to an increased availability of the control and protection scheme.

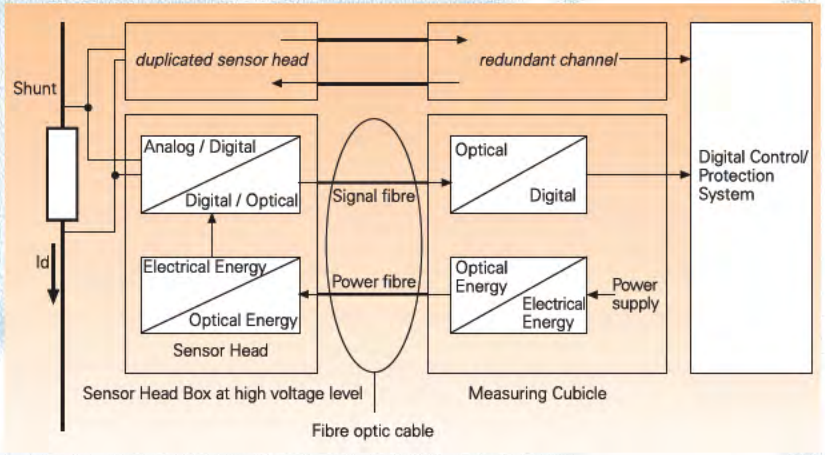



*Fig. 5.7.1-6: Principle of the hybrid optical measuring scheme*

The advantages of such a scheme are:
- Reduced weight (100 kg)
- Linear response (passive system)
- Improved EMC (due to fibre optics)
- Integrated harmonic measurement (Rogowsky coil) for use in active filters or harmonic monitoring schemes.

# 5.7 Control & Protection

Control of Power Transmission

The pole control system is responsible for firing the thyristor valves so that the requested power is transmitted. The pole controls on each side of the transmission link therefore have to fulfill different tasks. The pole control system on the rectifier side controls the current so that the requested power is achieved. The pole control system on the inverter side controls the DC voltage so that rated DC voltage is achieved.

The pole control is implemented redundantly. A failure in one system thus has no impact on power transmission.

This system can be repaired while the other system remains in operation. In bipolar schemes a redundant pole control system is assigned to each pole. Failures in one pole will not have any impact on the remaining pole.

Protection

The DC protection system has the task of protecting equipment and personnel. The protection systems can be divided into two areas, which are subsequently divided into different protection zones.

The HVDC-related protection functions are referred to as DC protection. These include converter protection, DC busbar protection, DC filter protection, electrode line protection and DC line protection.

The AC protection scheme consists mainly of the AC busbar, the AC line and the AC grid transformer protection as well as the AC filter protection and converter transformer protection.

The task of the protective equipment is to prevent damage of individual components caused by faults or overstresses.

Each protection zone is covered by at least two independent protective units – the primary protective unit and the secondary (or back-up) protective unit.

Comprehensive system monitoring and measurement plausibility functions are implemented in the protection systems. This serves to prevent false trips due to singular equipment failure.

The protection functions of the various protective relays are executed reliably for all operating conditions. The selected protective systems ensure that all possible faults are detected, annunciated and cleared selectively.

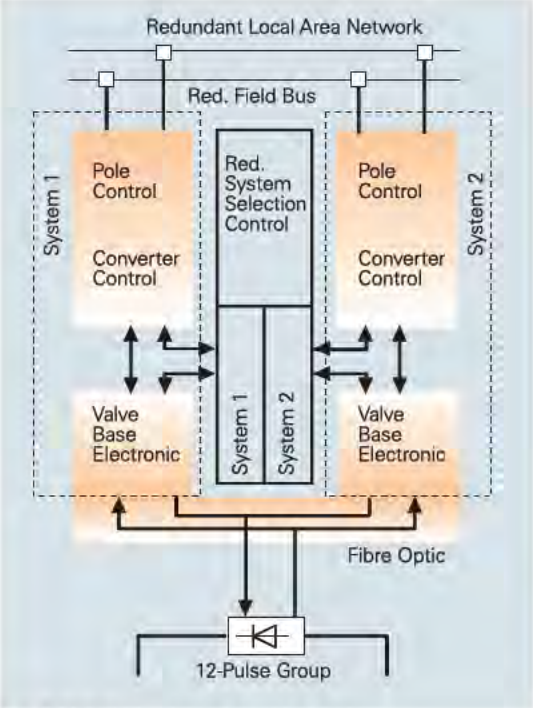



*Fig. 5.7.1-7: Redundant pole control system structure (for one 12-pulse group)*

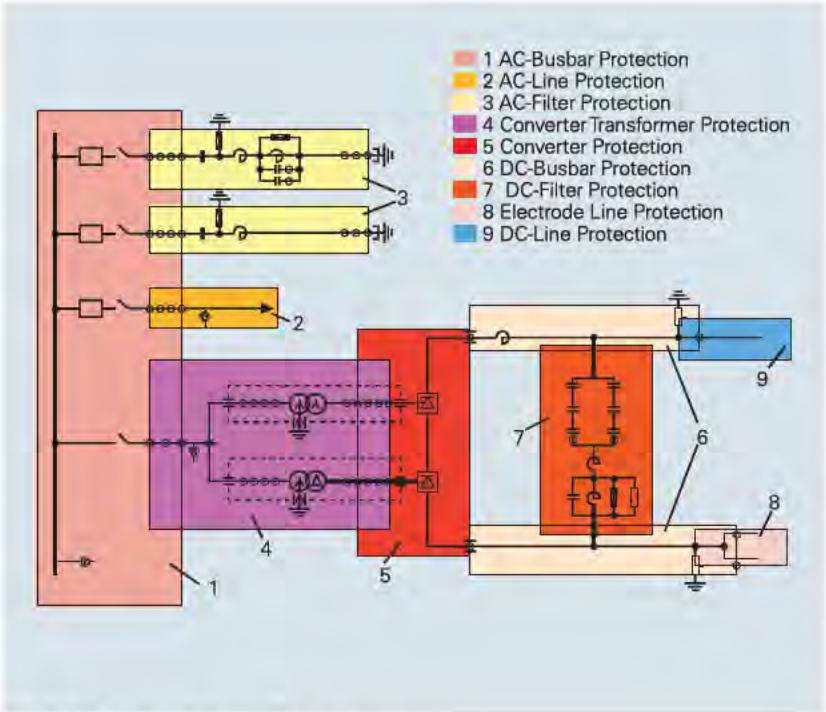



*Fig. 5.7.1-8: Protection zones, one pole/one station*

All protective equipment in the HVDC converter station is implemented either with digital multi-microprocessor systems or with digital Siemens standard protective relays. "The DC protection is designed to be fully redundant. Additionally both protection systems incorporate main and back-up protection functions using different principles. The AC protection consists of a main and back-up system using different principles. Each protective system is assigned its own measuring devices as well as power supplies."

### 5.7.3 Control Aspects

#### 5.7.3.1 Redundancy

All control and protection systems that contribute to the energy availability are configured redundantly. This covers any single faults in the control and protection equipment without loss of power.

#### 5.7.3.2 Operator Training

For Siemens HVDC application, an operator training simulator is optionally available. The simulator allows the operator to train with the same hardware and software as in the real process. This simulator consists of the original operator workstation and a simulation PC. The simulation PC runs the HVDC process and feeds the relevant data to the workstation.

### 5.7.4 Testing and Quality Assurance

The design process has a number of defined review steps. These allow verification of the control and protection system functionality and performance before delivery to site (see figure 5.7.1-10).

Already along with the tender, the use of accurate simulation tools allows to answer specific performance issues that are vital to the customer's grid.

#### 5.7.4.1 Offline Simulation EMTDC

Siemens uses a simulation model that includes all details of control and protection functionality in detail. Thus forecast of real system behaviour is reliable. Therefore it is possible to optimize the application to find the best economic solution while providing the optimum performance.

*Fig. 5.7.1-9: Real-time simulator*

#### 5.7.4.2 Dynamic Performance Test

The offline simulation with EMTDC is already an extremely accurate forecast of the real system behaviour. To verify the findings and optimize the controller settings, the control and protection systems are additionally tested during the dynamic performance test with a real-time simulator. During that phase, the customer may witness these performance tests of the final control and protection software.

### 5.7.4.3 Functional Performance Test

In the functional performance test, the dedicated control and protection hardware is installed and tested with a real-time simulator. The purpose of the FPT is to test the proper signal exchange between the various control components as well as the verification of the specified control sequences. This allows optimized commissioning time. Furthermore, customer personnel can participate in this test for operator training and become familiar with the control system.

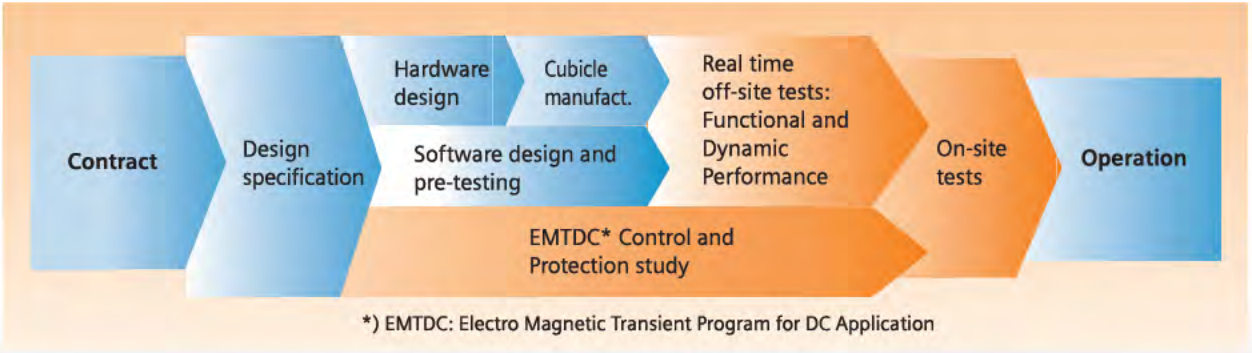
*Fig. 5.7.1-11: Example of a functional performance test setup*

### 5.7.4.4 On-Site Tests

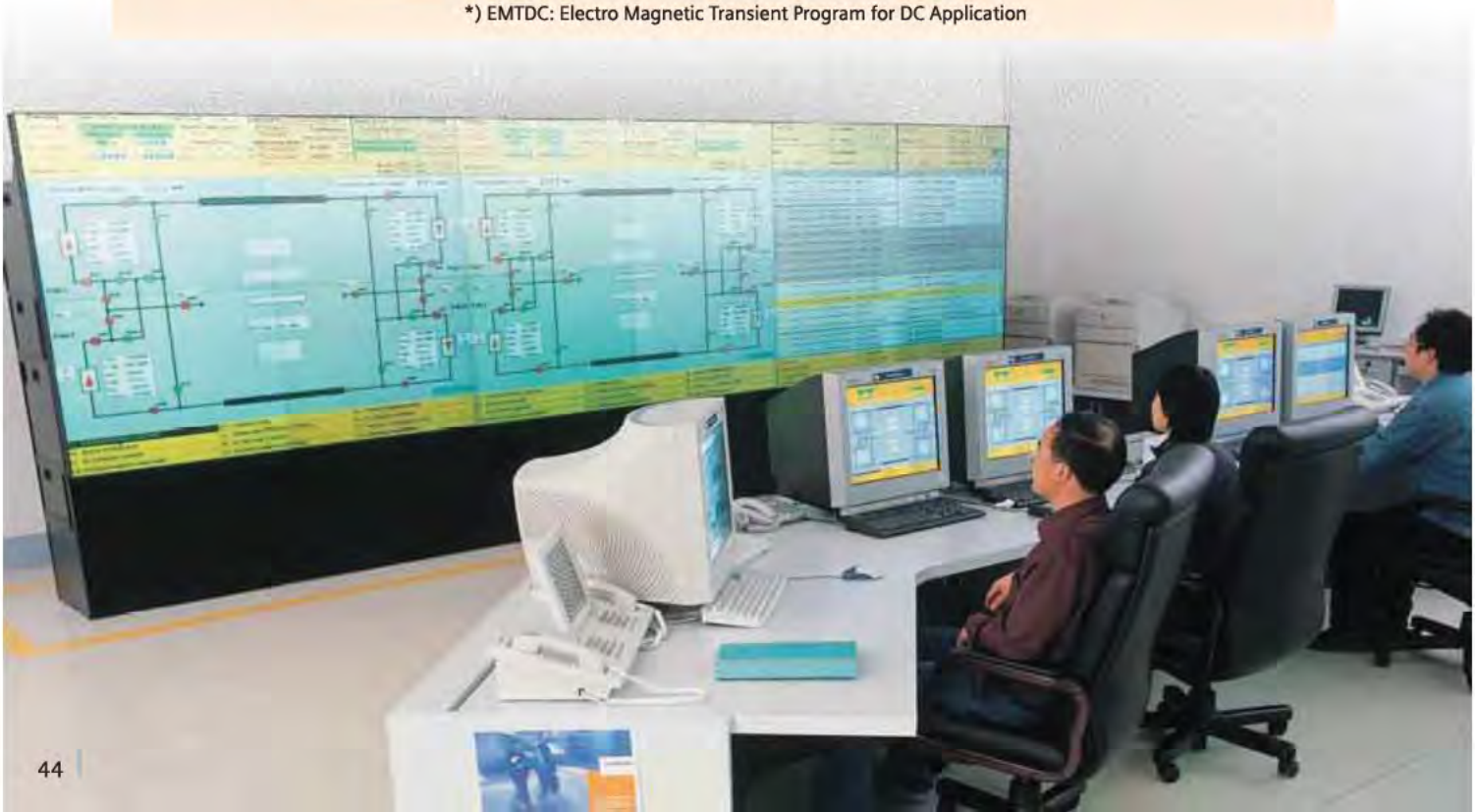
On-site tests are basically divided into test steps regarding the related station (station A, station B) and into the test steps related to the whole HVDC system.

At the precommissioning stage, the base work for commissioning the control system and protection system is required. The main task is preparation and individual testing of any single system. This is required to assure the systems are free of transportation damage. The next station-related tests are the subsystem tests. Subsystems consist of equipment items which are grouped according to common functions like AC filter banks or thyristor valve systems. The main task is testing the proper function of interconnected systems before switching on high voltage. Following this, station tests with high voltage but no energy transfer will take place. Finally, system and acceptance tests with several operating points of energy transfer will be used for fine tuning and verification of system performance.

*Fig. 5.7.1-10: The main steps for the HVDC control and protection versus the time starting from the contract award up to commercial operation*




*) EMTDC: Electro Magnetic Transient Program for DC Application



# Appendix H
# Resource Areas: Expected Concerns and Potential Mitigations

*This table is meant for early planning purposes and does not represent the final NEPA determination.*

## RESOURCES-MITIGATIONS

| Resource | Analysis Method | Expected Concern | Rationale | Eliminate ? |
|---|---|---|---|---|
| **Land Use/Visual Resources** | | | | |
| Land Use | Desktop Review | Low | Cable would be placed within existing powerline right-of-way (ROW) and converter station would be added to existing substation. | |
| Coastal Zone Management Act (CZMA) | Consistency determination | Medium | Project would occur within the coastal zone. A CZMA consistency determination would be performed. | |
| | | | | |
| **Noise - Acoustic Environment** | | | | |
| Construction Noise | Comparative Assessment | Low | Temporary impacts during construction phase. No long-term changes to noise environment. | |
| | | | | |
| **Biological/Natural Resources** | | | | |
| Threatened and Endangered (T&E) Species | Desktop review | Medium | There is potential for T&E species, both marine and terrestrial, within the proposed project area. A U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) report will be run for the site and potential impacts to potentially present species will be identified. A Section 7 consultation will be initiated with the USFWS and National Marine Fisheries Service (NMFS). Species-specific surveying will be negotiated with the relevant regulatory agency. | |
| Vegetation | Desktop review and possible veg mapping survey | Low | On land, cable would be placed in existing, previously disturbed powerline ROW and converter station would be added to existing substation. Horizontal directional drill (HDD) installation would minimize veg impacts. In ocean, HDD would bypass seagrass. | |
| Wildlife | Desktop review | Low | On land, cable would be placed in existing, previously disturbed powerline ROW and converter station would be within the developed Port of Mayaguez. HDD installation and placing infrastructure in previously disturbed areas would minimize wildlife impacts. | |
| Marine Wildlife | Qualitative discussion | Medium | In ocean, HDD would bypass corals and important seagrass habitat to the degree feasible. A National Oceanic and Atmospheric Administration (NOAA) fisheries T&E list will be obtained for the proposed locations. A geophysical and geotechnical (G&G) survey will be conducted prior to construction, which will identify and allow for avoidance of corals. If a coral cannot be avoided, then the USFWS and NOAA will be notified and appropriate mitigations will be agreed upon. | |
| Marine Fisheries | Qualitative discussion - Essential Fish Habitat Areas of Particular Concern (HAPCs) | Medium | HAPCs will be located and potential effects would be identified. NMFS will be consulted with based on the degree of potential effects and necessary mitigation measures will be agreed upon. | |
| | | | | |
| **Cultural Resources** | | | | |
| Historic - National Register of Historic Places (NRHP) | Based on literature search | Low | There are 16 NRHP-listed properties within Mayaguez municipality and two NRHP-listed properties on Mona Island. No impacts would occur to Mona Island or its nearshore waters. The cable would be placed in the existing, previously disturbed powerline ROW, and the converter station would be within the developed Port of Mayaguez. HDD installation would avoid impacts to eligible and listed NRHP properties. | |

| Resource | Analysis Method | Expected Concern | Rationale | Eliminate ? |
|---|---|---|---|---|
| Visual Resources | | Low | Cable would be buried in existing powerline ROW and converter station would be added to the developed Port of Mayaguez. No substantial change to existing setting or aesthetics. | |
| Terrestrial Archaeological Sites | Based on literature search and existing surveys | Low | Cable would be placed in existing, previously disturbed powerline ROW, and a converter station would be added to the developed Port of Mayaguez. HDD installation would avoid most impacts. | |
| Underwater Archaeological Sites | Based on literature search | Medium | Medium probability of historic shipwrecks along the subsea high-voltage direct current (HVDC) transmission cable system proposed aquatic sites and the 1,000-meter-wide ROW. An underwater survey to identify properties eligible for listing to the NRHP will be conducted and submitted to the Puerto Rico State Historic Preservation Officer (SHPO) for review and concurrence before construction. The project will avoid, minimize, or mitigate adverse effects on eligible properties for listing to the NRHP. Further consultation with the Puerto Rico SHPO and other consultant parties will occur if eligible properties to the NRHP cannot be avoided. | |
| Traditional Cultural Properties | Based on tribal consult | Low | There are no federally recognized tribal nations in Puerto Rico. | |
| | | | | |
| **Air Quality (includes assessment of greenhouse gas [GHG] emissions)** | | | | |
| National Ambient Air Quality Standards (NAAQS) | Qualitative Assessment | No Impact | Mayaguez municipio is in full attainment. | X |
| | | | | |
| **Climate Change** | | | | |
| Effect of Proposed Action on climate change | Quantify emissions/ calculate SC-GHG | Low | Temporary GHG emissions during construction. Apply recent Council on Environmental Quality (CEQ) guidance. Explain that energy production will happen regardless of project. | |
| Impacts of climate change on the Proposed Action | Review models for the region | Low | Special considerations (e.g., armoring) may be needed due to effects from climate change and increased hurricanes. | |
| | | | | |
| **Hazardous Materials and Waste** | | | | |
| Waste Generation | General discussion | Low | Hazardous waste would be generated only during construction and would consist of typical construction-related wastes (e.g., petroleum, oils, lubricants), which would be handled in compliance with federal and local regulations. | |
| Current Conditions | General discussion | Low | There are no National Priorities List (NPL) sites in Mayaguez. | |
| | | | | |
| **Water Resources** | | | | |
| Surface Waters | General discussion/delineation | Medium | HDD installation would avoid surface waters. A HDD Contingency Plan would be implemented to avoid/minimize impacts from potential inadvertent releases. Best management practices (BMPs) would be implemented during construction to minimize potential impacts to surface waters from erosion and sedimentation. | |
| Groundwater | General discussion | Medium | An inadvertent release during HDD could affect groundwater. A HDD Contingency Plan would be implemented to avoid/minimize impacts from potential inadvertent releases. | |
| Wetlands | Desktop review/delineation | Medium | HDD installation would avoid wetlands. A HDD Contingency Plan would be implemented to avoid/minimize impacts from potential inadvertent releases. BMPs would be implemented during construction to minimize potential impacts to wetlands from erosion and sedimentation. | |

| Resource | Analysis Method | Expected Concern | Rationale | Eliminate ? |
|---|---|---|---|---|
| Floodplains | Review FIRM | Medium | The converter station would be constructed within the 100-year floodplain in the Port of Mayaguez. The project won't change elevations or alter flood storage capacity. All necessary permits for construction in a floodplain will be acquired/complied with. | |
| | | | | |
| **Geology and Soils** | | | | |
| Soils | Existing data review | Medium | There would be impacts to soils from HDD and construction of the converter station. Construction BMPs would be implemented to mitigate effects to soils. | |
| Landforms | Existing data review | Medium | Potential effects to known undersea land forms. | |
| Seismicity | Existing data review | Low | Project would not affect regional seismicity. Seismicity may affect the project in terms of health and safety. | |
| | | | | |
| **Transportation** | | | | |
| Regional Access | Qualitative Description | Low | Temporary impacts would be limited to construction timeframe. | |
| Local Access | Qualitative Description | Low | Temporary impacts would be limited to construction timeframe. There may be a modernization project at the Mayaguez port; no information available yet. The port is currently active and ramping up operations slowly after the hurricanes. | |
| | | | | |
| **Utilities** | | | | |
| Water Supply, Treatment, and Distribution | Qualitative Description | No Impact | | X |
| Wastewater Collection and Treatment | Qualitative Description | No Impact | | X |
| Electrical Supply | Qualitative Description | Benefit | Benefits from increased energy resiliency. | |
| Stormwater | Qualitative Description | Low | Impacts to existing infrastructure would be avoided. Stormwater BMPs and controls would be implemented during construction in accordance with permits. | |
| | | | | |
| **Health and Safety** | | | | |
| Safety/Occupational Health | Qualitative Description | Low | Occupational Safety and Health Administration (OSHA) standard operating procedures (SOPs) and regulations would be implemented to ensure a safe work environment. | |
| Protection of Children | Qualitative Description | No Impact | Site access would be controlled during construction. | X |
| General Public | Qualitative Description | Low | Site access would be controlled during construction. | |
| | | | | |
| **Socioeconomics** | | | | |
| Regional Effects | Qualitative Description | Benefit | Overall benefit from use of local labor during construction and positive impacts to local businesses from increased energy resilience (e.g., less downtime for businesses from power outages). Review if there would be any impacts to Ferries del Caribe during subsea cable installation activities. | X |
| | | | | |
| **Environmental Justice (EJ)** | | | | |
| Determine if disproportionate effect | Qualitative Description | Benefit | Project would provide improved services to historical EJ communities. | |
| | | | | |

# Appendix I
# *Mona Passage HVDC Cable Route Assessment Report*

Jacobs Challenging today. Reinventing tomorrow.

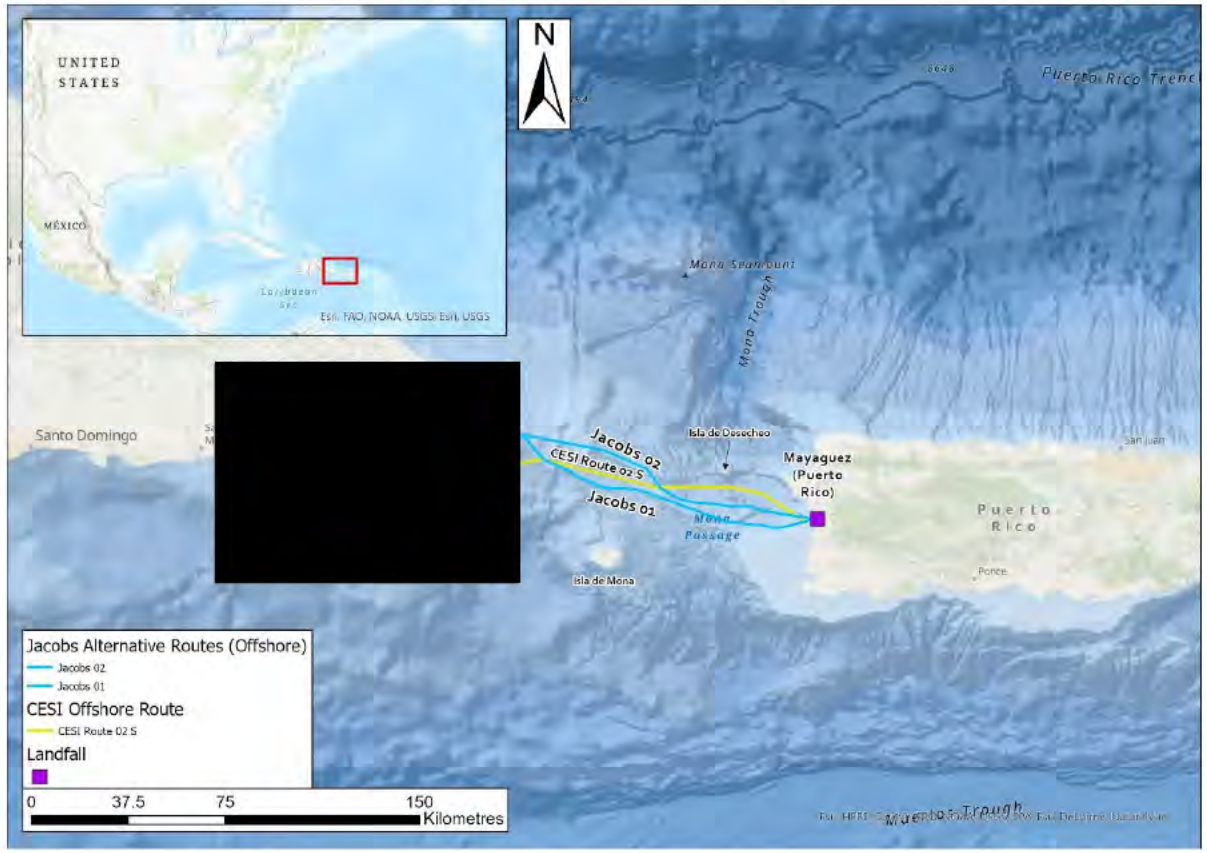
# Mona Passage HVDC Cable Route Assessment Report

Project name: PR to DR HVDC interconnector
Project no: D3731000
Client: Caribbean Transmission Development Company
Prepared by: Roger Moore, Claudio Fassardi, Ewan Fountain
Reviewed by: Mohsen Zadeh, PE
Revision no: 1.0
Date: 07 June 2023

# Executive Summary

# Executive Summary

- This report summarizes a high-level review of the CESI route and two alternative routes that minimize maximum water depth and potential constraints.
- The review is based on collation of open-source multi-discipline datasets which are suitable for planning but not engineering design.
- The quality of data are sufficient for early screening of route options to traverse the most favorable ground and to avoid environmental and other restricted areas
- It is concluded that either of the Jacob's routes are preferred given significantly reduced water depth and avoidance of known constraints
- It is recommended that Jacobs_01 and Jacobs_02 are taken forward for reconnaissance geophysical/ geotechnical survey for determination at SELECT
- Jacobs_01 route is slightly favoured as the water depth and constraints are minimised



# Section 1: Background and Scope

# Background

- Jacobs Engineering Group (“Jacobs”) has been contracted by the Caribbean Transmission Development Corp (“CTDC”) to provide engineering reviews and studies in support of obtaining a Presidential Permit for the proposed subsea HVDC interconnector connecting Puerto Rico to Dominican Republic across the Mona Passage.
- A feasibility desk study was carried out by CESI in July 2022 provided a preliminary routing assessment and preferred route.
- This report re-appraises the CESI route and identifies several alternative ‘Jacobs’ routes which minimises maximum water depth and various potential constraints.
- A preferred route is identified, Jacobs 01, which is recommended for SELECT and scoping of subsea cable analysis by Cable OEM as well as reconnaissance surveys to progress the preliminary design of the HVDC interconnector.

# Scope

- Assemble Geographic Information System (GIS) dataset of the Mona Passage, to view relevant information and support analysis of route corridors.
- Appraise the preferred CESI route corridor to characterise the seabed conditions and constraints.
- Identify and appraise alternative route corridors to characterise the seabed conditions and constraints.
- Perform an assessment of all route corridors and recommend a preferred route corridor that minimises water depth and constraints.
- Document the findings in an illustrated report (i.e., this report).

# Section 2: Review of CESI’s Route Assessment

# CESI Feasibility Desk Study: Mona Passage Route Options Review (1/2)

- CESI (2022) presents a comprehensive collection of data and information and site characterization, however, its application to the assessment and selection of viable routes appears limited.
- CESI (2022) notes that the proposed routes were selected on the basis of bathymetry, orography, geology and ecology; and that "All the solutions (i.e. routes) preliminarily identified can be considered feasible from the environmental point of view". Other important aspects such as technical, constructability, relative costs, permitting, etc. do not appear to have been considered.
- There is limited to no geophysical and geotechnical (G&G) assessment of seabed conditions from the bathymetry/geophysical data. CESI (2022) refers to Figure 4.3.5 (on page 24 in its report) which highlights regional seabed morphologies and bottom types. However, there is no assessment of their significance to corridor selection and cable routing.
- CESI (2022) suggests that "The proposed sea routes are designed mainly considering bathymetry, orography and geology of the seafloor crossed by the cable", through analysis of seismic lines (geophysical data) to interpret the regional subsurface. However, no evidence is presented of an appropriate assessment of the available bathymetry and G&G data sources, so the basis of CESI's routing design is limited and incomplete given the availability of data. It is important to conduct an integrated assessment of all pertinent multi-discipline data (environmental, G&G, metocean, etc.), particularly reconciling the challenges/reliability of route corridors and identification of significant constraints (red flags) to routing and installation of the cable.
- All CESI routes have a common section that develops in the central area of the Mona Passage, which according to CESI (2022), is in relatively flat and shallow seabed. However, the routes, shown in blue in Figure 2 (of CESI report), appear to cross a deep basin of up to 1,000m water depth. There is no justification for why these were chosen in favour of alternative shallow water routes, i.e., along the 'Desecheo Ridge' (circa 200/300m water depth) and 'Bajo de Cinco' (circa 100/300m water depth). The latter does not appear to have been considered or assessed.

# CESI Feasibility Desk Study: Mona Passage Route Options Review (2/2)

- The CESI's G&G element of the scoring relies upon a very simplistic assessment e.g., 'sand, mud, rocks' and maximum slope impacting the scoring. A more detailed/robust evaluation of the available data is required for corridor selection and preferred route optimization.
- There is limited consideration of the impact of known subsea landslides (Lopez-Venegas et al., 2008), this landslide is on the north flank of the Mona Passage and does not directly influence the CESI routes.
- There is no consideration of the impact of shallow seabed soils on the routing (i.e., carbonate content, which is suggested to be high in some areas) as this will impact the design and performance of the cable (i.e., ampacity and thermal properties).
- Currents in the Mona Passage are known to be strong (Bourkland and Dorsy, 1977). No analysis is presented for currents, potential related impacts and the need for cable protection.
- The area is affected by hurricanes and tropical storms. No analysis of the impacts of storm waves and storm surges on the landing and nearshore locations is presented, and the impact of waves on the bottom with respect to cable protection.
- The constructability aspect of the land-sea connection, presumably to be performed with horizontal direction drilling (HDD) is not evaluated. Geology, metocean conditions, bathymetry, bottom conditions, land availability, permits, etc. could result in a proposed landfall location that is unsuitable which will impact the shore approach of the subsea cable crossing.
- The ranking in terms of the Global Index shows relatively small differences. For example, routes 5 and 6 (1.59) are similar to 1 (1.54). It is not clear what is the significance of these relatively small differences in the Global Index.

# Section 3: Jacobs Offshore Route Assessment, Alternative Routes and Selection

# Geospatial Datasets Assembled for Jacobs Assessment

These geospatial datasets were utilised to assess the CESI route and identify alternative routes.

| Source | GIS Datasets |
|---|---|
| Marine Cadastre National Viewer (Marine Cadastre National Viewer)<br><br>NOAA Historical Hurricane Tracks | • Anchorage Areas<br>• Artificial Reefs<br>• Bathymetric Contours<br>• Benthic Cover<br>• Coastal Barrier Resource Areas<br>• Coast Guard Jurisdictions<br>• Coastal Maintained Channels<br>• Deep-Sea Coral Observations (NOAA National Marine Fisheries Service)<br>• Essential Fish Habitat (NOAA National Marine Fisheries Service)<br>• Habitat Areas of Particular Concern (NOAA National Marine Fisheries Service)<br>• Marine Protected Areas Inventory (NOAA National MPA Center)<br>• National Environmental Policy Act<br>• Ocean Disposal Sites<br>• Ocean Sediment Thickness Contours (NOAA National Centers for Environmental Information)<br>• Rivers and Harbors Act (NOAA Office for Coastal Management)<br>• Seagrasses (NOAA Office for Coastal Management)<br>• Tropical Cyclone Storm Segments<br>• USGS Sediment Texture (US Geological Survey)<br>• Unexploded Ordnance Areas (UXO)<br>• Wrecks and Obstructions (NOAA Office of Coast Survey)<br>• Historical Hurricane Tracks. |
| Gebco (GEBCO - The General Bathymetric Chart of the Oceans) | • Gebco Global Gridded Bathymetry (C. 440 m) |
| NOAA: IHO Data Centre for Digital Bathymetry Viewer (IHO Data Centre for Digital Bathymetry Viewer (noaa.gov) | • Multibeam Mosaic (C. 90 m)<br>• Multibeam Mosaic Hillshade (C. 90 m)<br>• DEM Global Mosaic (C. 30-90 m)<br>• DEM Global Mosaic Hillshade (C. 30-90 m) |

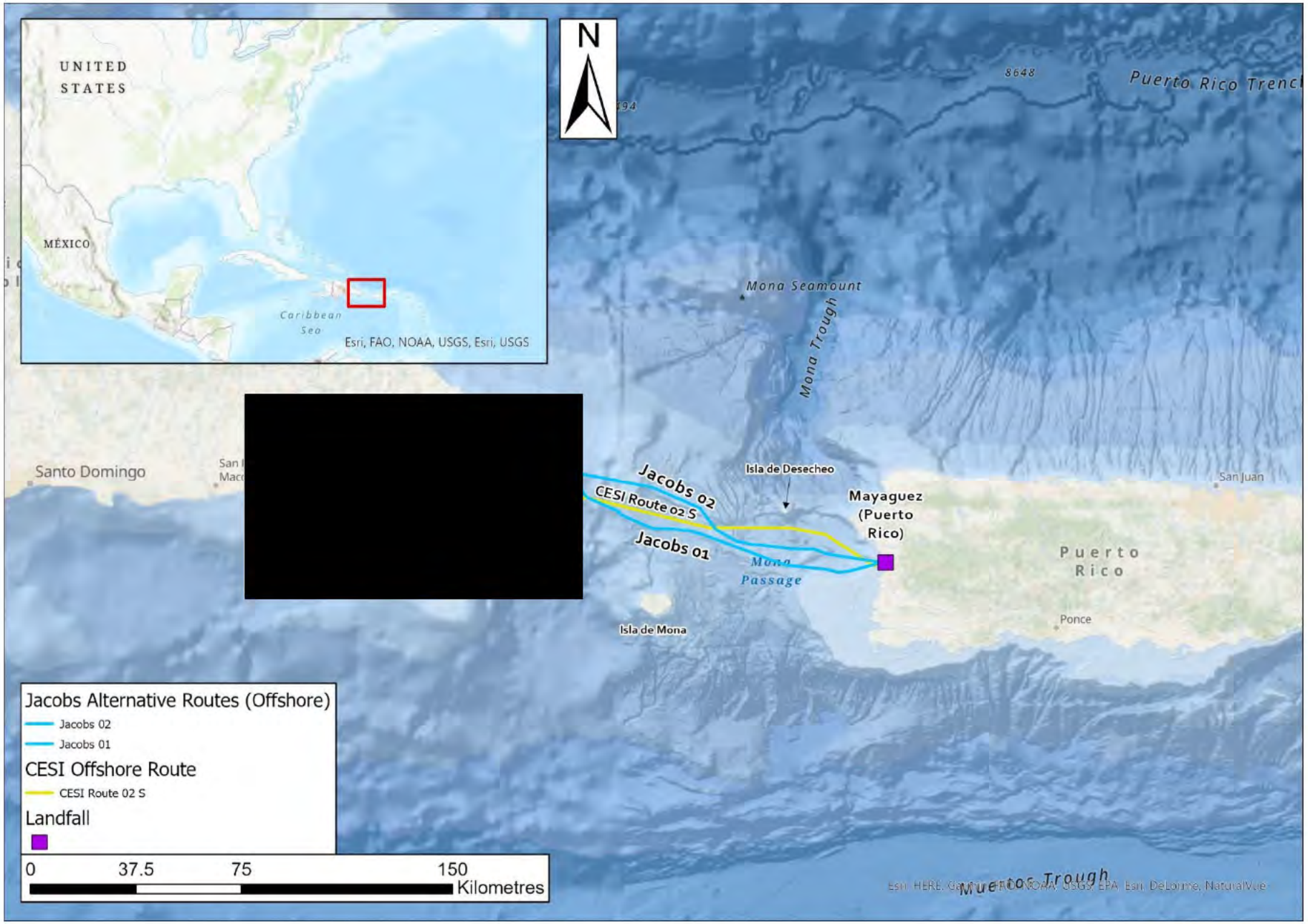
Note: These data are suitable for coastal and ocean planning but not engineering design.

# Jacobs Cable Route Corridor Assessment Methodology

- Assemble Geographic Information System (GIS) dataset of the Mona Passage, to view relevant information and support geospatial analysis of route corridors.
- Appraise the preferred CESI route corridor to characterise the seabed conditions and constraints.
- Identify and appraise 2 no. alternative route corridors (1km width) to characterise the seabed conditions and constraints.
- Perform an assessment of all route corridors and recommend a preferred route corridor that minimise water depth and constraints.
- Document the findings in an illustrated report (i.e., this report).

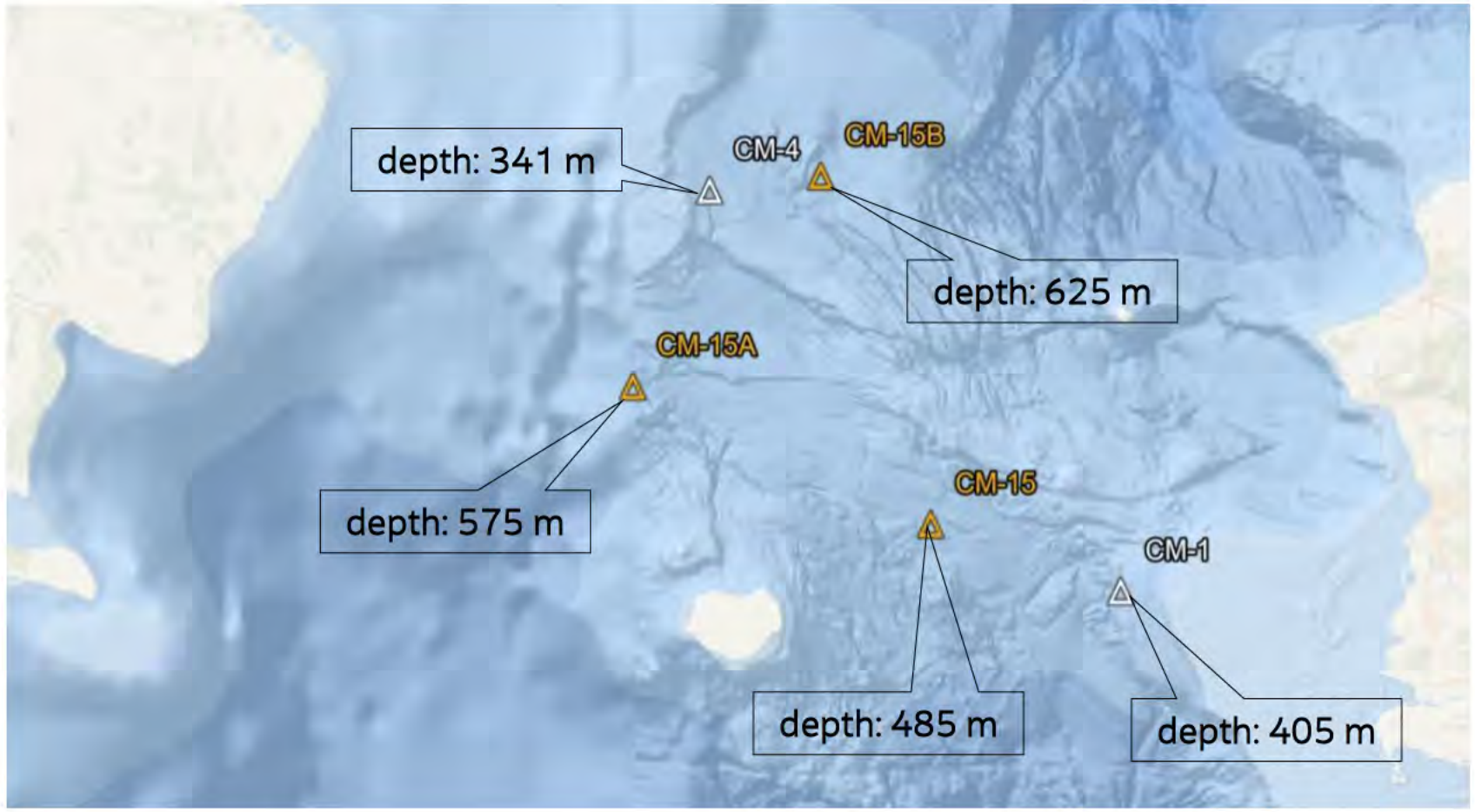
# Site Setting

- The study area, known as the Mona Passage is situated between the Caribbean Islands of Puerto Rico and The Dominican Republic.
- The Mona Passage is located on an active continental margin subject to shallow earthquake activity.
- Seismic events are typically low magnitude, though destructive events have occurred (i.e., 1918 earthquake and tsunami, Chaytor and Ten Brink, 2010).
- With water depths up to c.1000 m and almost completely submerged except several islands, the Mona Passage geomorphology consists of erosional, karst, depositional and structural features (Chaytor and Ten Brink, 2010; CESI, 2022)

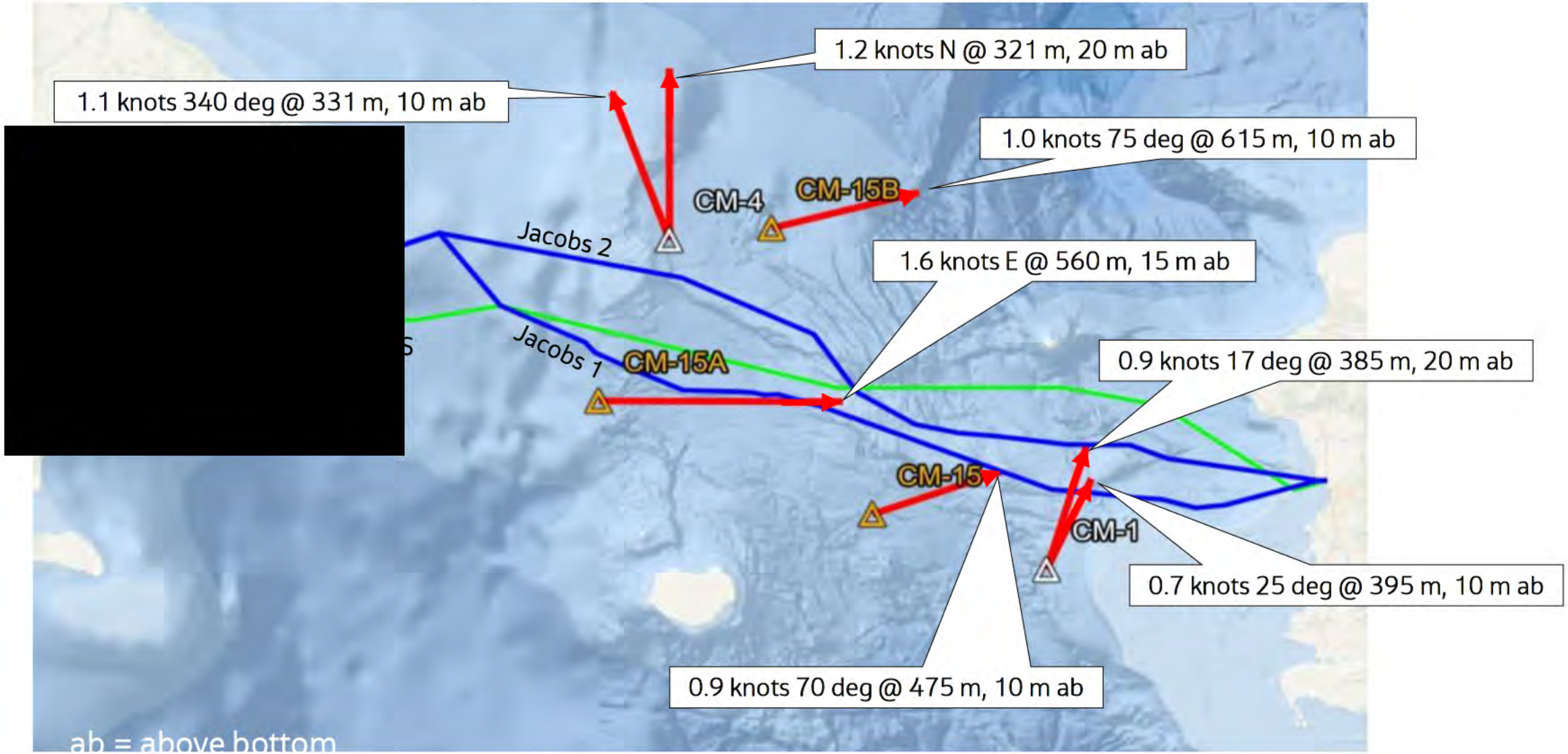


# Mona Passage: Ocean Currents

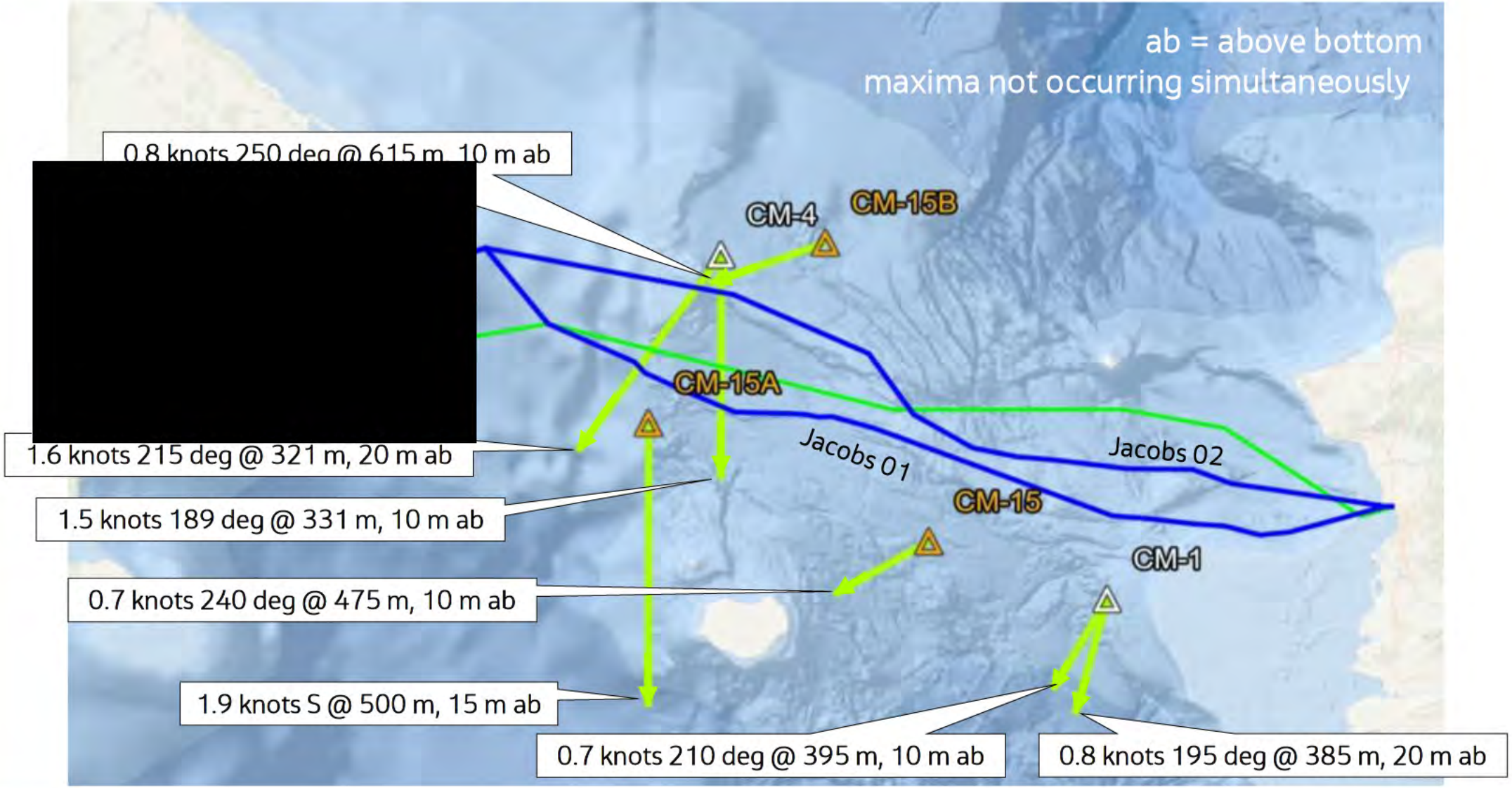
- Data inputs: seafloor erosion, migration of sand waves, hydrodynamic loads
- Based on near bottom current meter (CM) measurements by:
  - Burns and Car (1975), 3 CMs, Fall of 1972, 10 and 15 m above bottom
  - Bourkland and Dorey (1977), 2 CMs, March to July 1975, 10 and 20 m above bottom



# Currents – Maximum Speed and Direction: North-easterly



# Currents – Maximum Speed and Direction – South-westerly

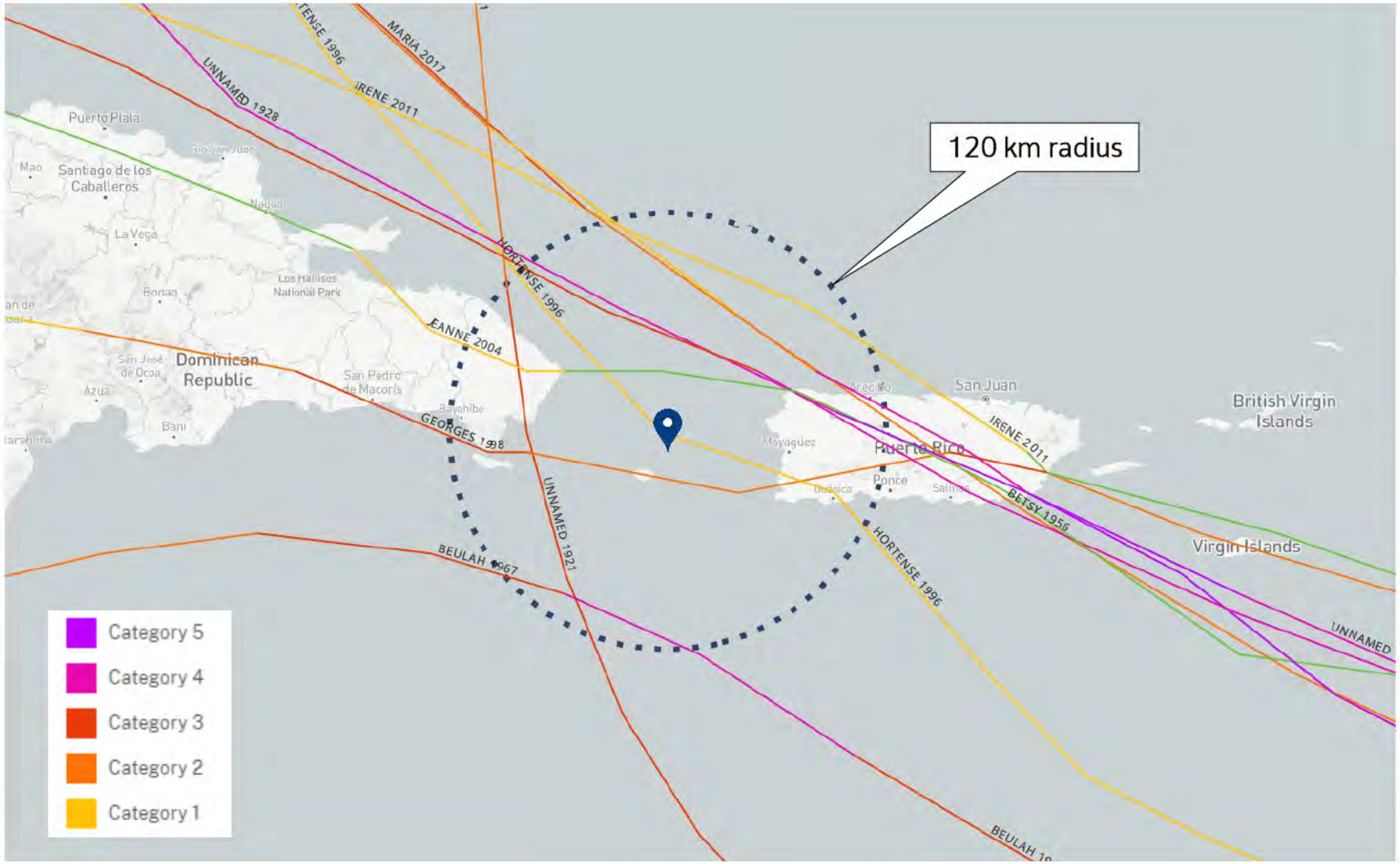


# Mona Passage Ocean Currents: Summary

- Near the bottom, currents are strong, 0.7 to 1.9 knots.
- Maximum bottom currents on the east side of the passage (Mona Island) are weaker (0.7 to 0.9 knots) than on the west side (0.8 to 1.9 knots).
- On the east side of the passage maximum bottom currents trend aligned with the Puerto Rico coast.
- On the west side of the passage maximum bottom currents trend aligned southwest- northeast.
- Maximum bottom currents may not significantly exceed 1.7 knots on the west side of the passage and 1 knot on the east side (Bourkland and Dorey,1977).
- However, the bottom relief is very complex and affects the flow (funnelling, channelling, diverting, blocking, etc.), localized stronger and weaker currents should be expected.
- Maximum flow of the Caribbean Current is in June and July and minimum in October (Wust, 1964).

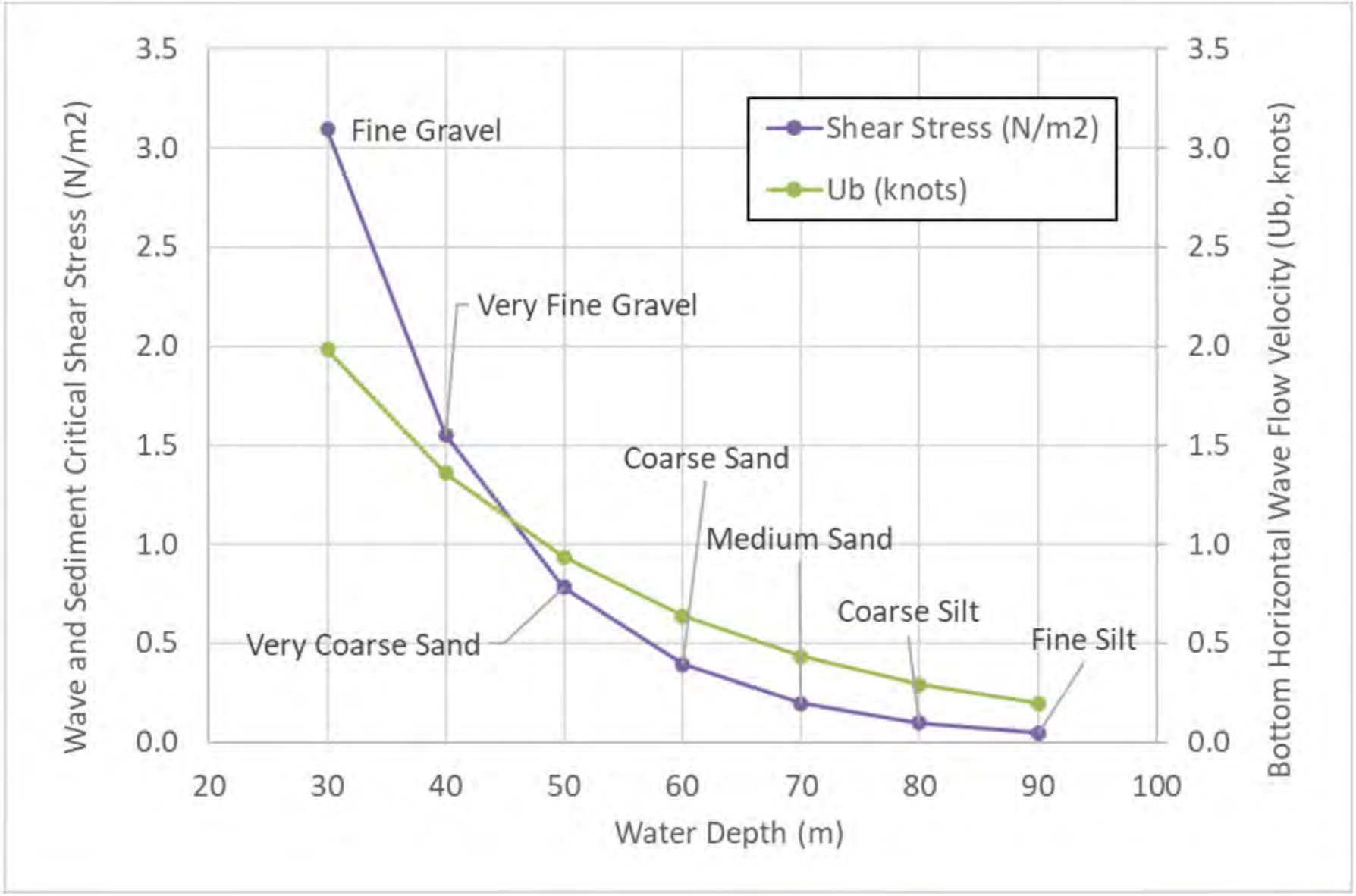
# Hurricanes

- Trend SE to NW
- Most damaging would be south-passing, like Maria 2017, but with landfall on Dominican Republic south of El Cabo



# Hurricanes

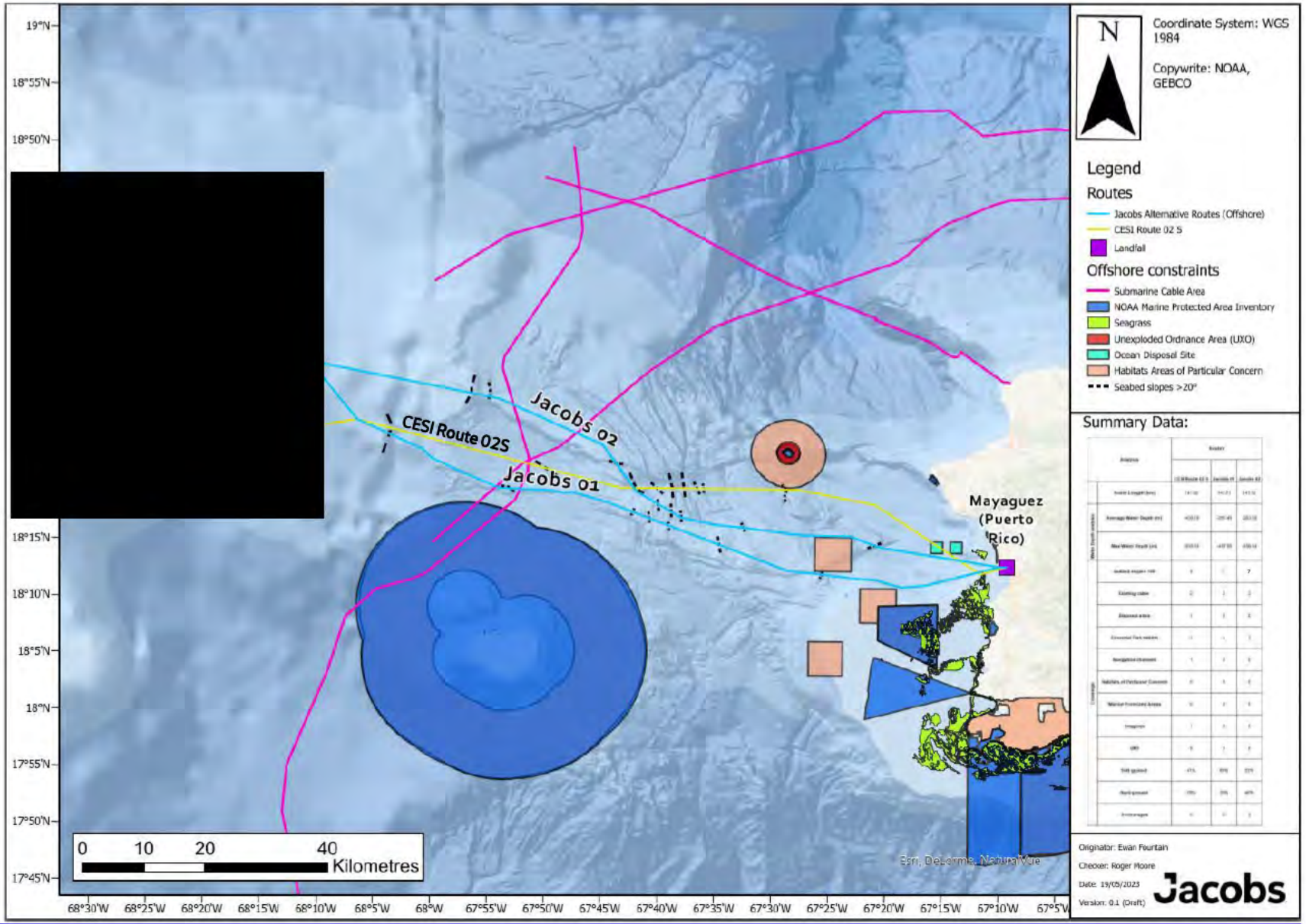
- Generic south-passing hurricane (e.g., Maria, 2017)
  - Hs = 6 m
  - T = 10 seconds
- In 80 -100 m water depth, hurricane 6 m, 10-second waves would induce flow velocities < 0.5 knot and only move silt sediment
- When waves combined with current and cable-seafloor interaction, flow velocities and shear stresses would be higher.



# Overview of Cable Route Corridors

- Three routes assessed in this study report:

1. CESI Route 02 S
   - Slides 21-29
2. Jacobs Route 01
   - Slides 30-38
3. Jacobs Route 02
   - Slides 39-47

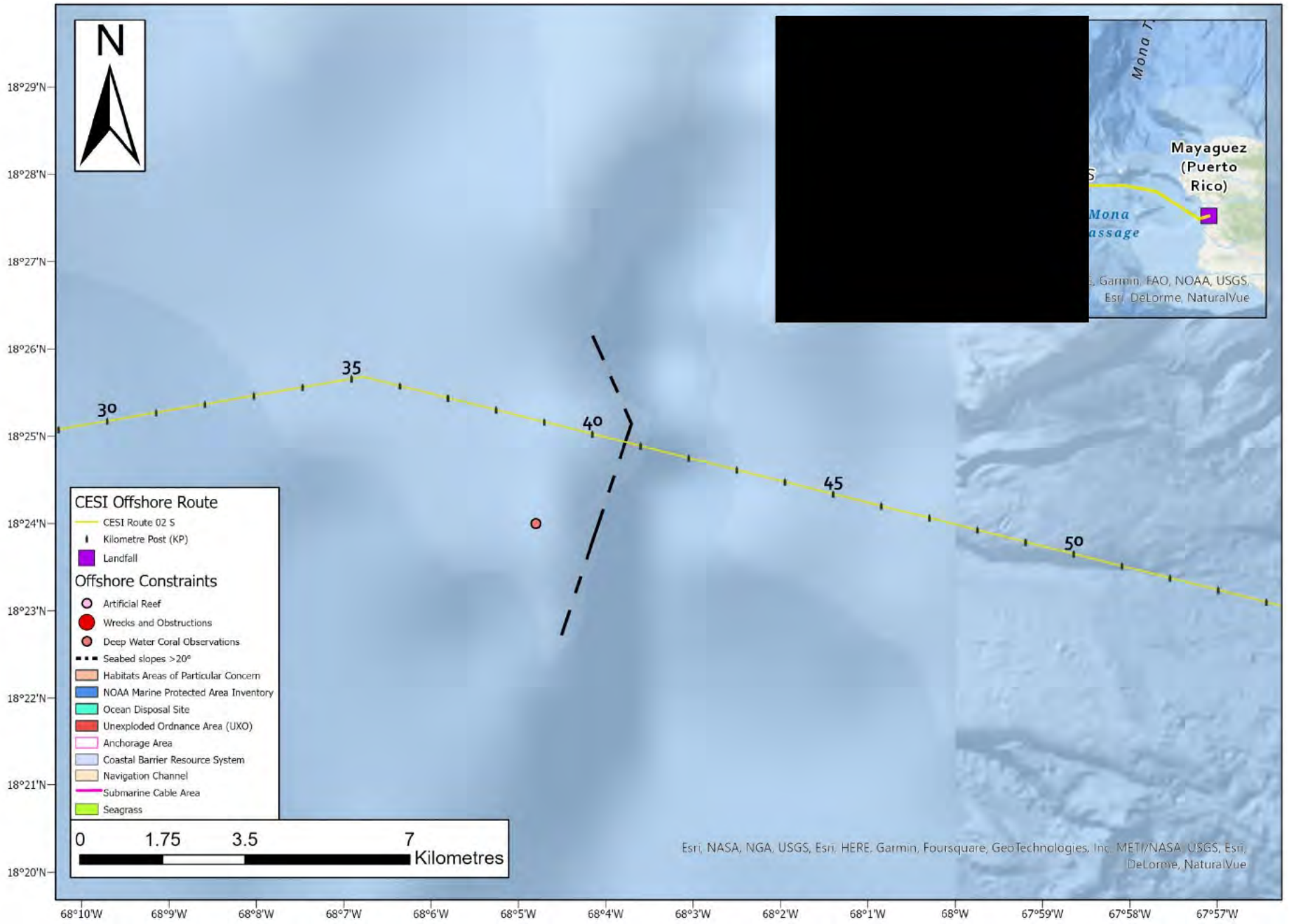


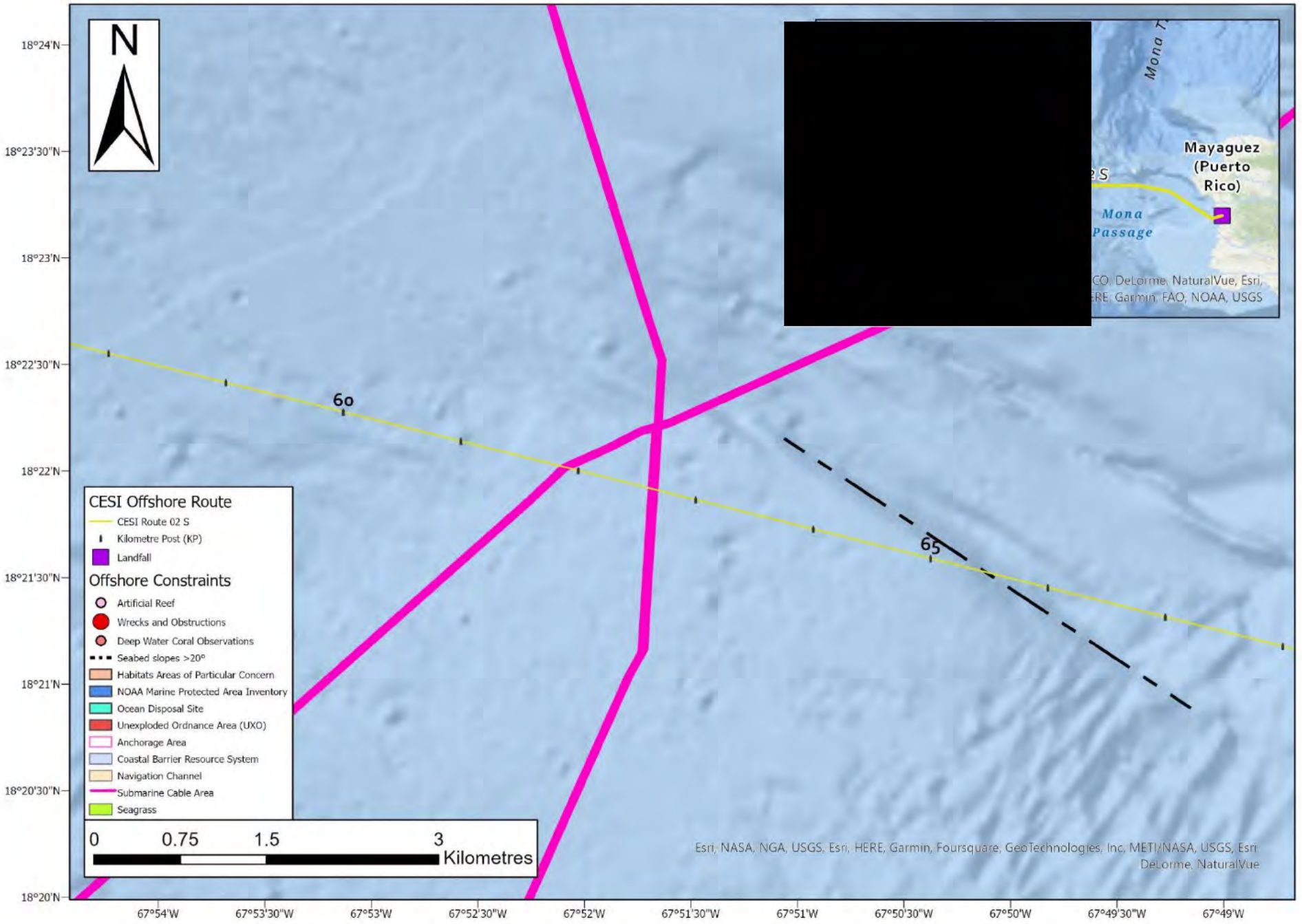
# Section 3.1: CESI Route 02S

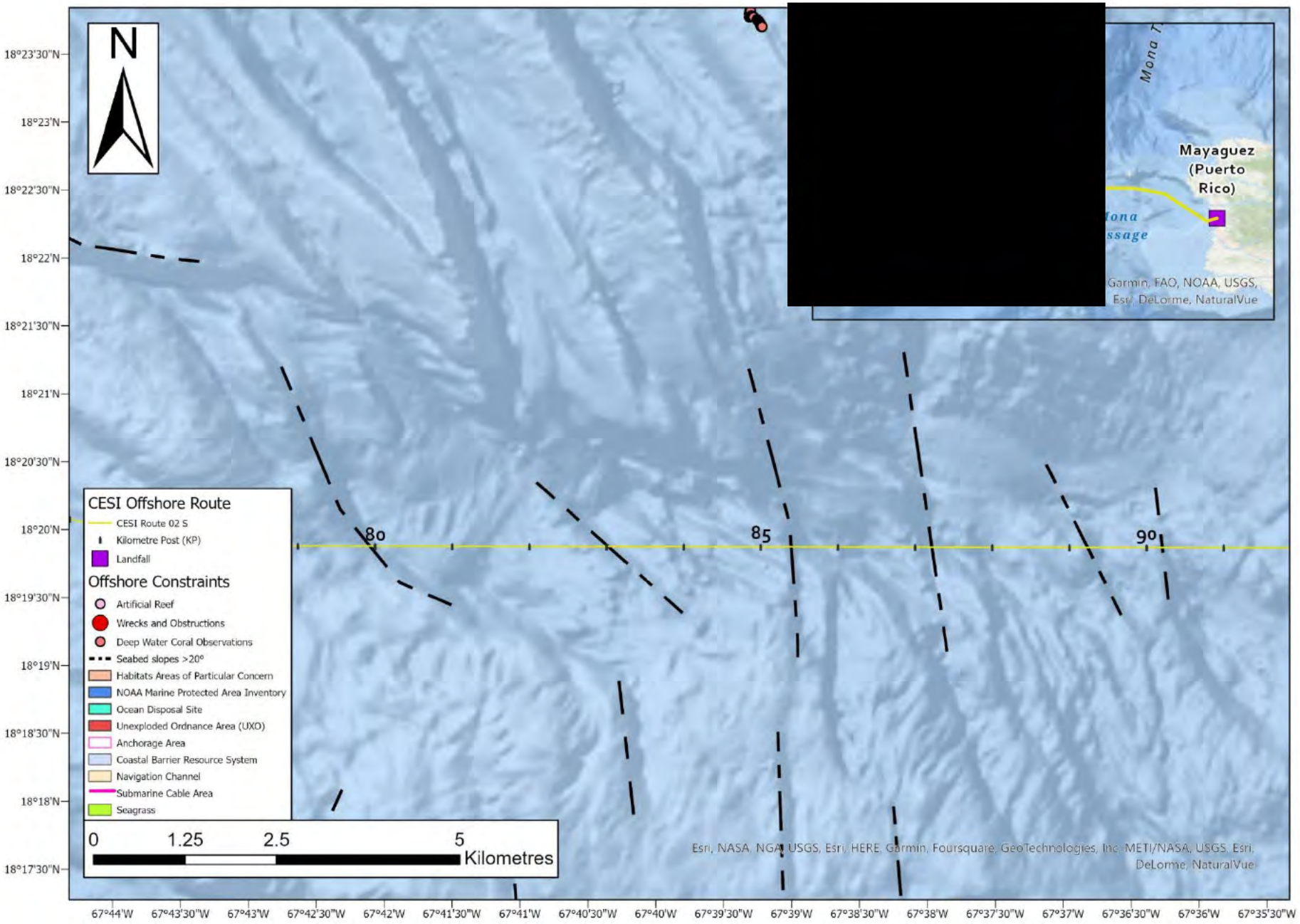
# CESI Route 02S (Length: 141.26 km)

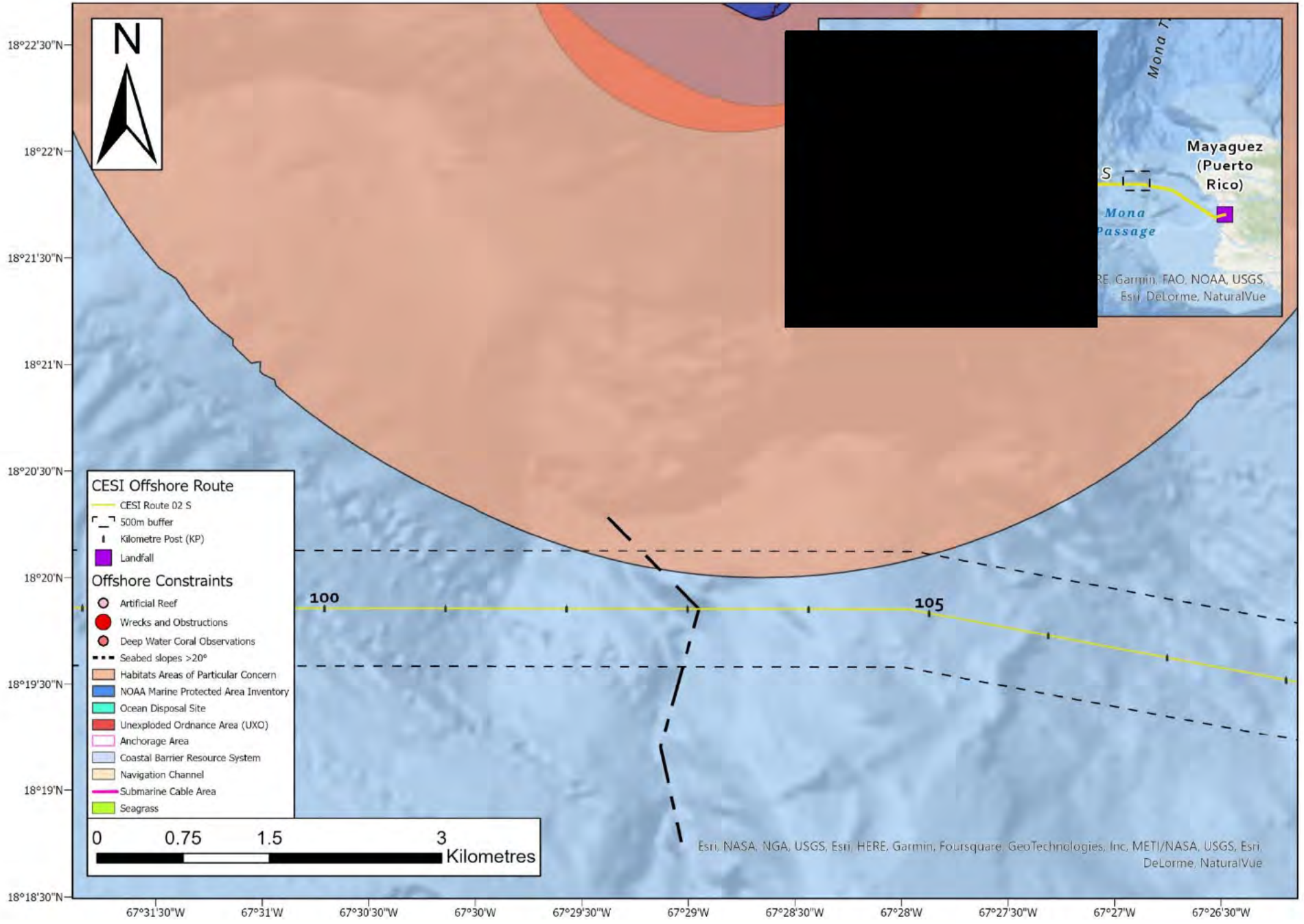
| Pros | Cons | Attributes considered |
|---|---|---|
| • Shortest route (141.26 km) | • Maximum water depth (-930.34 m)<br>• Average water depth (-430.10 m)<br>• Most no. of fault scarps / steep slopes (>20°) encountered<br>• Crosses area of seagrass (KP 137)<br>• At least 2 existing cable crossings (KP 62 & 62.5)<br>• Crosses an ocean disposal site (KP 127.5 to 129.5)<br>• Crosses 3 Essential Fish Habitats | • National Environmental Policy Act<br>• Coast Guard Jurisdictions<br>• Clean Water Act<br>• Federal & state waters<br>• Rivers and Harbours Act<br>• Comprehensive Environmental Response, Compensation and Liability Act (existing ocean disposal sites) |

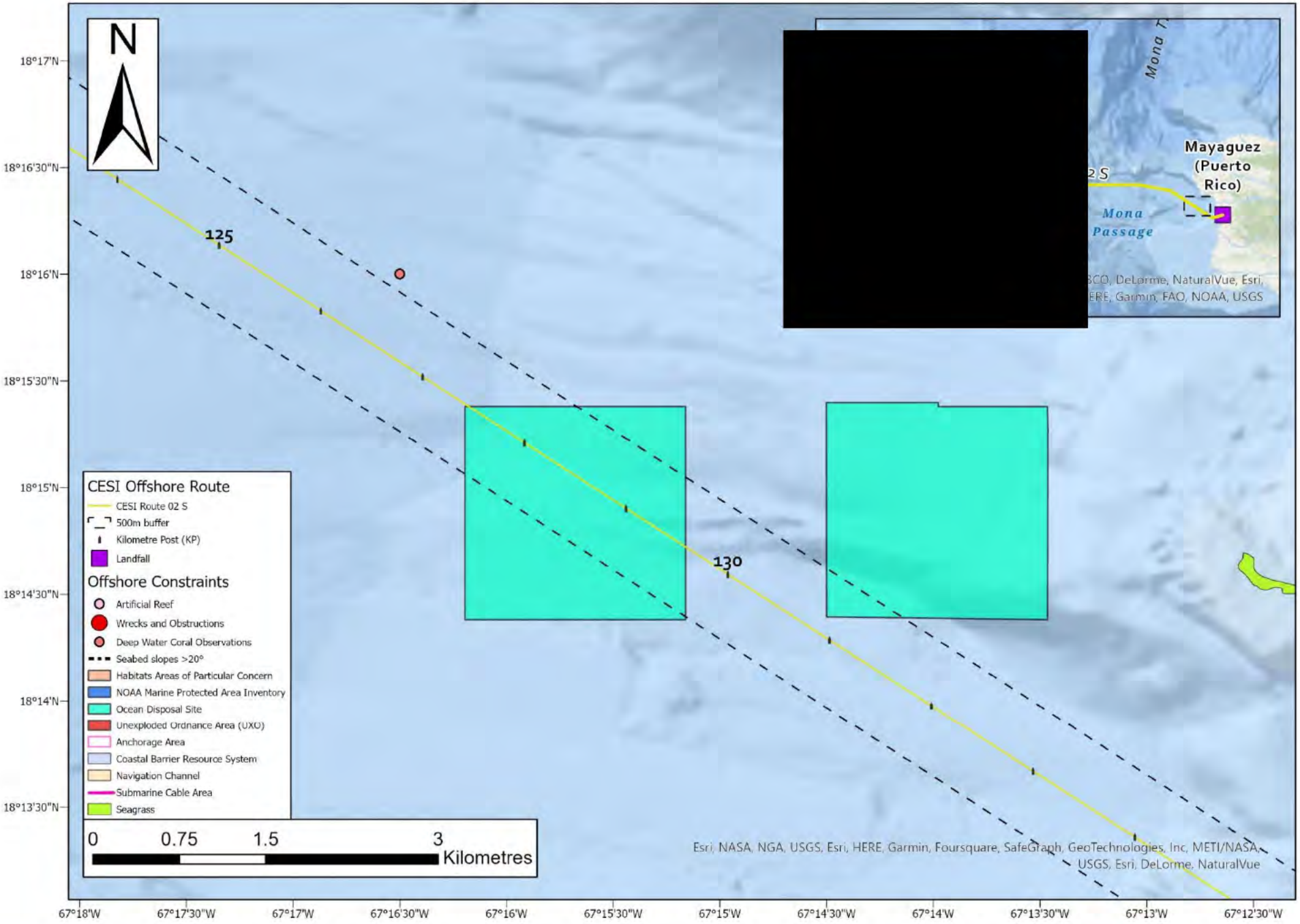
- The following illustrations highlight where the CESI Route 02 S interfaces with offshore constraints
- A 500m buffer either side of the centreline is assumed to define the cable corridor

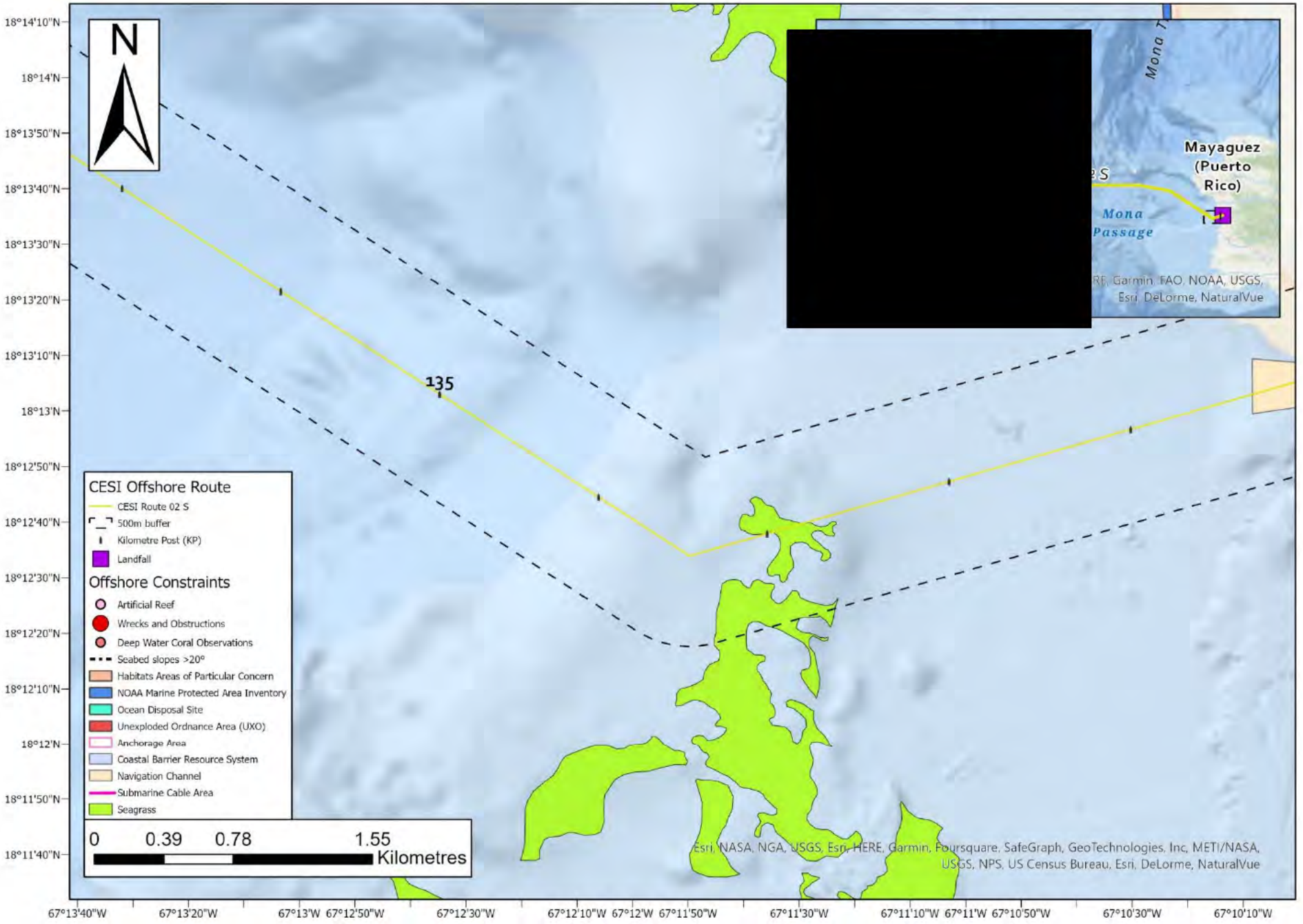

N
18°29'N
18°28'N
18°27'N
18°26'N
18°25'N
18°24'N
18°23'N
18°22'N
18°21'N
18°20'N
68°10'W
68°9'W
68°8'W
68°7'W
68°6'W
68°5'W
68°4'W
68°3'W
68°2'W
68°1'W
68°W
67°59'W
67°58'W
67°57'W
30
35
40
45
50
CESI Offshore Route
CESI Route 02 S
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0
1.75
3.5
7
Kilometres
Mayaguez
(Puerto
Rico)
Mona
assage
Garmin, FAO, NOAA, USGS,
Esri, DeLorme, NaturalVue
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri,
DeLorme, NaturalVue

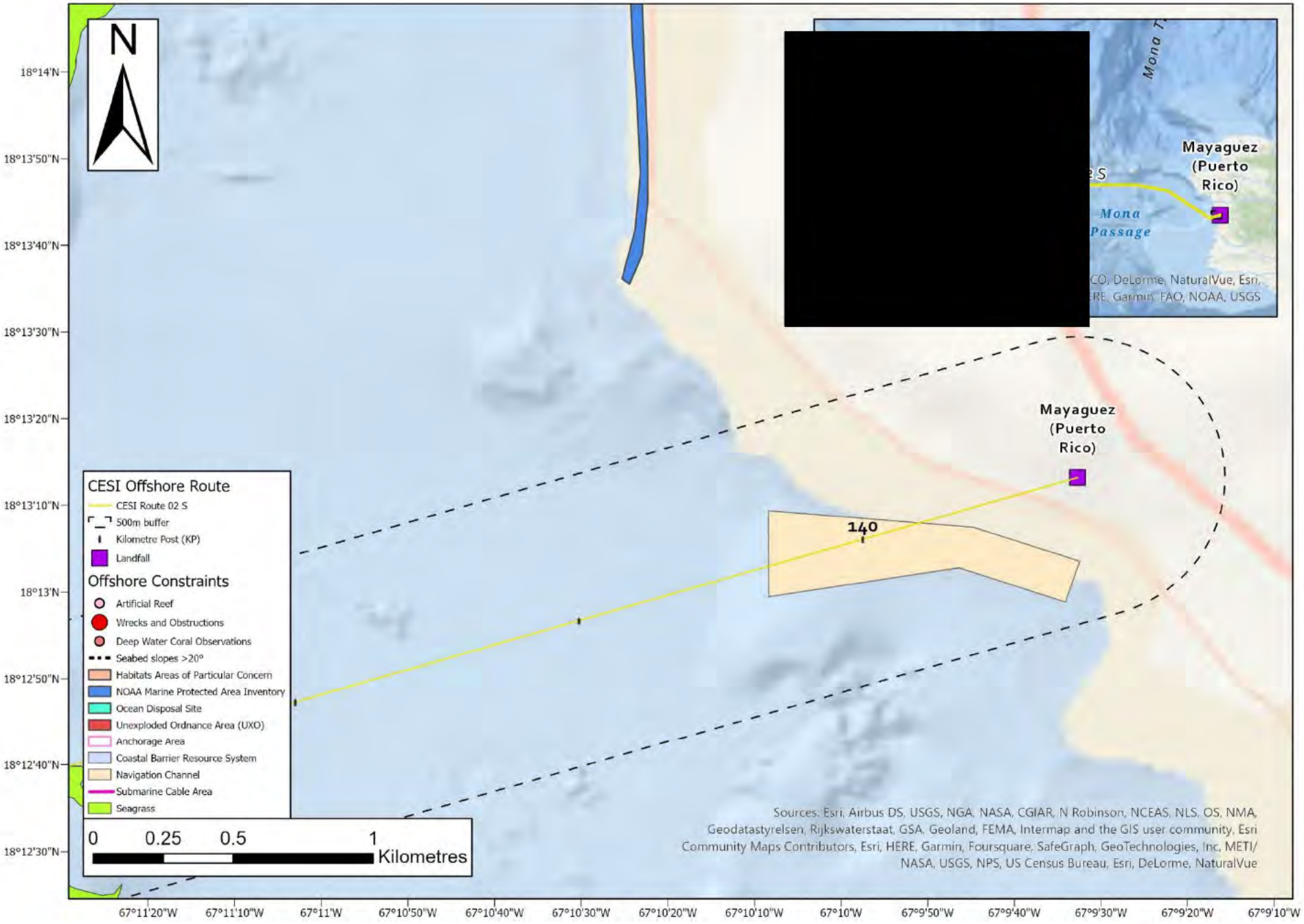

N
18°24'N
18°23'30"N
18°23'N
18°22'30"N
18°22'N
18°21'30"N
18°21'N
18°20'30"N
18°20'N
67°54'W
67°53'30"W
67°53'W
67°52'30"W
67°52'W
67°51'30"W
67°51'W
67°50'30"W
67°50'W
67°49'30"W
67°49'W
6o
65
Mayaguez (Puerto Rico)
Mona Passage
CO, DeLorme, NaturalVue, Esri, ERE, Garmin, FAO, NOAA, USGS
CESI Offshore Route
CESI Route 02 S
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 0.75 1.5 3
Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue


N
CESI Offshore Route
CESI Route 02 S
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 1.25 2.5 5 Kilometres
80
85
90
Mayaguez (Puerto Rico)
Garmin, FAO, NOAA, USGS, Esri, DeLorme, NaturalVue
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue
18°23'30"N
18°23'N
18°22'30"N
18°22'N
18°21'30"N
18°21'N
18°20'30"N
18°20'N
18°19'30"N
18°19'N
18°18'30"N
18°18'N
18°17'30"N
67°44'W
67°43'30"W
67°43'W
67°42'30"W
67°42'W
67°41'30"W
67°41'W
67°40'30"W
67°40'W
67°39'30"W
67°39'W
67°38'30"W
67°38'W
67°37'30"W
67°37'W
67°36'30"W
67°36'W
67°35'30"W


N
18°22'30"N
18°22'N
18°21'30"N
18°21'N
18°20'30"N
18°20'N
18°19'30"N
18°19'N
18°18'30"N
67°31'30"W
67°31'W
67°30'30"W
67°30'W
67°29'30"W
67°29'W
67°28'30"W
67°28'W
67°27'30"W
67°27'W
67°26'30"W
Mayaguez (Puerto Rico)
Mona Passage
RE, Garmin, FAO, NOAA, USGS, Esri, DeLorme, NaturalVue
CESI Offshore Route
CESI Route 02 S
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
100
105
0 0.75 1.5 3 Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue


N
18°17'N
18°16'30"N
18°16'N
18°15'30"N
18°15'N
18°14'30"N
18°14'N
18°13'30"N
67°18'W
67°17'30"W
67°17'W
67°16'30"W
67°16'W
67°15'30"W
67°15'W
67°14'30"W
67°14'W
67°13'30"W
67°13'W
67°12'30"W
125
130
Mayaguez (Puerto Rico)
Mona Passage
CESI Offshore Route
CESI Route 02 S
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 0.75 1.5 3 Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue


N
135
CESI Offshore Route
CESI Route 02 S
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 0.39 0.78 1.55
Kilometres
Mayaguez (Puerto Rico)
Mona Passage
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NPS, US Census Bureau, Esri, DeLorme, NaturalVue
18°14'10"N
18°14'N
18°13'50"N
18°13'40"N
18°13'30"N
18°13'20"N
18°13'10"N
18°13'N
18°12'50"N
18°12'40"N
18°12'30"N
18°12'20"N
18°12'10"N
18°12'N
18°11'50"N
18°11'40"N
67°13'40"W
67°13'20"W
67°13'W
67°12'50"W
67°12'30"W
67°12'10"W
67°12'W
67°11'50"W
67°11'30"W
67°11'10"W
67°11'W
67°10'50"W
67°10'30"W
67°10'10"W

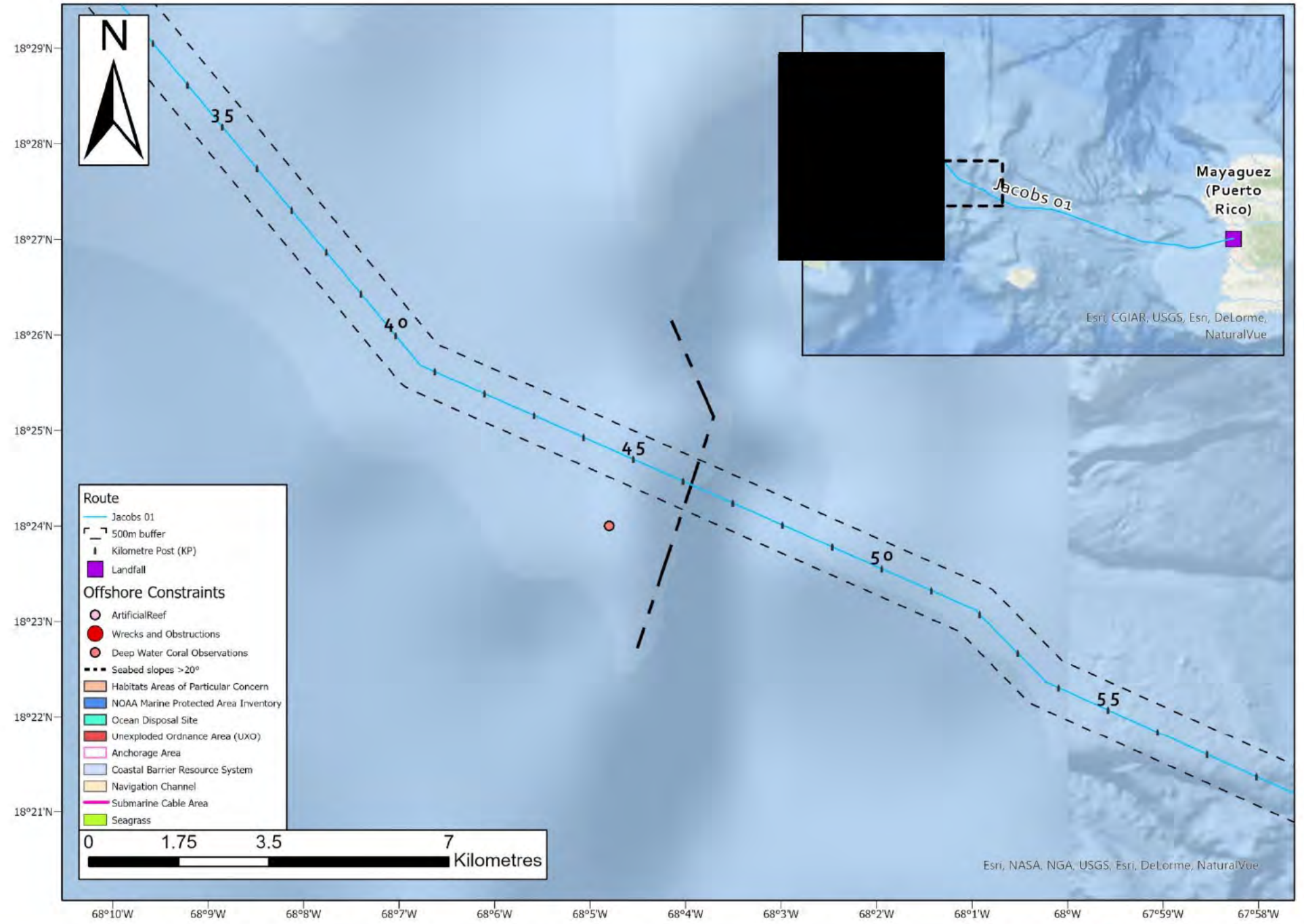

N
18°14'N
18°13'50"N
18°13'40"N
18°13'30"N
18°13'20"N
18°13'10"N
18°13'N
18°12'50"N
18°12'40"N
18°12'30"N
67°11'20"W
67°11'10"W
67°11'W
67°10'50"W
67°10'40"W
67°10'30"W
67°10'20"W
67°10'10"W
67°10'W
67°9'50"W
67°9'40"W
67°9'30"W
67°9'20"W
67°9'10"W
Mayaguez (Puerto Rico)
Mona Passage
Mayaguez (Puerto Rico)
140
CESI Offshore Route
CESI Route 02 S
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 0.25 0.5 1 Kilometres
Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, Esri, HERE, Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc, METI/ NASA, USGS, NPS, US Census Bureau, Esri, DeLorme, NaturalVue

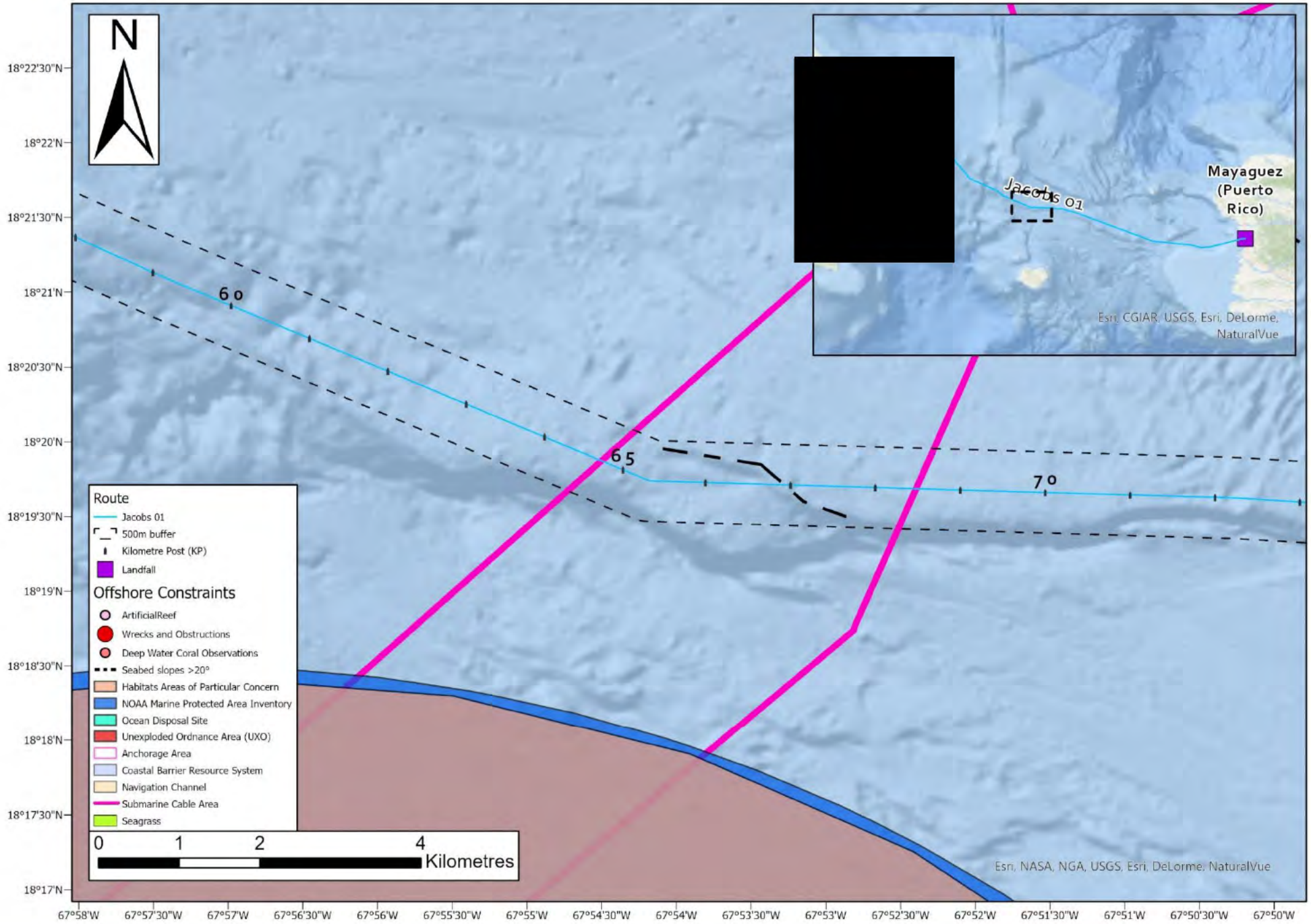
# Section 3.2: Jacobs 01 route

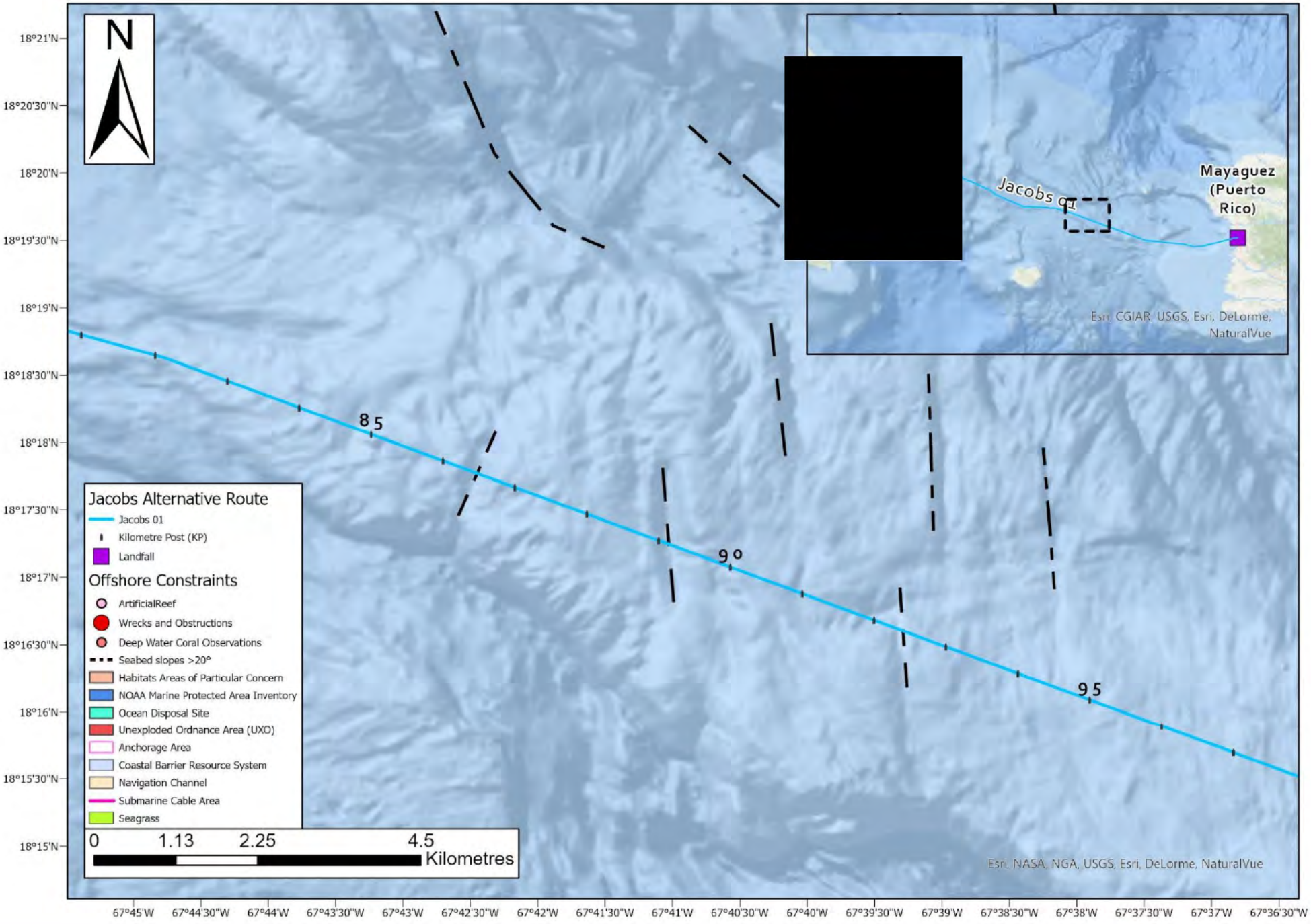
# Jacobs 01 route (Length: 147.73 km)

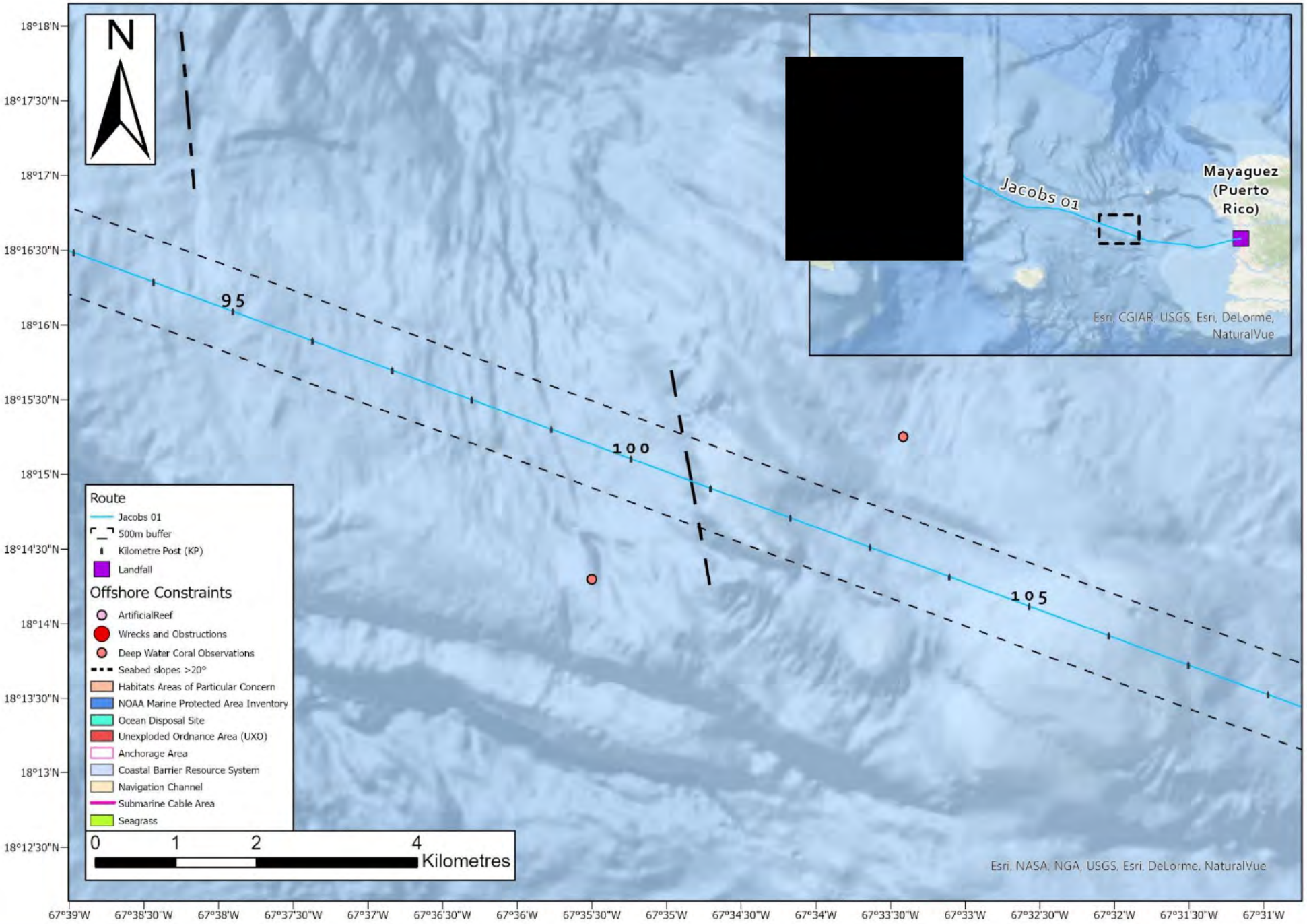
| Pros | Cons | Attributes considered |
|---|---|---|
| • Maximum water depth (-478.09 m)<br>• Average water depth (-256.49 m)<br>• Shortest length across hard ground (35% hard & 65% soft)<br>• Fewest fault scarps / steep slopes (>20°) encountered | • At least 2 existing cable crossings<br>• Crosses 4 Essential Fish Habitats | • National Environmental Policy Act<br>• Coast Guard Jurisdictions<br>• Clean Water Act<br>• Federal & state waters<br>• Rivers and Harbours Act<br>• Comprehensive Environmental Response, Compensation and Liability Act (existing ocean disposal sites) |

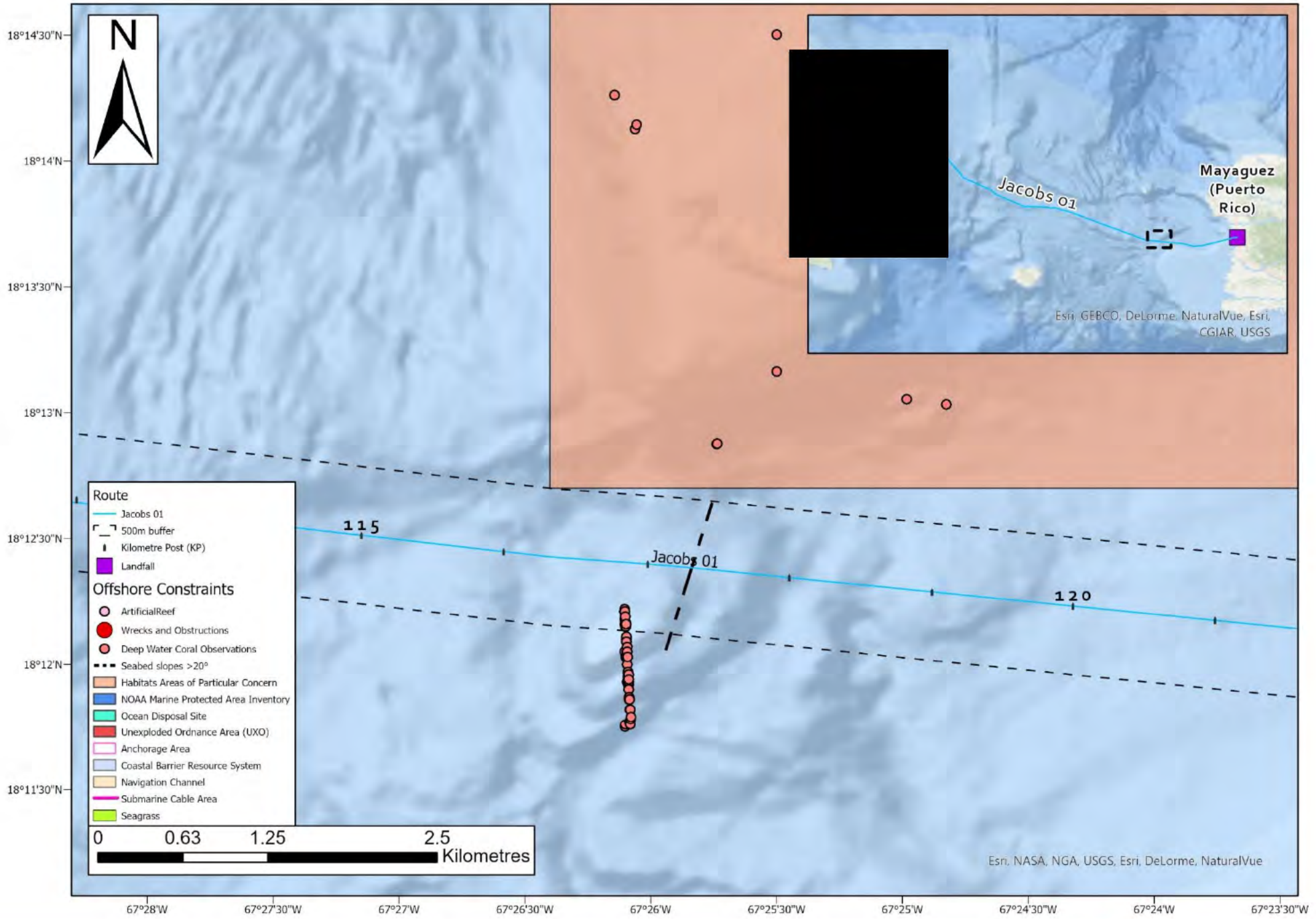
- The following slides illustrate where Jacobs Route 01 interfaces with offshore constraints
- Avoidance of all known constraints has been taken into account in determining the alternative Jacobs routes
- A 500m buffer is applied either side the centreline of the proposed cable route: the buffer is shown in the illustrations below in areas of close interaction with geophysical and environmental features of interest

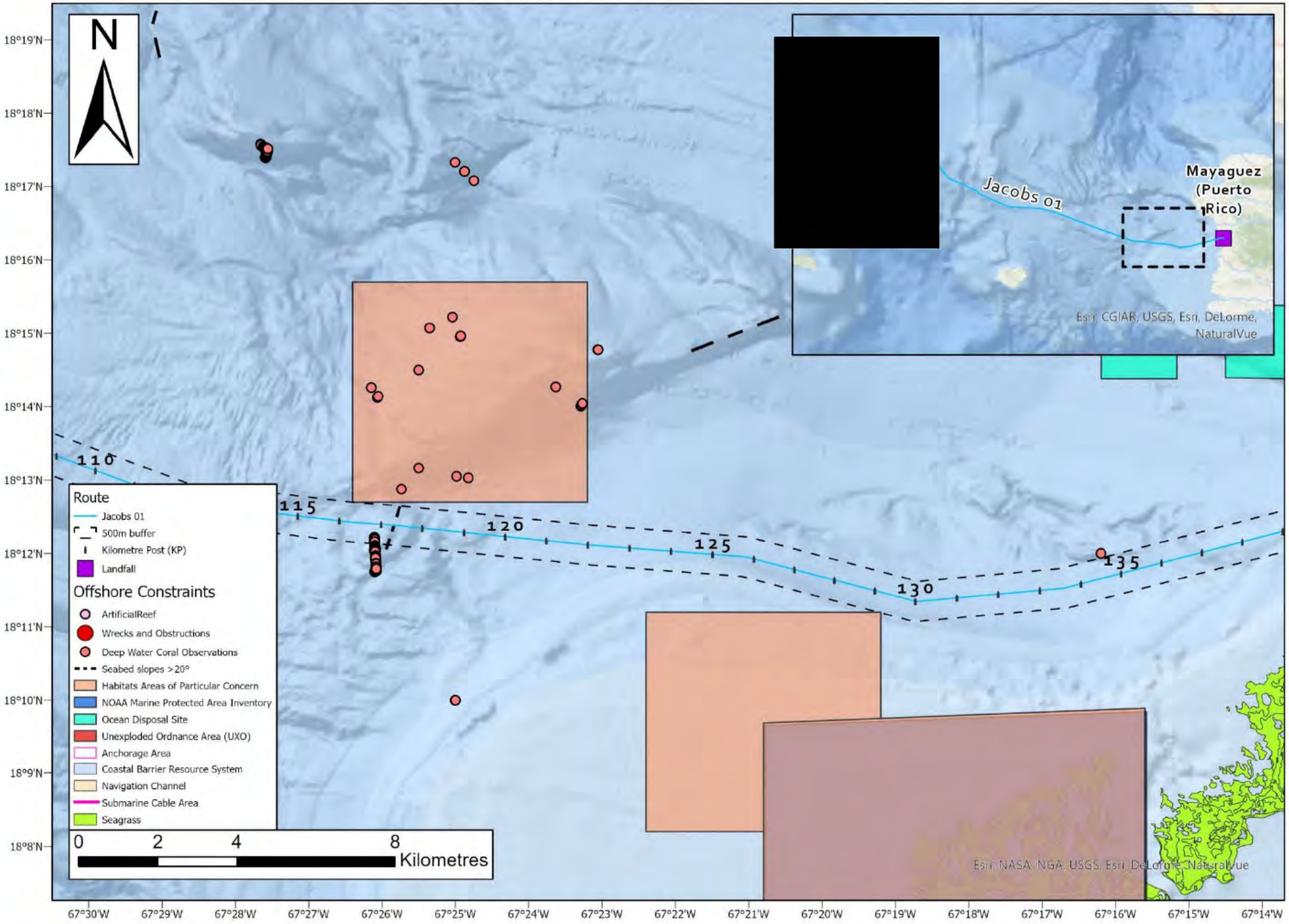

N
35
40
45
50
55
Jacobs 01
Mayaguez (Puerto Rico)
Esri, CGIAR, USGS, Esri, DeLorme, NaturalVue
Route
Jacobs 01
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
ArtificialReef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 1.75 3.5 7
Kilometres
Esri, NASA, NGA, USGS, Esri, DeLorme, NaturalVue
18°29'N
18°28'N
18°27'N
18°26'N
18°25'N
18°24'N
18°23'N
18°22'N
18°21'N
68°10'W
68°9'W
68°8'W
68°7'W
68°6'W
68°5'W
68°4'W
68°3'W
68°2'W
68°1'W
68°W
67°59'W
67°58'W

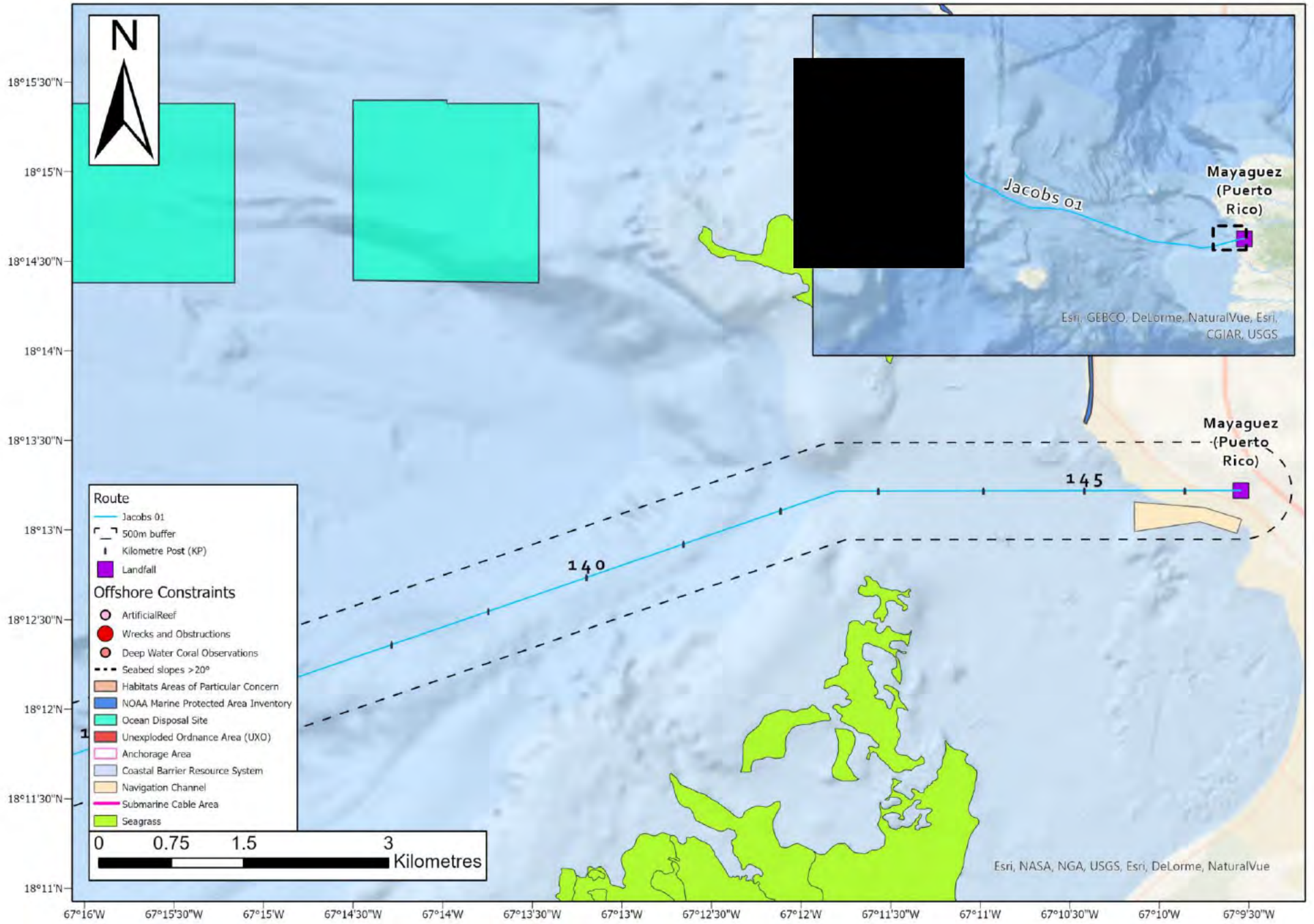

N
18°22'30"N
18°22'N
18°21'30"N
18°21'N
18°20'30"N
18°20'N
18°19'30"N
18°19'N
18°18'30"N
18°18'N
18°17'30"N
18°17'N
67°58'W
67°57'30"W
67°57'W
67°56'30"W
67°56'W
67°55'30"W
67°55'W
67°54'30"W
67°54'W
67°53'30"W
67°53'W
67°52'30"W
67°52'W
67°51'30"W
67°51'W
67°50'30"W
67°50'W
6 0
6 5
7 0
Jacobs 01
Mayaguez (Puerto Rico)
Esri, CGIAR, USGS, Esri, DeLorme, NaturalVue
Route
Jacobs 01
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
ArtificialReef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 1 2 4
Kilometres
Esri, NASA, NGA, USGS, Esri, DeLorme, NaturalVue


N
18°21'N
18°20'30"N
18°20'N
18°19'30"N
18°19'N
18°18'30"N
18°18'N
18°17'30"N
18°17'N
18°16'30"N
18°16'N
18°15'30"N
18°15'N
67°45'W
67°44'30"W
67°44'W
67°43'30"W
67°43'W
67°42'30"W
67°42'W
67°41'30"W
67°41'W
67°40'30"W
67°40'W
67°39'30"W
67°39'W
67°38'30"W
67°38'W
67°37'30"W
67°37'W
67°36'30"W
Jacobs 01
Mayaguez (Puerto Rico)
Esri, CGIAR, USGS, Esri, DeLorme, NaturalVue
85
90
95
Jacobs Alternative Route
Jacobs 01
Kilometre Post (KP)
Landfall
Offshore Constraints
ArtificialReef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0
1.13
2.25
4.5
Kilometres
Esri, NASA, NGA, USGS, Esri, DeLorme, NaturalVue


N
18°18'N
18°17'30"N
18°17'N
18°16'30"N
18°16'N
18°15'30"N
18°15'N
18°14'30"N
18°14'N
18°13'30"N
18°13'N
18°12'30"N
95
100
105
Jacobs 01
Mayaguez (Puerto Rico)
Esri, CGIAR, USGS, Esri, DeLorme, NaturalVue
Route
Jacobs 01
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
ArtificialReef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 1 2 4
Kilometres
Esri, NASA, NGA, USGS, Esri, DeLorme, NaturalVue
67°39'W
67°38'30"W
67°38'W
67°37'30"W
67°37'W
67°36'30"W
67°36'W
67°35'30"W
67°35'W
67°34'30"W
67°34'W
67°33'30"W
67°33'W
67°32'30"W
67°32'W
67°31'30"W
67°31'W


N
18°14'30"N
18°14'N
18°13'30"N
18°13'N
18°12'30"N
18°12'N
18°11'30"N
67°28'W
67°27'30"W
67°27'W
67°26'30"W
67°26'W
67°25'30"W
67°25'W
67°24'30"W
67°24'W
67°23'30"W
Jacobs 01
Mayaguez (Puerto Rico)
Esri, GEBCO, DeLorme, NaturalVue, Esri, CGIAR, USGS
115
120
Jacobs 01
Route
Jacobs 01
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
ArtificialReef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0
0.63
1.25
2.5
Kilometres
Esri, NASA, NGA, USGS, Esri, DeLorme, NaturalVue


N
Jacobs 01
Mayaguez (Puerto Rico)
Esri, CGIAR, USGS, Esri, DeLorme, NaturalVue
Esri, NASA, NGA, USGS, Esri, DeLorme, NaturalVue
110
115
120
125
130
135
Route
Jacobs 01
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
ArtificialReef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 2 4 8
Kilometres
18°19'N
18°18'N
18°17'N
18°16'N
18°15'N
18°14'N
18°13'N
18°12'N
18°11'N
18°10'N
18°9'N
18°8'N
67°30'W
67°29'W
67°28'W
67°27'W
67°26'W
67°25'W
67°24'W
67°23'W
67°22'W
67°21'W
67°20'W
67°19'W
67°18'W
67°17'W
67°16'W
67°15'W
67°14'W

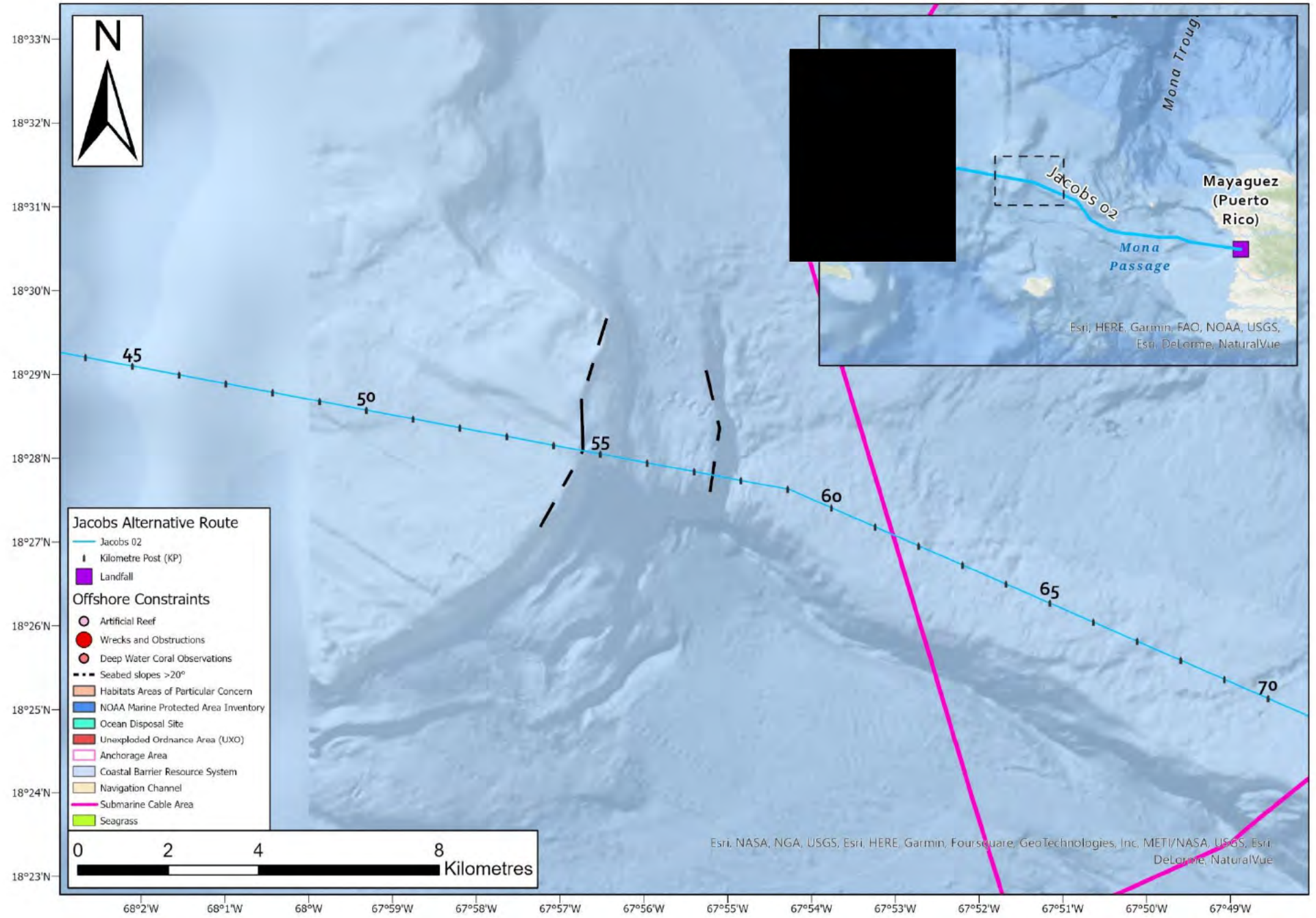

N
Jacobs 01
Mayaguez (Puerto Rico)
Esri, GEBCO, DeLorme, NaturalVue, Esri, CGIAR, USGS
Mayaguez (Puerto Rico)
145
140
Route
Jacobs 01
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
ArtificialReef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 0.75 1.5 3 Kilometres
Esri, NASA, NGA, USGS, Esri, DeLorme, NaturalVue
18°15'30"N
18°15'N
18°14'30"N
18°14'N
18°13'30"N
18°13'N
18°12'30"N
18°12'N
18°11'30"N
18°11'N
67°16'W
67°15'30"W
67°15'W
67°14'30"W
67°14'W
67°13'30"W
67°13'W
67°12'30"W
67°12'W
67°11'30"W
67°11'W
67°10'30"W
67°10'W
67°9'30"W

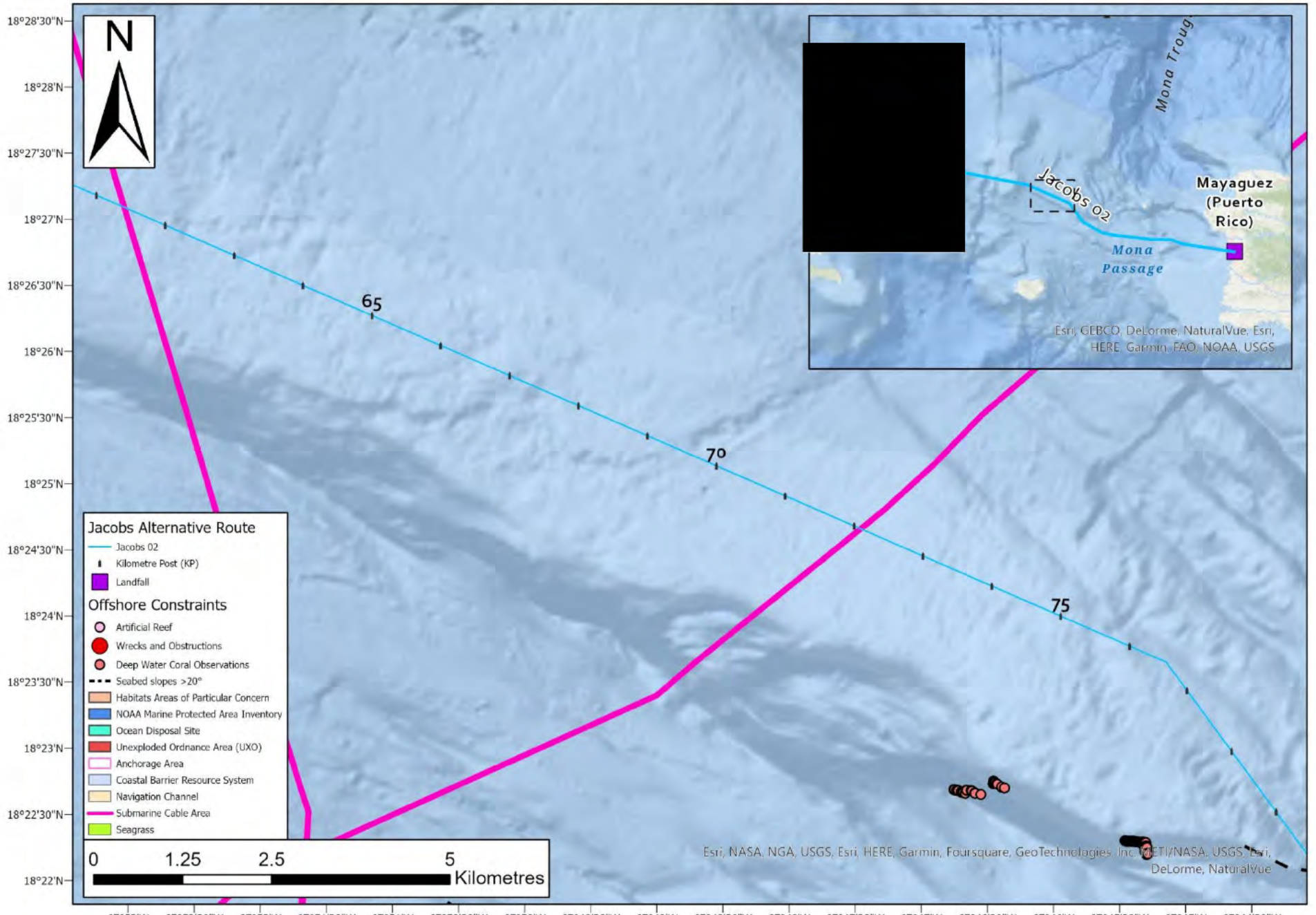
# Section 3.3: Jacobs 02 route

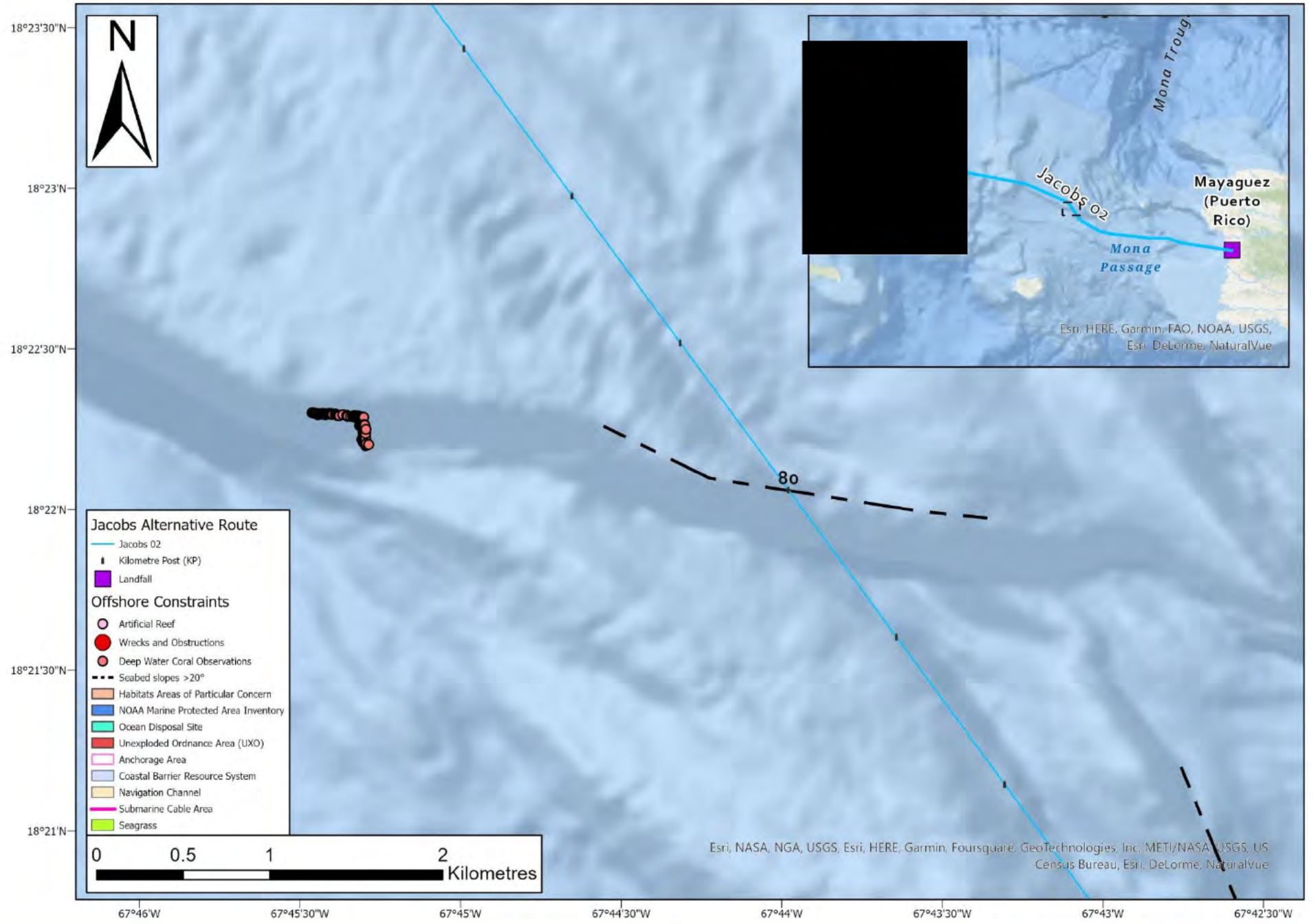
# Jacobs 02 route (Length: 145.52 km)

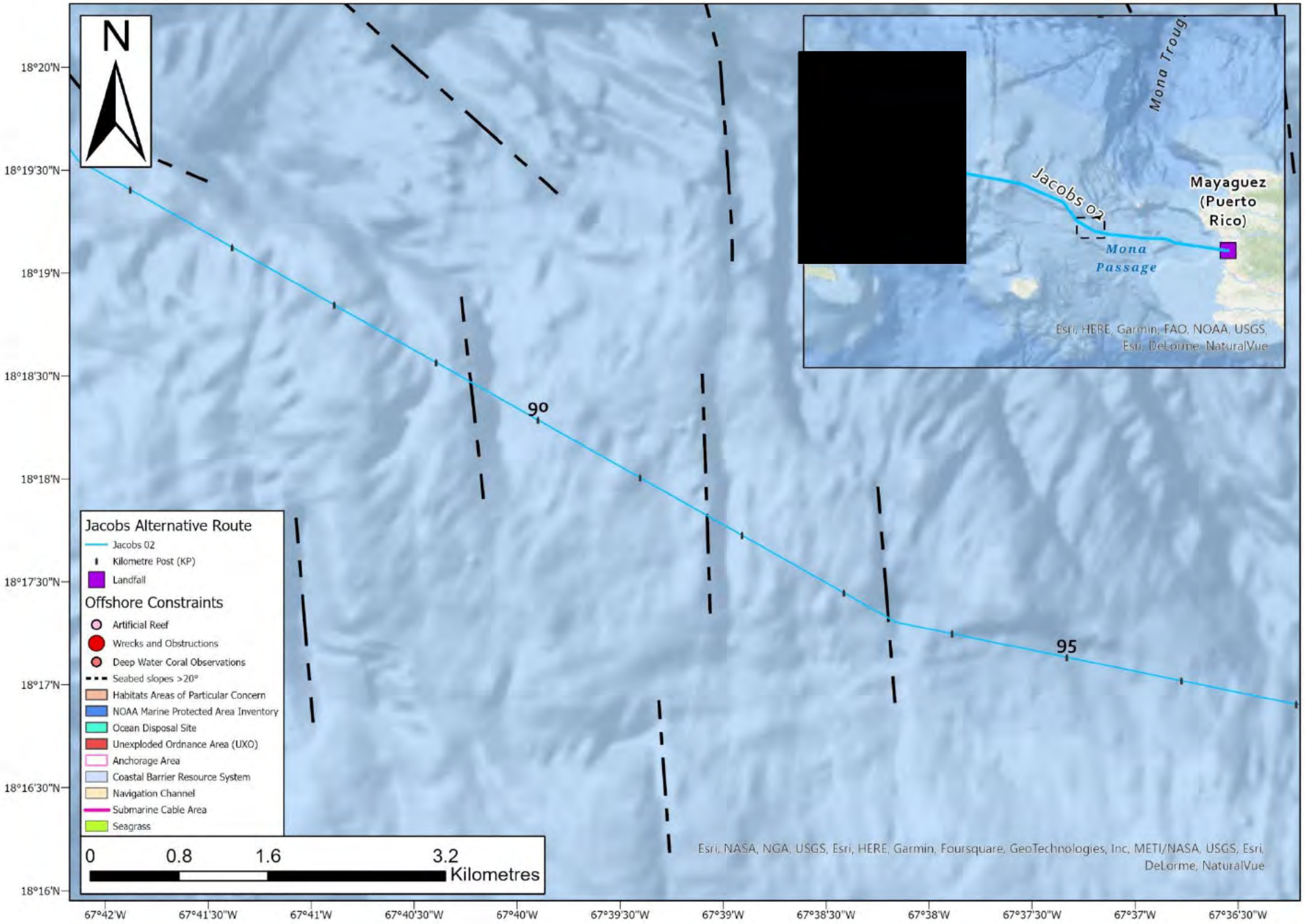
| Pros | Cons | Attributes considered |
|---|---|---|
| • Maximum water depth (-556.54m) | • At least 2 existing cable crossings<br>• Crosses 3 Essential Fish Habitats | • National Environmental Policy Act<br>• Coast Guard Jurisdictions<br>• Clean Water Act<br>• Federal & state waters<br>• Rivers and Harbours Act<br>• Comprehensive Environmental Response, Compensation and Liability Act (existing ocean disposal sites) |

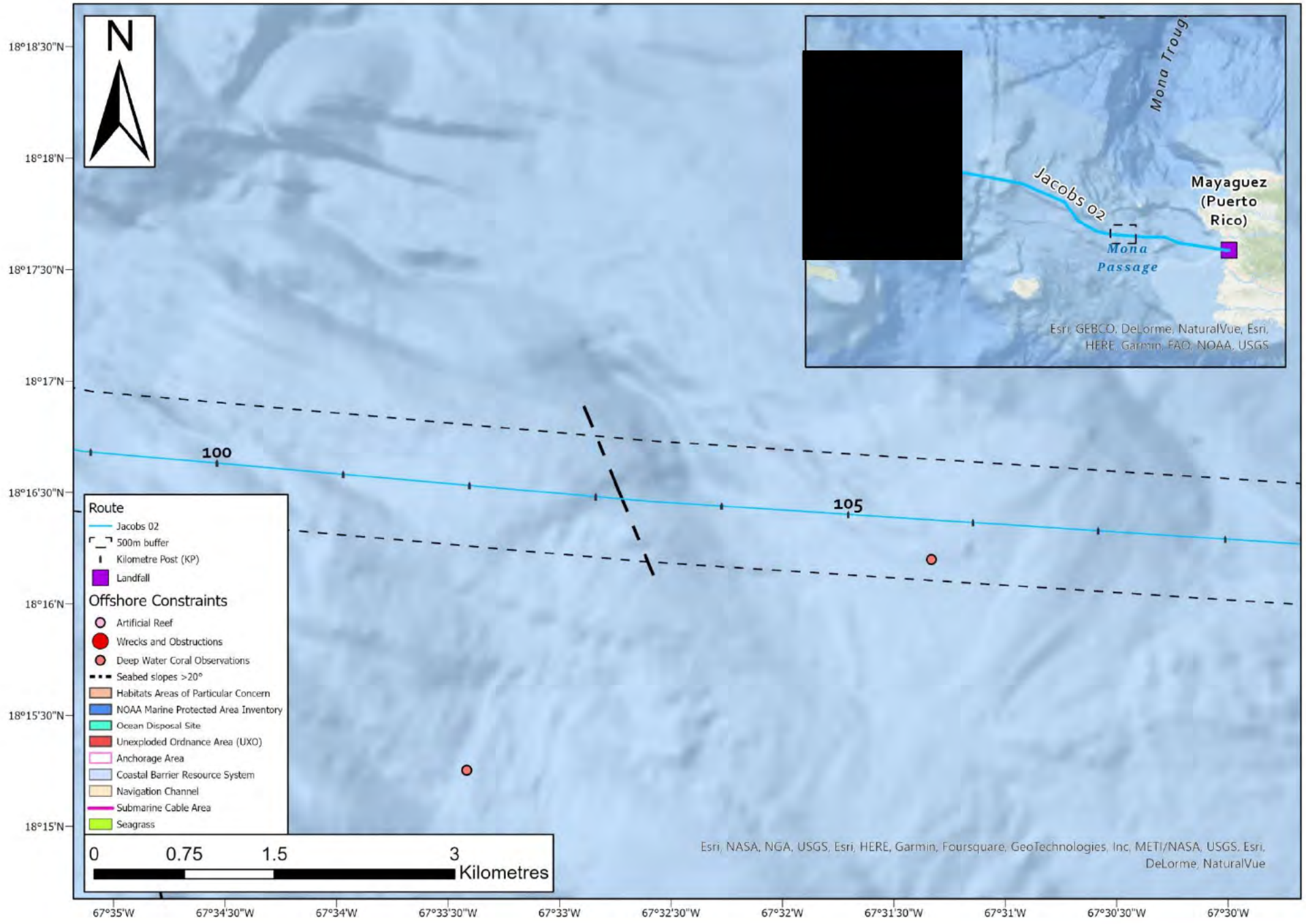
- The following slides illustrate where Jacobs Route 02 interfaces with offshore constraints
- Avoidance of all known constraints has been considered in determining the alternative Jacobs routes
- A 500m buffer is applied either side the centreline of the proposed cable route: the buffer is shown in the illustrations below in areas of close interaction with geophysical and environmental features of interest

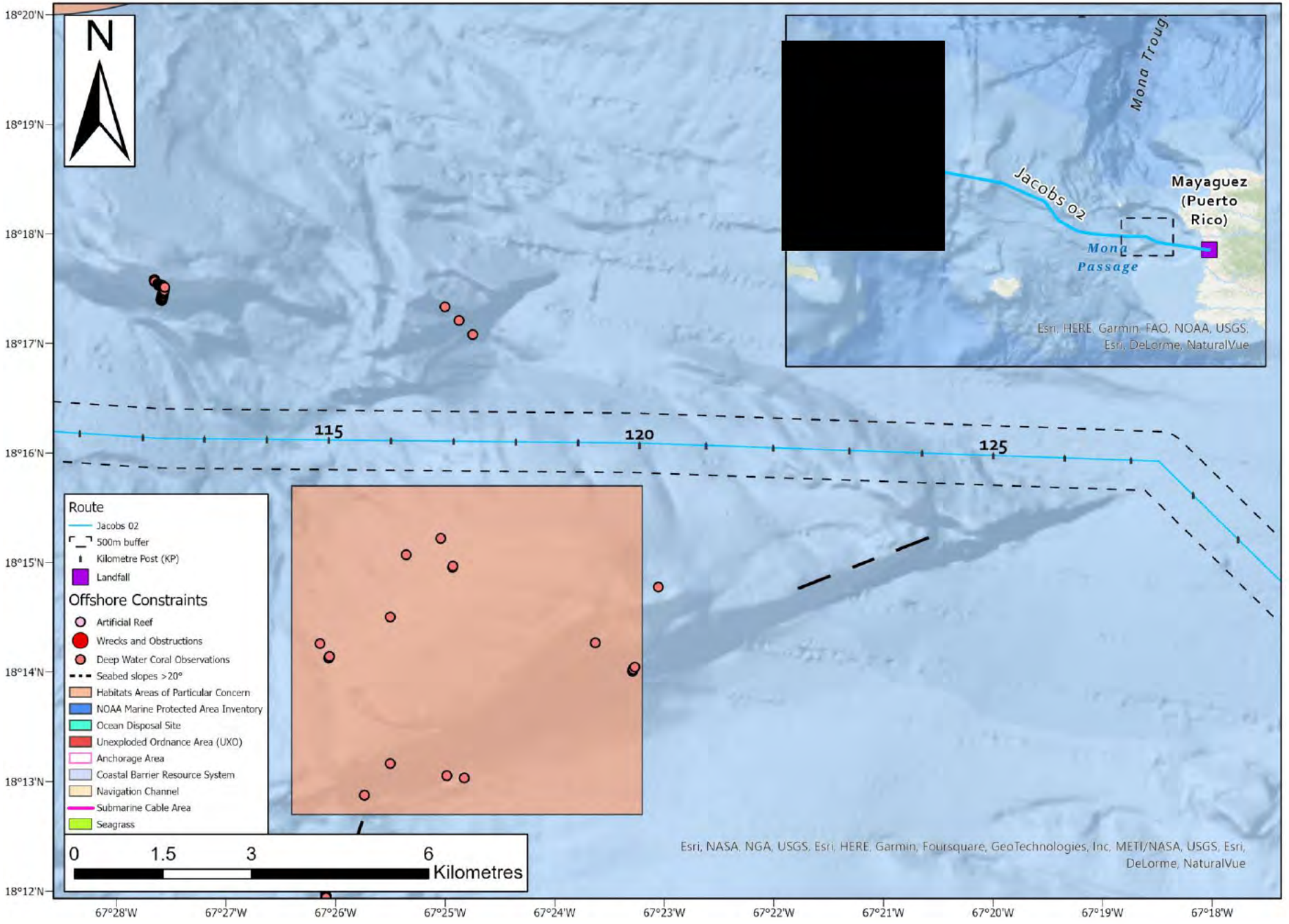

N
18°33'N
18°32'N
18°31'N
18°30'N
18°29'N
18°28'N
18°27'N
18°26'N
18°25'N
18°24'N
18°23'N
68°2'W
68°1'W
68°W
67°59'W
67°58'W
67°57'W
67°56'W
67°55'W
67°54'W
67°53'W
67°52'W
67°51'W
67°50'W
67°49'W
45
50
55
60
65
70
Jacobs Alternative Route
Jacobs 02
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0
2
4
8
Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri DeLorme, NaturalVue
Mona Troug
Jacobs 02
Mayaguez (Puerto Rico)
Mona Passage
Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, DeLorme, NaturalVue

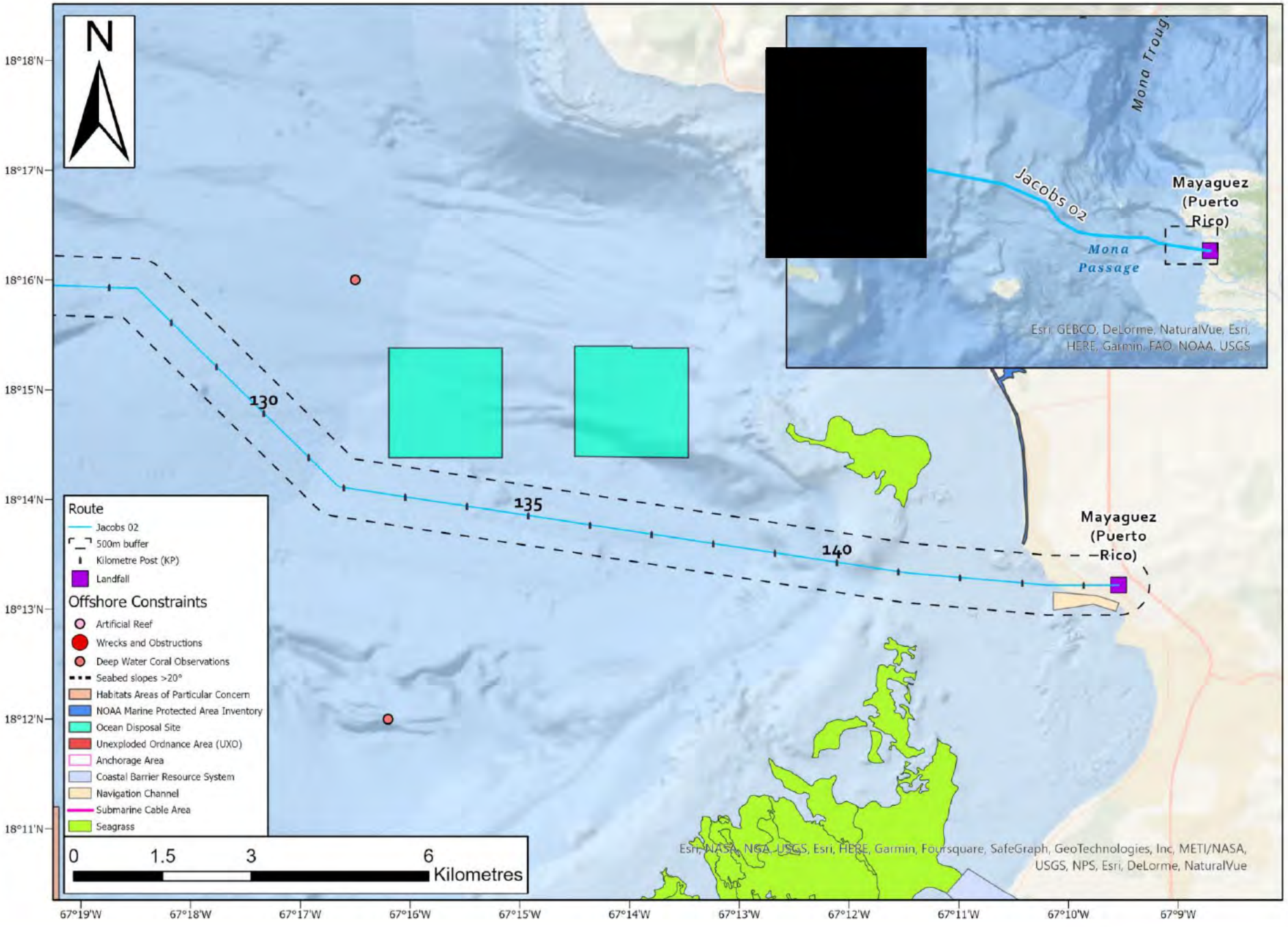

N
Jacobs Alternative Route
Jacobs 02
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 1.25 2.5 5 Kilometres
65
70
75
Jacobs 02
Mayaguez (Puerto Rico)
Mona Passage
Mona Troug
Esri, GEBCO, DeLorme, NaturalVue, Esri, HERE, Garmin, FAO, NOAA, USGS
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue
18°28'30"N
18°28'N
18°27'30"N
18°27'N
18°26'30"N
18°26'N
18°25'30"N
18°25'N
18°24'30"N
18°24'N
18°23'30"N
18°23'N
18°22'30"N
18°22'N
67°53'W
67°52'30"W
67°52'W
67°51'30"W
67°51'W
67°50'30"W
67°50'W
67°49'30"W
67°49'W
67°48'30"W
67°48'W
67°47'30"W
67°47'W
67°46'30"W
67°46'W
67°45'30"W
67°45'W
67°44'30"W


N
18°23'30"N
18°23'N
18°22'30"N
18°22'N
18°21'30"N
18°21'N
67°46'W
67°45'30"W
67°45'W
67°44'30"W
67°44'W
67°43'30"W
67°43'W
67°42'30"W
Mona Troug
Jacobs 02
Mayaguez (Puerto Rico)
Mona Passage
Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, DeLorme, NaturalVue
80
Jacobs Alternative Route
Jacobs 02
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 0.5 1 2 Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, US Census Bureau, Esri, DeLorme, NaturalVue


N
18°20'N
18°19'30"N
18°19'N
18°18'30"N
18°18'N
18°17'30"N
18°17'N
18°16'30"N
18°16'N
67°42'W
67°41'30"W
67°41'W
67°40'30"W
67°40'W
67°39'30"W
67°39'W
67°38'30"W
67°38'W
67°37'30"W
67°37'W
67°36'30"W
90
95
Mona Trough
Jacobs 02
Mayaguez (Puerto Rico)
Mona Passage
Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, DeLorme, NaturalVue
Jacobs Alternative Route
Jacobs 02
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0 0.8 1.6 3.2
Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue


N
18°18'30"N
18°18'N
18°17'30"N
18°17'N
18°16'30"N
18°16'N
18°15'30"N
18°15'N
67°35'W
67°34'30"W
67°34'W
67°33'30"W
67°33'W
67°32'30"W
67°32'W
67°31'30"W
67°31'W
67°30'30"W
67°30'W
100
105
Route
Jacobs 02
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0
0.75
1.5
3
Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue
Mona Trough
Jacobs 02
Mayaguez (Puerto Rico)
Mona Passage
Esri, GEBCO, DeLorme, NaturalVue, Esri, HERE, Garmin, FAO, NOAA, USGS


N
18°20'N
18°19'N
18°18'N
18°17'N
18°16'N
18°15'N
18°14'N
18°13'N
18°12'N
67°28'W
67°27'W
67°26'W
67°25'W
67°24'W
67°23'W
67°22'W
67°21'W
67°20'W
67°19'W
67°18'W
115
120
125
Mona Trough
Jacobs 02
Mayaguez (Puerto Rico)
Mona Passage
Esri, HERE, Garmin, FAO, NOAA, USGS, Esri, DeLorme, NaturalVue
Route
Jacobs 02
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0
1.5
3
6
Kilometres
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, GeoTechnologies, Inc, METI/NASA, USGS, Esri, DeLorme, NaturalVue


N
18°18'N
18°17'N
18°16'N
18°15'N
18°14'N
18°13'N
18°12'N
18°11'N
67°19'W
67°18'W
67°17'W
67°16'W
67°15'W
67°14'W
67°13'W
67°12'W
67°11'W
67°10'W
67°9'W
130
135
140
Jacobs 02
Mona Passage
Mona Troug
Mayaguez (Puerto Rico)
Mayaguez (Puerto Rico)
Esri, GEBCO, DeLorme, NaturalVue, Esri, HERE, Garmin, FAO, NOAA, USGS
Esri, NASA, NGA, USGS, Esri, HERE, Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NPS, Esri, DeLorme, NaturalVue
Route
Jacobs 02
500m buffer
Kilometre Post (KP)
Landfall
Offshore Constraints
Artificial Reef
Wrecks and Obstructions
Deep Water Coral Observations
Seabed slopes >20°
Habitats Areas of Particular Concern
NOAA Marine Protected Area Inventory
Ocean Disposal Site
Unexploded Ordnance Area (UXO)
Anchorage Area
Coastal Barrier Resource System
Navigation Channel
Submarine Cable Area
Seagrass
0
1.5
3
6
Kilometres

# Assessment of Route Options

| Analysis | | Route Corridors | | |
|---|---|---|---|---|
| | | CESI Route 02 S | Jacobs 01 | Jacobs 02 |
| | Route Length (km) | 141.26 | 147.73 | 145.52 |
| Water Depth analysis | Average Water Depth (m) | -430.19 | -256.49 | -263.59 |
| | Max Water Depth (m) | -930.34 | -478.09 | -556.54 |
| Crossings | Seabed slopes >20° | 9 | 7 | 7 |
| | Existing cables | 2 | 2 | 2 |
| | Disposal sites | 1 | 0 | 0 |
| | Essential Fish Habitat | 3 | 4 | 3 |
| | Navigation channels | 1 | 0 | 0 |
| | Habitats of Particular Concern | 0 | 0 | 0 |
| | Marine Protected Areas | 0 | 0 | 0 |
| | Seagrass | 1 | 0 | 0 |
| | UXO | 0 | 0 | 0 |
| | Soft ground | 41% | 65% | 52% |
| | Hard ground | 59% | 35% | 48% |
| | Anchorages | 0 | 0 | 0 |

# Section 4: Conclusions and References

# Conclusions

- As part of Jacobs' review and assessment, the CESI Route 02S is less favourable due to significantly greater average and maximum water depths and interfaces with significant constraints (red flags) e.g. restricted areas.
- Jacob's has identified two alternative routes which minimise maximum water depth and constraints. These routes will be less costly to survey and progress through SELECT and pre-FEED and ultimately provide the most favourable route crossings for the HVDC interconnector
- It is recommended that Jacobs_01 and Jacobs-02 are taken forward for reconnaissance geophysical and geotechnical survey for determination at SELECT.
- The Jacobs_01 route is slightly favoured as the water depth and constraints are minimised.

# References


- Bourkland, M. and S. Dorey. 1977. Current Meter Data Report for Mona Passage. Technical Note TN 3431-01-77. Naval Oceanographic Office. Washington D.C. April.
- Burns, D.A. and M. Car. 1975. Current Meter Data Report for the Caribbean Sea. Technical Note 6110-6-75, Naval Oceanographic Office. Washington D.C. August.
- Chaytor, J.D. and Ten Brink, U.S. 2010. Extension in mona passage, Northeast Caribbean. Tectonophysics, 493(1-2), pp.74-92.
- CESI. 2022. Pre-feasibility study of an HVDC interconnection between Puerto Rico and Dominican Republic – Preliminary line routing assessment
- Lopez-Venegas, A.M., Ten Brink, U.S. and Geist, E.L., 2008. Submarine landslide as the source for the October 11, 1918 Mona Passage tsunami: Observations and modeling. Marine Geology, 254(1-2), pp.35-46.
- Wust, G. 1964. Stratification and Circulation on the Antillean-Caribbean Basins. Columbia University Press. New York and London.

# Copyright notice

## Important

The material in this presentation has been prepared by Jacobs®.