CZM PERMIT APPLICATION
MAJOR LAND & WATER

AT&T OF THE VIRGIN ISLANDS INC

No. 1, 2, 3, 4, 5 & 6 Estate Peterborg
Northside, St. Thomas, VI 00801

MAGEN'S BAY, ST. THOMAS USVI
TRANS-CARIBBEAN FIBER SYSTEM
CABLE LANDING PROJECT

Submitted by:
TRANS AMERICAS FIBER US, LLC
175 Distant Island Dr.
Beaufort, South Carolina 29907

Trans Americas Fiber

December 20, 2023

EGS

7-SEAS-L

GSRC

CRUZAN MARITIME SERVICES, LLC

Tysam Tech, LLC

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1. INTRODUCTION

Magen's Bay, St. Thomas USVI Trans-Caribbean Fiber System Cable Landing Project

This project seeks to install an armored telecommunication fiber optics cable at Magen's Bay, St. Thomas USVI as part of a major Trans-Caribbean Fiber System venture to improve capacity and connectivity between the continental United States of America and the Caribbean. Of an approximate 4,393-kilometer cable system delineated across numerous segments, the primary branch of this cable system, spanning 2,166 kilometers, will connect between Vero Beach, FL and Butler Bay, St. Croix. The primary Florida-to-St. Croix, TCFS trunk segment will have five (5) branching unit (BU) segments, one of which will make landfall at Magen's Bay, St. Thomas, USVI. This branch will begin 93.5 kilometers from the St. Croix landing site, extend to the Magen's Bay landing site over a route that spans 23 kilometers. The cable will be surfaced laid and enter a landing manhole installed at the shoreline transition point at Magen's Bay and connect via existing underground conduit to the AT&T of the Virgin Islands distribution building located at No. 1, 2, 3, 4, 5 & 6 Estate Peterborg, Northside St. Thomas, VI 00801.

Cable design and type were developed in the planning stages based on engineering considerations identified during the route planning process. The landings were selected to optimize the approach to existing infrastructure, minimize interference with existing cables, and use existing infrastructure where available to install new cable, minimizing environmental impact and maximizing the protection and projected life of the cables.

An important component of the route planning process is the minimization of impacts to the marine environment within the Waters of the USVI, particularly coral reefs and other benthic habitat. Deepwater marine route segment surveys were conducted along the cable route to the approach and entry into the USVI Waters, in conjunction with concurrent benthic habitat surveys of the shallow and medium-depth waters from the edge of USVI Waters to shoreline transition points.

The submarine fiber optic cable is proposed to be laid on the seafloor coming from the west from deep water at a north/south cable intersection 0.75 nautical miles west of the USVI Waters territorial boundary. The cable runs east passing approximately one nautical mile north of Cricket Rock onward to a point approximately 0.7 nautical miles north of Outer Brass. From there, it continues east to a point roughly one nautical mile northeast of Outer Brass where it runs south-southeast into the shallow waters of Magen's Bay.

There are no existing bores at the proposed Magen's Bay landing site. The St. Thomas landing will require cable to be surface pinned and then ploughed to the land side of the Mean High Tide Line (MHTL). A manhole will be installed at the shoreline where it will be used to transition the cable to existing conduit buried in established easements. The proposed fiber optic cable will be winched through existing conduit running through a property easement to a manhole located on the subject property of AT&T of the Virgin Islands and connected to existing infrastructure at this location. The cable will be anchored and/or pinned to the seafloor.

Where new infrastructure is needed, disruption of the shoreline and shallow water seafloor will be minimized by using the seafloor features that effectively function as a natural corridor for the cable route (e.g. optimizing use of flat sea bed, avoiding slopes, side-slopes and hard bottom areas where possible) as well as employing minimally impacting installation methods.

Benthic surveys of this area were conducted November 18-20, 2022 to identify and quantify the

presence/absence of specific marine habitats, to include but not be limited to coral reef structures (both mesophotic and shallow-water), seagrasses, hardbottom, and fisheries habitat that may be impacted by the installation of the cable. Particular attention was paid to areas near land that may have connected or associated hard-bottom habitats that could support these deep reefs and the proposed route was videotaped using a drop camera, ROV and/or diver held camera.

Randomly selected sections on and near the proposed route were sampled with a drop camera to look for any possible significant benthic habitat. The benthic community was a uniform fine sand/silt for the entire route except for a short stretch of approximately 0.5km east of the north end of Outer Brass Island in 70-foot-deep water and approximately 0.08 km near the shore landing site within Magen's Bay.

In the ROV video footage from the same area an existing cable is plainly visible with no observed disturbance of benthic habitats as with other existing cables found elsewhere, some on the reef and some well off the bottom. No evidence of habitat degradation was observed. The reef documented at approximately 200' to 300' from shore is a mixed bottom with various habitats and benthic life, including hard corals of various species so attention will be paid as to not disturb this area during installation.

Based on the proposed route, no observable long-term impact of existing cable infrastructure on top of various types of seafloor, and the method of installation of the proposed cable, this project is anticipated to have minimal impact during temporary construction activities as well as long-term presence and operation, while providing a significant benefit to the island of St. Thomas.

APPLICATION FORMS

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES
DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DEVELOPMENT PERMIT APPLICATION

FORM L&WD-2
PERMIT APPLICATION

Date Received:_____ Trans Americas Fiber US, LLC, Julio Bran

Date Declared Complete:_____ Permit No._____

Application is hereby made for a Earth Change/Coastal Zone Permit

1. Name, mailing address and telephone number of applicant.
   Trans Americas Fiber US, LLC, Julio Bran
   2100 Ponce de Leon Blvd.,Ste 1172, Coral Gables, FL 33
   julio.bran@tafs-corp.com / 305-801-0783
   julio.bran@tafs-corp.com /

2. Name, title, mailing address and telephone number of owner of property and of developer.

Owner	Developer
AT&T OF THE VIRGIN ISLANDS INC, Jeff Chambers, President	Trans Americas Fiber US, LLC, Julio Bran
208 S Akard St., Dallas, TX 75202-4206	2100 Ponce de Leon Blvd., Suite 1172, Coral Gables, Florida 33134
jeffrey.chambers@att.com / 210-288-4298	julio.bran@tafs-corp.com / 305-801-0783

3. Location of activity. Plot No. 1, 2, 3, 4, 5 & 6

   Estate PETERBORG Island St. Thomas

4. Zoning District W-1, R-1

5. Name, mailing address and telephone number of project designer.
   Same as Developer

6. Name, mailing address and telephone number of principal earthwork contractor.
   B TECH CONTRACTING GROUP, LLC / 340-776-2484
   Northshore Rd Plot 36F, Estate La Grande Princesse, St. Croix, USVI

7. Summary of proposed activity. Include all incidental improvements such as utilities, roads, etc. (Use additional sheets if necessary).
   Installation of an armored telecommunication fiber cable to improve capacity and connectivity. Of an approximate 4,393-kilometer cable system over several segments, 23 kilometers will connect from main branch to Magen's Bay, St. Thomas. The cable will enter shoreline manhole after being surface laid, and connect to AT&T of the Virgin Islands distribution building by means of existing conduit.

7a. State type of Land Uses as specified in the VI Zoning Law, which are applied for e.g., restaurant, hotel, single dwelling, etc.
   Telecommunication cable and infrastructure install - Essential services

FORM L&WD-2/PERMIT APPLICATION
CONT'D

8. Date activity is proposed to start May 2024, be completed May 2025

9. Classification of minor or major permit. Check one:

☐ Minor Permit Application

☑ Major Permit Application

State below which criterion applies in making above check.
Does not meet 12 VIC §910(c) exceptions for minor permit status.

10. Application is hereby made for a permit to authorize the activities described herein. I agree to provide any additional information/data that may be necessary to provide reasonable assurance or evidence to show that the proposed project will comply with the applicable territorial water quality standard or other environmental protection standards both during construction and after the project is completed. I also agree to provide entry to the project site for inspectors from the environmental protection agencies for the purpose of making inspections regarding this application, and that to the best of my knowledge and belief the information provided herein, is true, complete and accurate. I further certify that I possess the authority to undertake the proposed activities.

Signature of Applicant or Agent

Date 12/27/23

Signature of Owner (Where Applicant or Agent is not Owner)

2-6-2024

FOR DEPARTMENT USE ONLY
Inspector Record

Date Inspected:_____

( )Permit Approved
( )Permit Disapproved

Inspector's Remarks:_____

_____

_____

_____ _____
Inspector Date

_____ _____
Commissioner, Planning & Natural Resources Date

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES
DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DEVELOPMENT PERMIT APPLICATION

FORM L&WD-3
ZONING REQUIREMENTS TABLE

The following table shall be completed by the applicant with entries as appropriate for the zoning district in which the activity is taking place. Not all the requirements will necessarily apply to a particular zone. Consult the Zoning Law. For your guidance also consult the zoning Requirement Matrix attached to the application forms, i.e., for a R-2 zone only items 1 through 11 will apply.

Applicants Name: Trans Americas Fiber US, LLC Signature: _____ Date: 12/27/23

Location of Activity-Plot No. 1, 2, 3, 4, 5 & 6 Estate PETERBORG Island St. Thomas

Zoning District: W-1, R-1

1. Proposed use (residential etc.) Telecommunications cable and infrastructure - Essential Services
2. Accessory use if any N/A
3. Number of on site parking spaces Existing 15 proposed 0
4. Area of lot, (sq. ft. or acreage) 3.9 acres
5. Area covered by proposed and existing buildings, (sq. ft.)
   87,700 sq. ft
6. Setback of building from street property line, (ft.)
   250 ft
7. Side yard setback ft) 0
8. Rear yard setback (ft) 65
9. Height of building (ft. or stories depending on zone) 2 stories
10. Proposed: 0
11. Lot width at street line (ft.) 765
12. Area of usable open space (sq. ft. and (%) of lot 134,208 sq ft. (79%)
13. Persons per acre ratio N/A
14. Floor area ratio N/A
15. Number of onsite parking and loading spaces 15
16. Building setback (yards 11, W-2 only) N/A

FOR DEPARTMENT USE ONLY

Inspector: _____ Date: _____ Permit No. _____

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES
DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DEVELOPMENT PERMIT APPLICATION

FORM L&WD-4
MAJOR PROJECT SUMMARY DATA

Section I. Applicant

1. Name, address and telephone number of applicant.
Trans Americas Fiber US, LLC, Julio Bran
2100 Ponce de Leon Blvd., Suite 1172, Coral Gables, Florida 33134
julio.bran@tafs-corp.com / 305-801-0783

2. Name, address and telephone number of owner of Property and of developer.
Developer - Trans Americas Fiber US, LLC, Julio Bran, 2100 Ponce de Leon Blvd., Suite 1172, Coral Gables, Florida 33134
julio.bran@tafs-corp.com / 305-801-0783
Owner - AT&T OF THE VIRGIN ISLANDS INC, 208 S Akard St., Dallas, TX 75202

Section II. Summary of Proposed Development

3. Describe the proposed development
Install an armored telecommunication fiber cable to improve capacity and connectivity.
The submarine fiber optic cable is proposed to be laid on the seafloor coming from the west in deep water
into shallow water at the Northside of St. Thomas. The cable route terminates underwater at northshore of Magen's Bay at proposed manhole.
Cable will be winched through an existing conduit previously installed by AT&T circa 1996.

Section III. Description of Proposed Development

4. Name of development Magen's Bay, St. Thomas USVI Trans-Caribbean Fiber System Cable Landing Project
5. Plot No. 1, 2, 3, 4, 5 & 6 PETERBORG
6. Zoning District: W-1, R-1
7. PWD Map No. 89-91-T63
8. Proposed use (residential, etc. as listed in Zoning Law):
Telecommunications cable and infrastructure - Essential Services
9. Accessory use if any N/A

FORM L&WD-4
MAJOR PROJECT SUMMARY DATA Cont'd

10. Area of Lot(s) (acreage) 3.9

11. Area covered by existing buildings (sq. ft.) 36,200 sq ft. (21%)

12. Area covered by proposed buildings (sq. t.) 0

13. Floor area total N/A

14. Floor area ratio (B-1, B-2 zones only) N/A

15. Number of buildings 3

16. Number of units total N/A

17. Schedule of units:

	Person		Persons
Efficiencies	N/A	x 1.5 Unit	N/A =
1 bedroom	N/A	x 2	N/A =
2 bedroom	N/A	x 3	N/A =
3 bedroom	N/A	x 4	N/A =
Other	N/A	x	N/A =
Total Persons	N/A		

18. Number of on site parking and loading spaces 15

19. Maximum building height (stories/ft) 2 stories

20. Adjoining property land use(s) Residential

21. Setback of building from street property line (ft) 75 ft

22. Sideyard setback (ft) 0

23. Rear yard setback (ft) 65

24. Density (person/acre) N/A

25. Area of usable open space (sq. ft. % of lot) 134,208 sq ft. (79%)

FORM L&WD-4
MAJOR PROJECT SUMMARY DATA Cont'd

Section IV. Comments

26. Proposed Potable Water Supply (method & quality estimate gal/day)
Cistern (Existing). 150 gallons per day

27. Proposed Sewage Treatment (method & quality estimate gal/day)
Septic System (Existing). 150 gallons per day

28. Proposed Solid Waste Disposal (method & quality estimate lbs/day)
Existing waste bins. 50 lbs/day

29. Proposed Electrical Supply (method & demand estimate KWH for single & 3 phase)
WAPA (Existing). No change to demand.

30. Air Conditioning (method & demand estimate (KWH)
Central Air Chiller (Existing). No change to demand.

31. Other Utilities N/A

32. Other

Section V.

33. Will the development extend onto or adjoin any beach tidelands, submerged lands or public trustlands?
Yes, fiber optics cable will be installed past MHTL, coming from main telecommunications branch from Florida.

34. Will the development maintain, enhance or conflict with public access to the shoreline and along the coast?
The development will not affect and will maintain public access to the shorliene and along the coast. The project itself will not inhibit nor promote recreational activities in the vicinity of the project.

35. Will the development protect or provide moderate income housing opportunities?
Will it displace moderate income housing?
No

36. How will the development affect traffic on the coastal access roads?
During the construction, a small number of additional vehicles will use the main road leading to the project site, Peterborg Rd N. After construction, no change to traffic is anticipated.

Signature of owner or authorized agent

2-6-2024
Date

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES DEPARTMENT OF PLANNING AND NATURAL RESOURCES DEVELOPMENT PERMIT APPLICATION

FORM L&WD-5
PROOF OF LEGAL INTEREST

AFFIDAVIT

I, AT&T OF THE VIRGIN ISLANDS INC & Trans Americas Fiber US, LLC being duly sworn depose and say that:
Applicant(s)* (or John Doe of Entity Applicant)

1. AT&T OF THE VIRGIN ISLANDS INC am/is the (check one)
(I or Entity/Applicant)

☒ Record title owner (fee simple) ☐ Lessee ☐ Other (specify) ☐

Of the real property described as Parcel No(s) 1, 2, 3, 4, 5 & 6

Estate PETERBORG Quarter Northside Island St. Thomas

***Applicant(s) is required to provide documentation for legal interest stated above (e.g. deed, lease, etc.)**

2. I have the irrevocable approvals, permission, or power of attorney from all other persons with a legal interest in the property to undertake the work proposed in the permit application as more fully set forth in the exhibit (s) attached hereto:

Jeffrey Chambers 2-6-2024
Signature Date

Signature Date

Jeffrey Chambers
Print

Print

The foregoing instrument was acknowledged before me this 6th day of February
20 24 by Jeffrey Chambers at _____ county
(Name or Name/Title of Entity)

of Bexar.

Veronica Garza
Notary Public

May 8, 2027
My Commission expires

VERONICA GARZA
Notary ID #11454507
My Commission Expires
May 8, 2027

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES
DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DEVELOPMENT PERMIT APPLICATION

PUBLIC NOTICE
(SUPPLEMENT TO FORM L&WD-6)

Pursuant to Act 5270, as approved by the Governor of the Virgin Islands on July 30, 1987, amending Section 910 (a) (2) and 911 (d) (2) of the Coastal Zone Management Act (Title 12, VI Code, Chapter 21), all applicants for Coastal Zone Management permits are required to present "certification from Bureau of Internal Revenue and Department of Finance" indicating "that the applicant has filed and paid all taxes, penalties and interest, and from the Office of the Lieutenant Governor that the applicants has filled its required annual report or has satisfactorily made agreement to pay the taxes or fill the required reports "12 VIC 910 (a) (2) (C), and " (2) A coastal zone permit that includes an occupancy or development lease shall only be granted for a particular parcel of filled land for a lease period of not more than 20 years; provided that nothing in this subsection shall prohibit a lessee or permittee from executing a new lease at the end of the 20 year period. Any lease executed at the end of the lease period shall meet the requirements of this Chapter and shall be approved by the Governor and ratified by the Legislature, or in the event the Legislature is not in session, by the Committee on Planning and Environmental Protection.

For applicants not required by law to submit an annual report or to satisfactorily make an agreement to pay taxes or file the required reports, a letter from the Bureau of Internal Revenue, and/or the Department of Finance, and/or the Lieutenant Governor's office so indicating will be required to continue further processing of the application.

Accordingly, all Coastal Zone Management permit applications (both minor and major), which are not accompanied by the certificates, as required by Act 5290, or written notification from said agencies indicating waiver or exemption of these requirements will not be accepted by the permitting office, It is the responsibility of each applicant to demonstrate compliance with the provisions of this Act.

GOVERNMENT OF
THE VIRGIN ISLANDS OF THE UNITED STATES
-0-
VIRGIN ISLANDS BUREAU OF INTERNAL REVENUE

(DPNR FORM L&WD-6)
APPLICATION FOR TAX FILING AND PAYMENT STATUS REPORT**

Date:_____

The applicant identified below hereby requests a letter certifying his or her tax filing and payment status for the purpose of receiving a Coastal Zone Management Permit from the Virgin Islands Department of Planning and Natural Resources pursuant to Act 5270, amending Sections 910 (a)(2) and 911 (d)(2) of the Coastal Zone Management Act (Title 12, Chapter 21, Virgin Islands Code). The applicant authorizes the Bureau of Internal Revenue to disclose any taxpayer information necessary to process this application to the Virgin Islands Department of Planning and Natural Resources, who may make such further disclosures as are necessary to carry out the requirements of the Coastal Zone Management Act, as amended.

Name: AT&T OF THE VIRGIN ISLANDS INC

Business Name: AT&T OF THE VIRGIN ISLANDS INC

EIN/TIN: 134924710

SSN:_____

Please Indicate:

- [x] *Corporation
- [ ] *Partnership
- [ ] Individual
- [ ] Other

Type of Business: Telecommunications

Please circle forms that you use: 1120, 1120s, 1065, 1040, 941 VI, 722 VI, 720, 720 VI, 720 BVI, 50VI, other (list)

Date Business Started:_____

Person Representing Applicant: Jeffrey Chambers Position: President

Signature:_____

Mailing Address: 208 S. Akard, Rm 1832

Date: 2-6-2024 Telephone Number: 210-288-4298

Reply to: #1A Lockharts Garden, St. Thomas VI 00802 **or** 4008 Estate Diamond, St. Croix VI 00820

* Partnerships and/or Corporations must list partners/ corporate officers, social security numbers and addresses on a seperate sheet and attach it to this application.

GOVERNMENT OF THE VIRGIN ISLANDS OF THE UNITED STATES
DEPARTMENT OF PLANNING AND NATURAL RESOURCES
DEVELOPMENT PERMIT APPLICATION

FORM L&WD-7
CORPORATION/ASSOCIATION APPLICATION
(To be used when a corporation or association is making a Permit Application in Tier l)

AT&T OF THE VIRGIN ISLANDS INC
(Corporation or Association Name)

By: _____
(Signature)
President or Vice-President or equivalent

President
Title/Position (Print)

Jeff Chambers
Print

WITNESS: _____

ATTEST: _____
Secretary (or equivalent) Signature

Secretary (or equivalent) Print

Seal

On this 6th day of February, 2024. before me the undersigned officer, personally appeared _____ Jeff Chambers who acknowledges himself to be the President of AT&T of Virgin Islands; that he executed the foregoing instrument in the capacity above and has the authority to execute this application on behalf of the company.

IN WITNESS WHEREOF, I have hereunto set my hand and official seal the day and year above written.

VERONICA GARZA
Notary ID #11454507
My Commission Expires
May 8, 2027

Veronica Garza

~~Include Supporting Documents:~~

1. Compliance with Act No. 5270 by providing:
   (a) Tax clearance letter from the Bureau of Internal Revenue
   (b) Property tax clearance letter from the Lieutenant Governor's Office.
   (c) Corporations and Associations: Certificate of Good Standing or equivalent, organizational documents & Amendments (Articles, Bylaws, Operating Agreement, Declarations)
   (d) Corporate Resolution (or equivalent) authorizing action on behalf of the company.

(Form L&WD-8) 1:08:96

Flood Plain Determination and Permit Application

To be completed by all applicants

1. Owner: AT&T OF THE VIRGIN ISLANDS INC
   Mailing Address 208 S Akard St., Dallas, TX 75202-4206
   Home Tel. #: N/A Business Tel. #: 210-288-4298 Cellular #: N/A

2. Designer: Trans Americas Fiber (TAF) U.S., LLC.
   Lic. #: ______ Tel. #: 305-801-0783 Cellular #: 305-801-0783

3. Plot #: 1, 2, 3, 4, 5 & 6 Estate: PETERBORG Quarter: Northside
   Flood Zone Designation: Zone VE

If your flood zone designation is Zone A, AE, AO, A1-30, A99, V, VO, Ve or V1-V30 as shown on the NFIP FIRM Map, then complete this section.

*************************************. NFIP Flood Zone Designation *********************************

1. Type of development:

   1 or 2 Family dwelling ( ) Mobile Home ( ) Non-Structural ( )

   3 Family or more, Apartment or Condo Structure ( ) Non- Residential Structure: (●)

   Commercial Structure ( ) New Construction ( ) Non-Structural ( )

   Addition to Structure (X) 50% Substantial Improvement of Existing Structure ( )

   Description of Activity Installation of an armored telecommunication fiber cable to improve capacity and connectivity in Magen's Bay, St. Thomas. The cable will enter shoreline manhole after being surface laid, and connect to AT&T of the Virgin Islands distribution building by means of existing conduit.

2. Base Flood Elevation at the Development Site is 15 ft. above mean sea level (msl).

3. Elevation of the First Floor, Basement or Flood proof level for proposed structure is 280 ft.

4. Describe the Non-Structural Activity i.e. septic tank, waste water treatment plants etc. (including the location and development): Installation of telecommunications cable through proposed shoreline manhole and through existing conduit to building structure for installation.

5. Attach a certified copy of site plan (8.5" x 11") showing Base Flood Elevation . See sample attached.

FOR OFFICE USE ONLY

Is the property located in an identified Flood Hazard Area? ( ) YES ( ) NO

NFIP Zone Designation: ________ Forward to Flood Plain Manager : ( ) YES ( ) NO

Application : APPROVED ( ) DENIED ( ) RESUBMIT ( )

Plan Reviewer Name: ______________________

Signature: ______________________ **Date:** ________

SUPPORTING DOCUMENTS

THE UNITED STATES VIRGIN ISLANDS
OFFICE OF THE LIEUTENANT GOVERNOR
OFFICE OF THE TAX ASSESSOR

TRENGENZA A. ROACH,ESQ.
LIEUTENANT GOVERNOR

COMMISSIONER OF INSURANCE
CHAIRMAN, V.I. BANKING BOARD

150' RADIUS FOR PARCEL NO. 1,2,3,4,5&6

DATE 5/23/2022

TAX NUMBER: 1-01301012600
ADDRESS: 1,2,3,4,5&6 PETERBORG

Property ID	Legal Description	Owner	Address	City	State	Zip Code	
101301010500	PETERSBORG 10-2-10 GT. NORTHSIDE	CLIFF HANGER LLC	1365 Turtle Creek Ln	Oakland	Michigan	48363	
101301010700	PETERBORG 10-2-9 GREAT NORTHSIDE QTR	BLAIR JAMES LAMPERT	6501 Red Hook Plz	St Thomas	U.S.Virgin Islands	8021373	
101301010900	10-2-8 PETERBORG GREAT NORTHSIDE QUARTER	CASAGRANDE, DIRK R	40 MASSACHUSETTS AVENUE	ARLINGTON	Massachusetts	2474	
101301011100	PETERBORG 10-2-7 GR NORTHSIDE	THE LOUIS R & GLORIA S GREWAY REVOCABLE TRUST	5386 Dunraven Cir	Golden	Colorado	80403	
101301012300	PETERBORG 10-2-5 GREAT NORTHSIDE QTR	ROSENBERG, MARK & JAYNE	PO Box 192830	San Juan	Puerto Rico	00919	
101301012400	PETERBORG 10-2-4 No.12 GREAT NORTHSIDE QTR.	L. L. HOLDING, LLC	P O BOX 4998	ST THOMAS	U.S.Virgin Islands	00801	
101301012500	PETERBORG 10-2-6 GT.NORTHSIDE QTR.	Mark and Jayne Carol Rosenberg Revocable Trust	11 Shad Rd W	Pound Ridge	New York	10576	
101301012800	10-2-3 ESTATE PETERBORG GR NORTHSIDE QTR	ADOLPHUS, ELENA and RENEL SMITH	PO BOX 303948	St Thomas	U.S.Virgin Islands	00803	
101301013100	PETERBORG 10-2-19 No.12 GREAT NORTHSIDE QTR.	PLAYA VISTA PROPERTIES LLC	8168 Crown Bay Marina	St Thomas	U.S.Virgin Islands	00802	
101301015200	10-3-6 PETERBORG GREAT NORTHSIDE QUARTER	WOOTTON COTTAGE TRUST	2067 Annette CRT	BURLINGTON	Ontario	L7M 3W1	
101301015400	PETERBORG 10-3-8 GT. NORTHSIDE	CLIFFSIDE BUILDERS LLC	6501 Red Hook Plz	St Thomas	U.S.Virgin Islands	00802	
101301017700	PETERBORG 10-3-9 GT. NORTHSIDE	SBA TOWERS USVI INC	8051 Congress Ave	Boca Raton	Florida	33487	
101301017800	PETERBORG 10-20&10-A-24 GT. NORTHSIDE	C. V. FERREYRA LLC	PO BOX 304993	St Thomas	U.S.Virgin Islands	00803	
101301018000	PETERBORG 10-22 GT. NORTHSIDE	HICKSTED, PATRICIA M. & RICHARD L., TRUSTEES	18124 Wedge Pkwy	Reno	Nevada	89511	
101301019900	PETERBORG 10-3-5 GREAT NORTHSIDE QTR.	WOOTTON, KENNETH (Trustee)	5100 South Service Rd	BURLINGTON	Ontario	L7L 6A5	
101301021200	PETERBORG 7-6&10-21 GT. NORTHSIDE	FRANK A & JULIA R ODLUM LIV TR	PO Box 12138	St Thomas	U.S.Virgin Islands	00801	
101301021400	PETERBORG 10-19,10A-23&7-5 GT. NORTHSIDE	ST.JOSEPH,LLC	180 W Main St	Clinton	Connecticut	6413	
101303010300	PETERBORG 10-2-20 GT. NORTHSIDE	SMITH, DAVON and VANIQUA GUMBS-SMITH	PO Box 303623	St Thomas	U.S.Virgin Islands	00803	
101303010400	PETERBORG 10-2-18 GREAT NORTHSIDE QTR	ANDERSON, SHAWNA	1620 N Ocean Blvd	Pompano Beach	Florida	33062	
101303010500	10-2-17 PETERBORG NO 12 GREAT NORTHSIDE QTR	BATT, CARL	117 Devlin Rd	Groton	New York	13073	

WAYNE D. CALLWOOD TERRITORIAL PUBLIC SURVEYOR

NUMBER 1105 KING STREET, CHRISTIANSTED • ST. CROIX, VIRGIN ISLANDS 00820
CHRISTIANSTED - TEL 340.773.6459 • FAX 340.773.4052 • FREDERIKSTED - TEL 340.772.3115 • FAX 340. 772.9325
NO. 5049 KONGENS GADE • ST. THOMAS, VIRGIN ISLANDS 00802 • TEL 340.776.8505 • FAX 340.776.4612

ENVIRONMENTAL ASSESSMENT REPORT

MAJOR WATER PERMIT APPLICATION

Environmental Assessment Report

Applicant: Trans Americas Fiber (TAF) U.S., LLC.
Project: Magen's Bay, St. Thomas USVI Trans-Caribbean Fiber System Cable Landing Project

December 2023

Prepared by: Tysam Tech, LLC

Tysam Tech, LLC

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1.00 NAME AND ADDRESS OF APPLICANT 4

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1.00 NAME AND ADDRESS OF APPLICANT

Trans Americas Fiber (TAF) U.S., LLC.

Mailing Address:

2100 Ponce de Leon Blvd., Suite 1172
Coral Gables, Florida 33134

Physical Address:

2100 Ponce de Leon Blvd., Suite 1172
Coral Gables, Florida 33134

2.00 LOCATION OF PROJECT

The project is located at the following physical address:

Magen's Bay Cable Station
No. 1, 2, 3, 4, 5 & 6 Estate Peterborg, Northside
St. Thomas, VI 00801

The Landing Site Permitting for the Trans-Caribbean Fiber System, Magen's Bay, St. Thomas project is located in northern St. Thomas, on the north coast of Magen's Bay. The landing site is positioned 18°22'19.7"N 64°55'42.5"W, while the cable station is located at 18°22'26.0"N 64°55'40.4"W. Sections 2.01 and 2.02 include Location and Agency Review Maps and Vicinity Maps, respectively.

2.01 Location and Agency Review Map

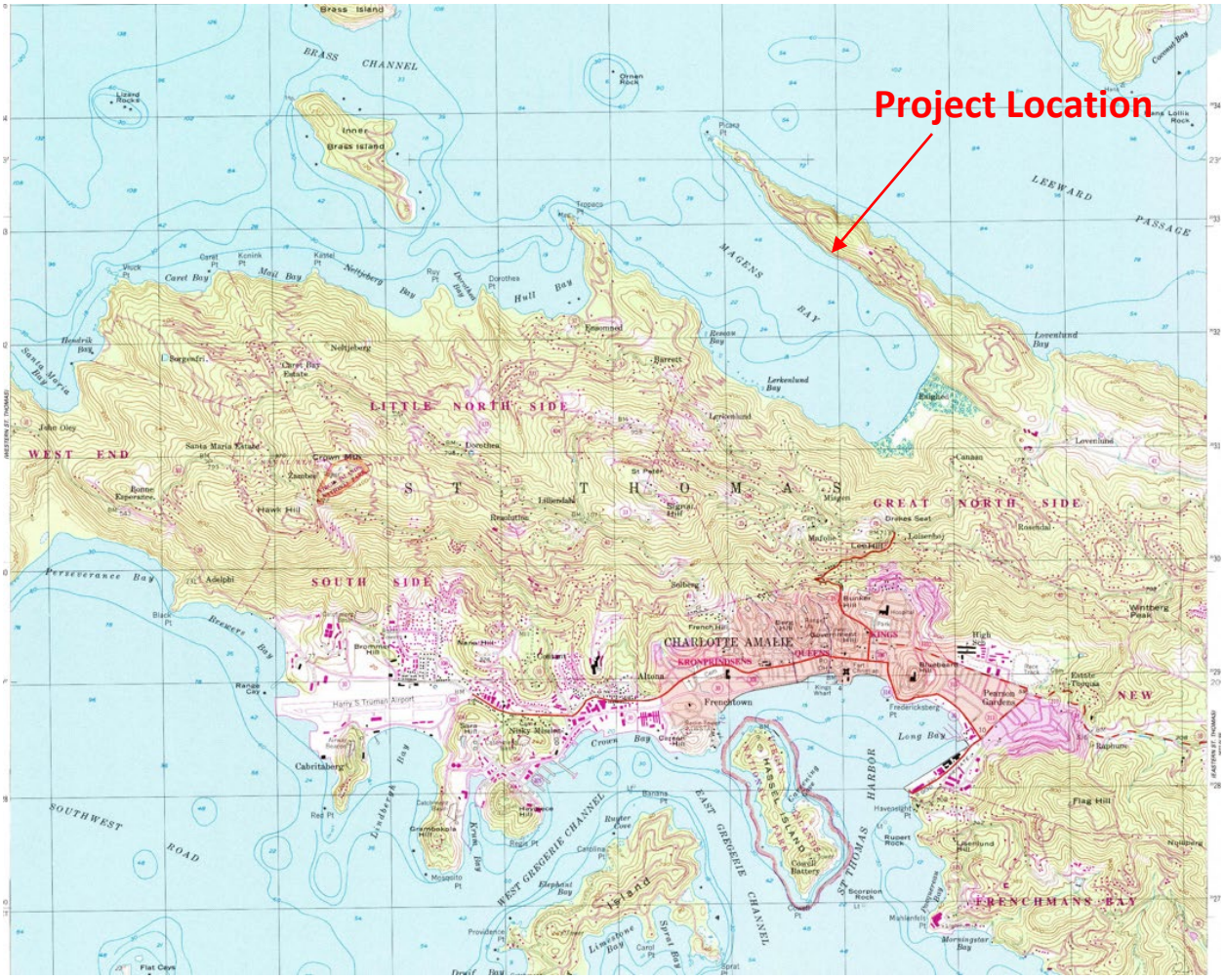


Figure 2.01.1 – Location and Agency Review Map (USGS Quadrangle Map, Central St. Thomas, VI, 1955, 1987 ed.)

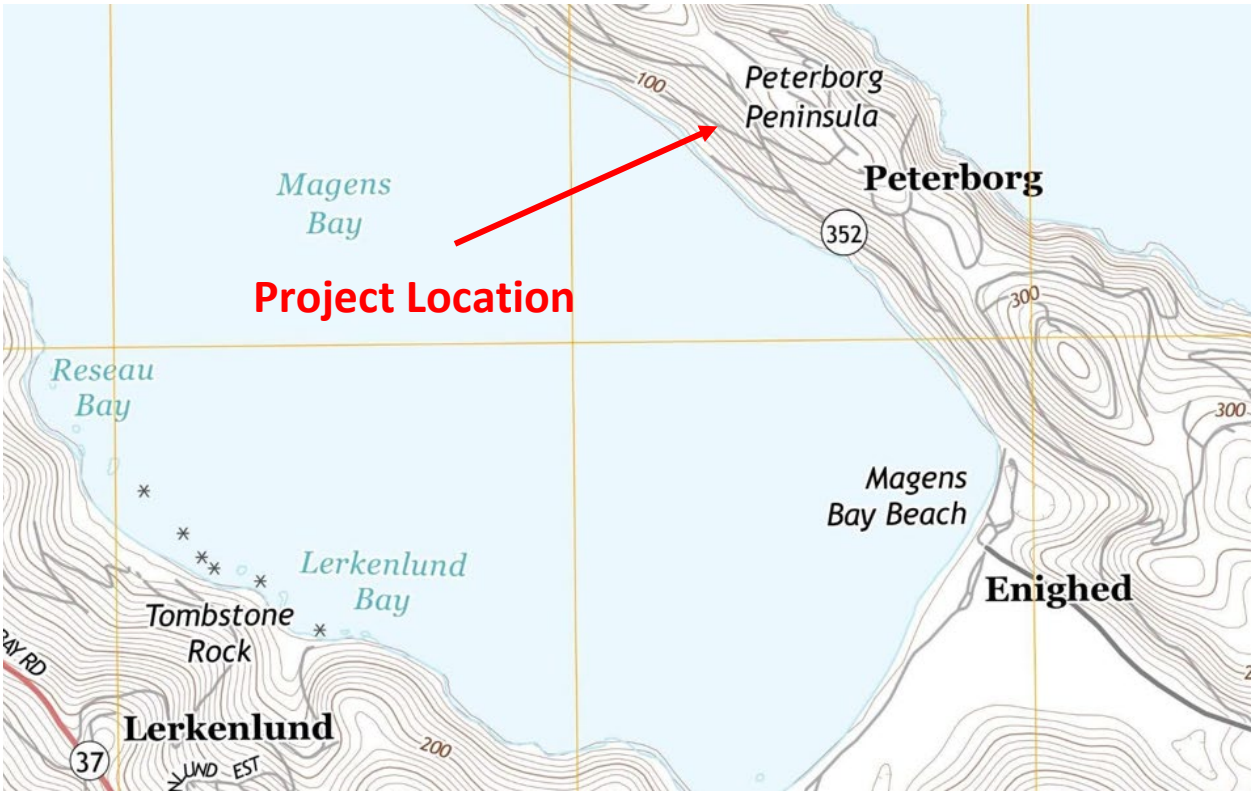


Figure 2.01.2 – Location and Agency Review Map (USGS Quadrangle Map, Charlotte Amalie, VI, 2013)

2.02 Vicinity Map

Figure 2.02.1 – Vicinity Map (Google Earth, 2023)

Figure 2.02.2 – Vicinity Map (MapGeo, Aerial 2020)

3.00 ABSTRACT

This project seeks to install an armored telecommunication fiber optics cable at Magen's Bay, St. Thomas USVI as part of a major Trans-Caribbean Fiber System venture to improve capacity and connectivity between the continental United States of America and the Caribbean. Of an approximate 4,393-kilometer cable system delineated across numerous segments, the primary branch of this cable system, spanning 2,166 kilometers, will connect between Vero Beach, FL and Butler Bay, St. Croix. The primary Florida-to-St. Croix, TCFS trunk segment will have five (5) branching unit (BU) segments, one of which will make landfall at Magen's Bay, St. Thomas, USVI. This branch will begin 93.5 kilometers from the St. Croix landing site, extend to the Magen's Bay landing site over a route that spans 23 kilometers. The cable will be surfaced laid and enter a landing manhole installed at the shoreline transition point at Magen's Bay and connect via existing underground conduit to the AT&T of the Virgin Islands distribution building located at No. 1, 2, 3, 4, 5 & 6 Estate Peterborg, Northside St. Thomas, VI 00801.

Cable design and type were developed in the planning stages based on engineering considerations identified during the route planning process. The landings were selected to optimize the approach to existing infrastructure, minimize interference with existing cables, and use existing infrastructure where available to install new cable, minimizing environmental impact and maximizing the protection and projected life of the cables.

An important component of the route planning process is the minimization of impacts to the marine environment within the Waters of the USVI, particularly coral reefs and other benthic habitat. Deepwater marine route segment surveys were conducted along the cable route to the approach and entry into the USVI Waters, in conjunction with concurrent benthic habitat surveys of the shallow and medium-depth waters from the edge of USVI Waters to shoreline transition points.

The submarine fiber optic cable is proposed to be laid on the seafloor coming from the west from deep water at a north/south cable intersection 0.75 nautical miles west of the USVI Waters territorial boundary. The cable runs east passing approximately one nautical mile north of Cricket Rock onward to a point approximately 0.7 nautical miles north of Outer Brass. From there, it continues east to a point roughly one nautical mile northeast of Outer Brass where it runs south-southeast into the shallow waters of Magen's Bay.

There are no existing bores at the proposed Magen's Bay landing site. The St. Thomas landing will require cable to be surface pinned and then ploughed to the land side of the Mean High Tide Line (MHTL). A manhole will be installed at the shoreline where it will be used to transition the cable to existing conduit buried in established easements. The proposed fiber optic cable will be winched through existing conduit running through a property easement to a manhole located on the subject property of AT&T of the Virgin Islands and connected to existing infrastructure at this location. The cable will be anchored and/or pinned to the seafloor.

Where new infrastructure is needed, disruption of the shoreline and shallow water seafloor will be minimized by using the seafloor features that effectively function as a natural corridor for the cable route (e.g. optimizing use of flat seabed, avoiding slopes, side-slopes and hard bottom areas where possible) as well as employing minimally impacting installation methods.

Benthic surveys of this area were conducted November 18-20, 2022 as well as November 6, 2023 to identify and quantify the presence/absence of specific marine habitats, to include but not be limited to coral reef structures (both mesophotic and shallow-water), seagrasses, hardbottom, and fisheries habitat that may be impacted by the installation of the cable. Particular attention was paid to areas near land that may have connected or associated hard-bottom habitats that could support these deep reefs and the proposed route was videotaped using a drop camera, ROV and/or diver held camera.

Randomly selected sections on and near the proposed route were sampled with a drop camera to look for any possible significant benthic habitat. The benthic community was a uniform fine sand/silt for the entire route except for a short stretch of approximately 0.5km east of the north end of Outer Brass Island in 70-foot-deep water and approximately 0.08 km near the shore landing site within Magen's Bay.

In the ROV video footage from the same area an existing cable is plainly visible with no observed disturbance of benthic habitats as with other existing cables found elsewhere, some on the reef and some well off the bottom. No evidence of habitat degradation was observed. The reef documented at approximately 200' to 300' from shore is a mixed bottom with various habitats and benthic life, including hard corals of various species so attention will be paid as to not disturb this area during installation.

Based on the proposed route, no observable long-term impact of existing cable infrastructure on top of various types of seafloor, and the method of installation of the proposed cable, this project is anticipated to have minimal impact during temporary construction activities as well as long-term presence and operation, while providing a significant benefit to the island of St. Thomas.

Anticipated start date of this project is May 2024.

Project Assurances

- Employees' and the public's health and safety are protected with the best available systems and technologies.
- Environmental impact is considered at all times.
- No significant negative impact to environment.
- Air quality is protected.
- Stormwater quality is protected.
- Nearshore water quality is protected.

4.00 STATEMENT OF OBJECTIVES SOUGHT BY THE PROPOSED PROJECT

The objectives of this proposed project are to improve connectivity, reliability, and accessibility of telecommunications and network services in St. Thomas, USVI. The cable route and design were developed in the planning stages based on engineering considerations identified during the route planning process. Landings were selected to optimize the approach to existing infrastructure, to minimize interference with existing cables, and use existing infrastructure where available to install the new cable, thereby minimizing environmental impact.

5.00 DESCRIPTION OF PROJECT

5.01 Summary of Proposed Activity/Proposed Dates of Construction

a. Purpose of Project

The purpose of the project is to increase telecommunication strength, reliability, bandwidth and help minimize the risk of communications disruption by providing cable route diversity and alternative bandwidth access to existing cables in the Atlantic-Caribbean region.

b. Presence and Location of any Critical Area(s) and Possible Trouble Spots

The terrestrial portion of the project is in the narrow portion of land to the north of Magen's Bay, in Estate Peterborg. This is a residential area designated R-1 (Low Density) and has approximately 50-65% development of lots. The entire area has thick vegetation separating the properties, with the majority of vegetation being brush, with minimal grassy areas. An existing AT&T distribution building on the property houses all the necessary infrastructure to connect the proposed cable to active network systems on the island.

Slope is between 20 and 60 percent with elevation varying from 280 feet above sea level at the building manholes to the landing site at sea level. Existing conduit in the easement running from the building down to the proposed landing site will be used to route the new cable from the shoreline. A manhole connection terminal will be installed at the shoreline, in order to anchor the endpoint of the submarine cable as it is routed below ground up past the MHTL.

Magen's Bay and its surrounding area have been classified as particularly sensitive relating to marine resources and habitats, having been classified as an Area of Particular Concern (APC) as well as a Marine Protected Area (MPA) since 1993 and in subsequent evaluations as recently as the 2020-2025 United States Virgin Islands' Coral Reef Management Priorities, having been ranked within the top 10 areas most suitable for protection and management intervention for its coral reefs.

Magen's Bay has also been previously classified as an Area of Particular Concern (APC) due to it being listed on NOAA's National Marine Protected Areas. The Magen's Bay APC is located on the north central side of the island of St. Thomas. This APC is bound by Tropaco Point in the west, the entire Peterborg peninsula in the east, and has a seaward boundary that extends directly north to the shelf edge or three-nautical mile territorial limit (whichever is closer). Valuable resources within this area include primary archaeological sites, several types of forest, fish nursery habitats, and 8 endangered species (U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center).

The Environmental Sensitivity Index (ESI) Map indicates presence of fish, octopus, gastropods (i.e., conch), lobster, dolphin and whale in nearshore as well as shelf waters closer to Outer Brass Island and the proposed cable route. Of the whale species, the humpback whale is considered federally endangered and breeding grounds are indicated to be near these waters around the months of November to May. The map also indicates that the inner Magen's Bay beach to be an area for turtle nesting, particularly in January and December, and a breeding ground for a variety of marine and terrestrial species including crab, waterfowl, wading birds, seabirds, and shorebirds. Of the bird species, three are considered endangered: the Caribbean Coot (*Fulica caribaea*), ruddy duck (*Oxyura jamaicensis*), and white-cheeked pintail (*Anas bahamensis*) all of which breeds and nests year-round. In addition, two plant species considered endangered: the *Manilkara bidentata* and the *Tillandsia lineatispica,* were noted on the ESI near the vicinity of the project area.

A review of Endangered Species in the area, using the U.S. Fish & Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) Tool, indicates there are three endangered species within the proposed project area and four that are considered threatened. The two federal endangered sea turtle species that are known to swim in the offshore waters are the Hawksbill Sea Turtle (*Eretmochelys imbricata*) and Leatherback Sea Turtle (*Dermochelys coriacea*) along with the threatened species Green Sea Turtle (*Chelonia mydas*), Loggerhead Sea Turtle (*Caretta caretta*), and the Olive Ridley Sea Turtle (*Lepidochelys olivacea*). The Virgin Islands Tree Boa (*Chilabothrus granti*) is also an endangered species of reptile in the area. In addition, the West Indian Manatee (*Trichechus manatus*) has also been found in the offshore waters and are a threatened species.

Benthic surveys of the proposed cable route were conducted November 18-20, 2022 to identify and quantify the presence/absence of marine habitats, to include but not be limited to coral reef structures (both mesophotic and shallow-water), seagrasses, hardbottom, and fisheries habitat that may be impacted by the installation of the cable. Particular attention was paid to areas near land that may have connected or associated hard-bottom habitats that could support these deep reefs.

The benthic community was a uniform fine sand/silt for the entire route except for a short stretch of approximately 0.5km east of the north end of Outer Brass Island in 70-foot-deep water and approximately 0.08 km near the shore landing site within Magen's Bay. Those sections are noted in the attached Overview Map of the proposed cable route.

In the 70-foot-deep reef discovered, an existing cable is plainly visible with no observed disturbance of benthic habitats as with other existing cables found elsewhere, some on the reef and some well off the bottom. No evidence of habitat degradation was observed anywhere near existing cables. The reef documented at approximately 200' to 300' from shore is a mixed bottom with various habitats and benthic life, including hard corals of various species so attention must be paid as to not disturb this area during installation.

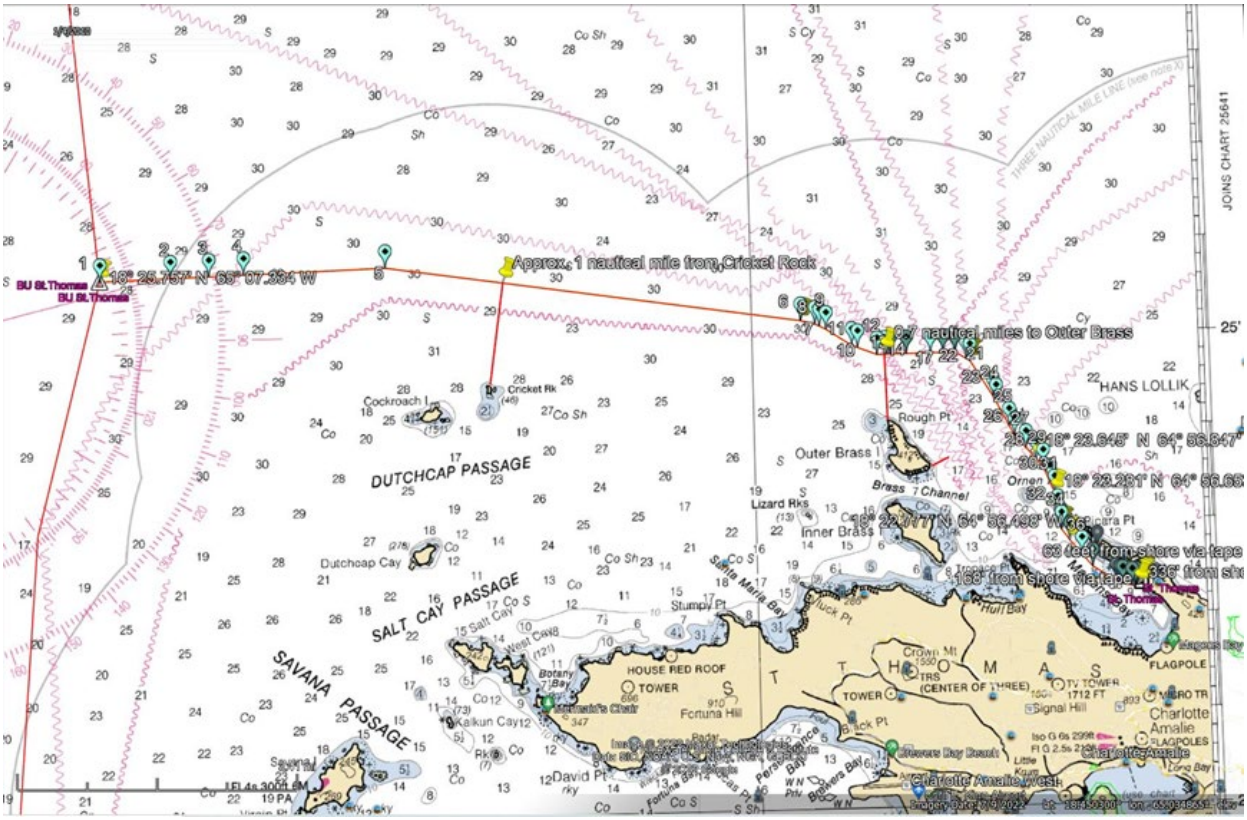


Figure 5.01.1 – NOAA chart overlay on Google Earth Image showing proposed cable route and the numerous existing cables identified by oscillating red lines.

c. Proposed Method of Construction

A specialized transmission cable vessel will lay cable through the majority of the deep-water segments of the full TCFS route, with the assistance of sonar, GPS, and ROVs. As it enters the 3 nm boundary of USVI Waters, the cable placement will transition to small vessel, placing and floating the cable into place with the use of ROVs and eventually divers. The proposed fiber cable will be laid until it reaches the available existing AT&T landing site, where it will be installed under the surface to a shoreline manhole transition structure, with diver assist and small vessel monitoring. The proposed fiber optic cable will be winched through existing conduit running through a property easement to a manhole located on the subject property of AT&T of the Virgin Islands and connected to existing infrastructure at this location. The cable will be anchored and/or pinned to the seafloor where hardbottom exists, estimated to be approximately 2.4% of the entire route in USVI Waters.

d. Provisions to Limit Site Disturbance

As the project involves work in and adjacent to the water line, site disturbance will be minimized and carefully performed, where required. In order to limit site disturbance, the proposed work timeline will be the minimum time required to perform each task to avoid unnecessary disturbance to surrounding areas. The project will stay almost exclusively within the footprint of existing infrastructure.

On the landside of the installation activities, no earth change, digging, vegetation or structure removal is required.

In-water work will require no directional drilling, but some digging, ploughing and installation of cable underground to a shoreline manhole will be required. Use of turbidity curtains and simple trenching methods will ensure minimal site disturbance both in water and at the shoreline.

Any disturbance to the seafloor due to placement activities will be monitored at all times and a Water Quality Plan will be implemented during any in-water activities. After each stage of site disturbance, stabilization and scour protection will be implemented immediately.

Where stabilization, pinning or anchoring of the cable is required, these activities will be done by divers and in a manner that minimizes potential sediment or sand plumes in the water.

e. Erosion and Sedimentation Control Methods to be Implemented

The following Best Management Practices (BMPs) will be implemented on the site to control runoff and protect natural resources:

Turbidity Curtain – Due to the work performed within the waterbody, a turbidity curtain will be used to minimize sedimentation during project implementation. These curtains are flexible, impermeable barriers which are weighted at the bottom to ensure that sediment does not travel underneath and are supported at the top through a flotation system.

The design of these BMPs will follow the minimum standards of the VI Environmental Protection Handbook (2002).

f. Schedule for Construction Activities and Implementation of Sediment Control Measures

Approach and installation of the cable is anticipated to begin by September 2023 and be completed by September 2024.

An important component of the route planning process is the minimization of impacts to the environment, particularly coral reefs.

The submarine fiber optic cable is proposed to be laid on the seafloor coming from the west from deep water at a north/south cable intersection 0.75 nautical miles west of the USVI Waters territorial boundary. The cable runs east passing approximately one nautical mile north of Cricket Rock onward to a point approximately 0.7 nautical miles north of Outer Brass. From there, it continues east to a point roughly one nautical mile northeast of Outer Brass where it runs south-southeast into the shallow waters of Magen's Bay.

The route was mapped by 55 GPS points starting at the intersection with the north/south cable (GPS point 1) and ending on land with GPS Point 55.

There are no existing bores at the proposed Magen's Bay landing site. The St. Thomas landing will require cable to be surface pinned and then ploughed to the land side of the Mean High Tide Line (MHTL). A

manhole will be installed at the shoreline where it will be used to transition the cable to existing conduit buried in established easements.

Where new infrastructure is needed, disruption of the shoreline and shallow water seafloor will be minimized by using the seafloor features that effectively function as a natural corridor for the cable route (e.g. optimizing use of flat sea bed, avoiding slopes, side-slopes and hard bottom areas where possible) as well as employing minimally impacting installation methods.

Turbidity curtains will be installed around cable landing activity as it approaches shallow water and the shoreline. As placement of cable will be done with the aid of divers in shallow water, adjustment to the turbidity curtains will be made as needed through constant communication between in-water crew and boat/shoreline observers.

g. Maintenance of Sediment and Siltation Control Measures

Turbidity curtains will be inspected daily during in-water work, with additional monitoring of performance during storms or inclement weather events. Any visible plume of sediment in water passing beyond the curtain from the project area will constitute inadequate performance of the curtain and require cessation of work until the faulty portion of the curtain can be modified, adjusted, or repaired to correct the inadequacy.

The site will be kept clear of litter, debris and materials such as paper, wood, concrete, etc. to prevent trash or construction material entering the water.

h. Method of Stormwater Management

No changes to topography, slope, land cover or use is proposed for this project, and no earth change is proposed for the shore-side portion of this project. As a result, there are no anticipated controls needed for stormwater control or pollution prevention.

i. Maintenance Schedule for Stormwater Facilities

No stormwater facilities existing at the site will be modified or obstructed, and no new stormwater structures or facilities are proposed for this project.

j. Maintenance of Sediment and Siltation Control Measures

No changes to topography, slope, land cover or use is proposed for this project, and no earth change is proposed for the shore-side portion of this project. As a result, there are no anticipated controls needed for stormwater control or pollution prevention and no anticipated maintenance requirements.

5.02 Exhibits and Drawings

5.02.01 Lot Layout (See Attached: Engineer/Surveyor drawings)

5.02.02 Position of Structures (See Attached: Engineer/Surveyor drawings)

5.02.03 Other Required Drawings (See Attached: Engineer/Surveyor drawings)

5.02.04 Required Maps (See Attached: Official Zoning Map, Parcel Map, FIRM)

5.03 Project Workplan

This project seeks to install an armored telecommunication fiber optics cable at Magen's Bay, St. Thomas USVI as part of a major Trans-Caribbean Fiber System venture to improve capacity and connectivity between the continental United States of America and the Caribbean. Of an approximate 4,393-kilometer cable system delineated across numerous segments, the primary branch of this cable system, spanning 2,166 kilometers, will connect between Vero Beach, FL and Butler Bay, St. Croix. The primary Florida-to-St. Croix, TCFS trunk segment will have five (5) branching unit (BU) segments, one of which will make landfall at Magen's Bay, St. Thomas, USVI. This branch will begin 93.5 kilometers from the St. Croix landing site, extend to the Magen's Bay landing site over a route that spans 23 kilometers.

The cable will be surfaced laid and enter a landing manhole installed at the shoreline transition point at Magen's Bay and connect via existing underground conduit to the AT&T of the Virgin Islands distribution building located at No. 1, 2, 3, 4, 5 & 6 Estate Peterborg, Northside St. Thomas, VI 00801.

The submarine fiber optic cable is proposed to be laid on the seafloor coming from the west from deep water at a north/south cable intersection 0.75 nautical miles west of the USVI Waters territorial boundary. The cable runs east passing approximately one nautical mile north of Cricket Rock onward to a point approximately 0.7 nautical miles north of Outer Brass. From there, it continues east to a point roughly one nautical mile northeast of Outer Brass where it runs south-southeast into the shallow waters of Magen's Bay.

As the depth gets shallower, the cable placement will transition to small vessel, placing and floating the cable into place with the use of ROVs and eventually divers guiding placement. The cable for the entire branch to St. Thomas will be comprised of Double Armor (DA) cable.

There are no existing bores at the proposed Magen's Bay landing site. The St. Thomas landing will require cable to be surface pinned and then ploughed to the land side of the Mean High Tide Line (MHTL). A manhole will be installed at the shoreline where it will be used to transition the cable to existing conduit buried in established easements. The proposed fiber optic cable will be winched through existing conduit running through a property easement to a manhole located on the subject property of AT&T of the Virgin Islands and connected to existing infrastructure at this location. The cable will be anchored and/or pinned to the seafloor.

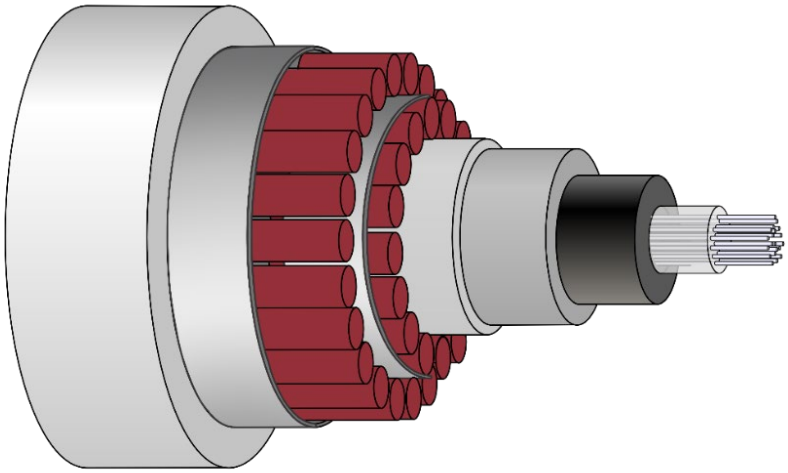


Figure 5.03.1 – Typical Cross-Section of Double Armored Telecommunication line

Table 5.03.1 below provides a summary of the cable route information, including key Location Route Points/Locations, GPS markers, cable depths/distances between those markers and cable type. Table 6, 7, 8 and 9 show the cable distance between events.

Pos No.	Event	Latitude (North)	Longitude (West)	Bearing °T	Distance (km)		Slack %	Cable Distance (km)		Cable Type	Cable Totals By Type (km)	Approx Depth (m)
					Between Positions	Cumulative Total		Between Positions	Cumulative Total			
1	BU 4 St. Thomas	18 ° 25.894 ' N	65 ° 08.486 ' W			0.000			0.000		0.000	51
				266.70 °	1.466		1.00	1.481		DA		
2	AC001	18 ° 25.848 ' N	65 ° 07.655 ' W			1.466			1.481			52
				258.48 °	1.194		1.00	1.206		DA		
3	AC002	18 ° 25.718 ' N	65 ° 06.990 ' W			2.660			2.687			51
				244.19 °	0.709		1.00	0.716		DA		
4	AC003	18 ° 25.551 ' N	65 ° 06.628 ' W			3.369			3.403			52
				236.18 °	1.271		1.00	1.284		DA		
5	AC004	18 ° 25.168 ' N	65 ° 06.028 ' W			4.640			4.686			52
				255.70 °	0.469		1.00	0.473		DA		
6	AC005	18 ° 25.105 ' N	65 ° 05.770 ' W			5.109			5.160			53
				275.70 °	0.518		1.00	0.523		DA		
7	AC006	18 ° 25.133 ' N	65 ° 05.477 ' W			5.627			5.683			53
				288.13 °	0.620		1.00	0.626		DA		
8	AC007	18 ° 25.237 ' N	65 ° 05.143 ' W			6.247			6.309			53
				298.95 °	1.754		1.00	1.771		DA		
9	AC008	18 ° 25.698 ' N	65 ° 04.271 ' W			8.001			8.081			55
				286.16 °	0.601		1.00	0.607		DA		
10	AC009	18 ° 25.788 ' N	65 ° 03.944 ' W			8.601			8.687			55
				268.70 °	0.565		1.00	0.570		DA		
11	AC010	18 ° 25.781 ' N	65 ° 03.623 ' W			9.166			9.258			55
				261.33 °	7.426		1.00	7.500		DA		
12	AC011	18 ° 25.175 ' N	64 ° 59.454 ' W			16.592			16.758			55
				248.88 °	0.650		1.00	0.657		DA		
13	AC012	18 ° 25.048 ' N	64 ° 59.109 ' W			17.242			17.415			54
				235.69 °	0.588		1.00	0.594		DA		
14	AC013	18 ° 24.868 ' N	64 ° 58.833 ' W			17.831			18.009			54
				224.22 °	1.831		1.00	1.849		DA		
15	AC014	18 ° 24.157 ' N	64 ° 58.108 ' W			19.662			19.858			20
				210.39 °	3.325		1.00	3.358		DA		
16	Approximate BMH, St. Thomas	18 ° 22.602 ' N	64 ° 57.153 ' W			22.987			23.216		23.216	-4

Table 5.03.1 – Summary Cable Route Information

6.00 ECOLOGICAL SETTING AND PROBABLE PROJECT IMPACT ON THE NATURAL ENVIRONMENT

6.01 Climate & Weather

Prevailing Winds

The Virgin Islands lie in the "Easterlies" or "Trade Winds" that traverse the southern part of the "Bermuda High" pressure area. The predominant winds are usually from the east- northeast and east (IRF, 1977). These trade winds vary seasonally and are broadly divided into 4 seasonal modes: 1) December to February; 2) March to May; 3) June to August; and 4) September to November. Below are the characteristics of these modes as taken from Marine Environments of the Virgin Islands Technical Supplement No. 1 (IRF, 1977), and based on U.S. Naval Oceanographic Office data.

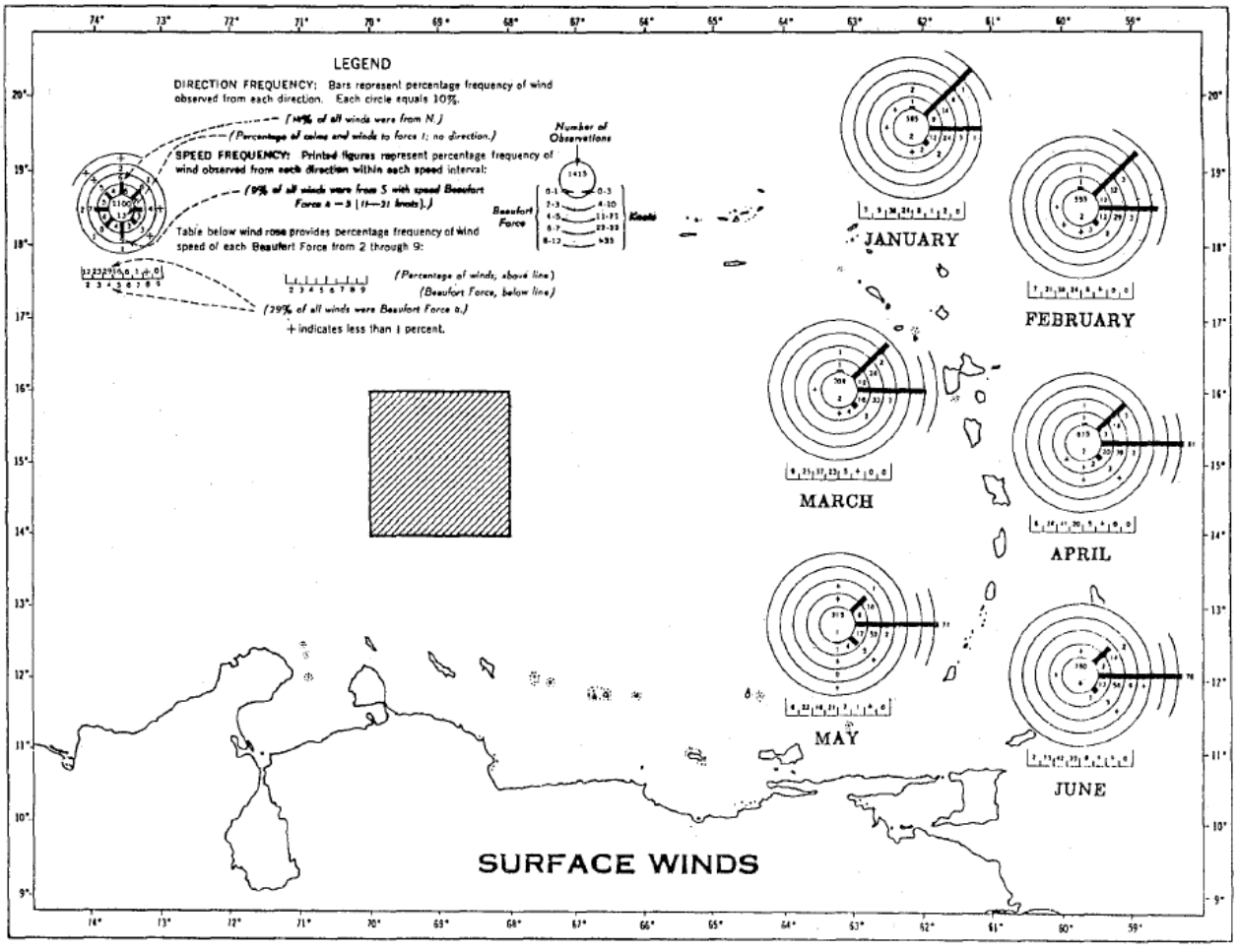


Figure 6.01.1 –Wind Direction and Speed Frequency, Central Caribbean, January - June. (IRF, 1977)

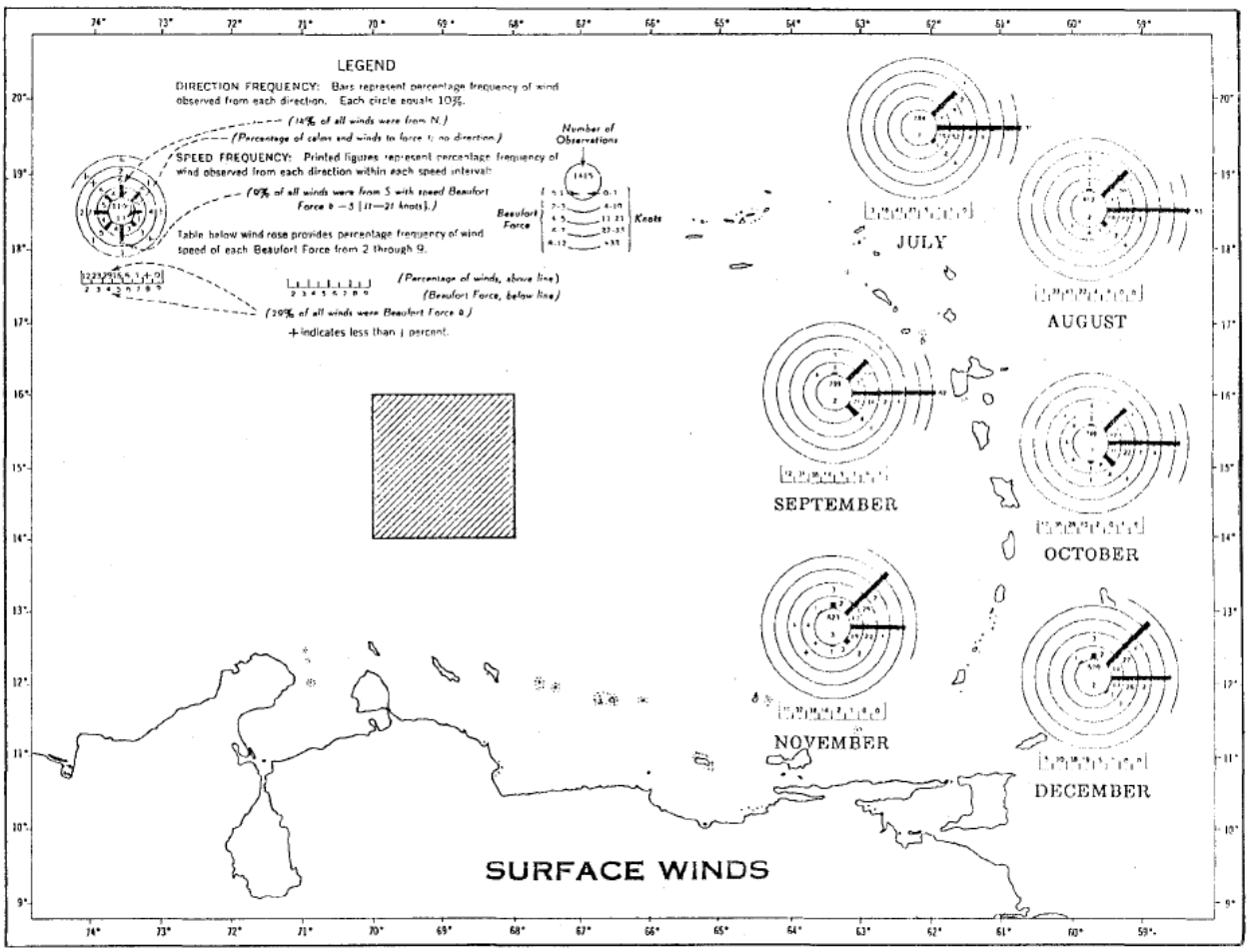


Figure 6.01.2 –Wind Direction and Speed Frequency, Central Caribbean, July - December. (IRF, 1977)

December – February

During the winter, the trade winds reach a maximum and blow with great regularity from the east-northeast. Wind speeds range from 11 to 21 knots about 60% of the time in January. This is a period when the Bermuda High is intensified with only nominal compensation pressure changes in the Equatorial Trough. The trade winds during this period are interrupted by “Northerners” or “Christmas Winds,” which blow more than twenty knots from a northerly direction in gusts from one to three days. Such outbreaks average about thirty each year. They are created by strengthening of high-pressure cells over the North American continent, which, in turn, allow weak cold fronts to move southeastward over the entire Caribbean region. These storms are accompanied by intermittent rains, clouds and low visibility.

March – May

During the spring, the trade winds are reduced in speed and blow mainly from the east. Winds exceed 20 knots only 13% of the time in April. The change in speed and direction is the result of a decrease of the Equatorial Trough.

June – August

Trade winds reach a secondary maximum during this period and blow predominantly from the east to east-southeast. Speeds exceed twenty knots 23% of the time during July. The trend for increasing winds results from the strengthening of the Bermuda High and a concurrent lowering of the pressure in the Equatorial Trough. Trade winds during this period are interrupted by occasional hurricanes.

September – November

During the fall, winds blow mainly from the east or southeast and speeds reach an annual minimum. Only 7% of the winds exceed 20 knots in October. The low speeds result from a decrease in the Equatorial Trough. During this period, especially during late August through mid-October, the normal trade wind regime is often broken down by easterly waves, tropical storms and hurricanes.

Storms and Hurricanes

There are numerous storm events each year, from squalls and thunderstorms to hurricanes. Standard rain events occur most frequently during the summer, lasting only a few hours and causing no pronounced change in the trade winds.

A tropical cyclone whose winds exceed 74 miles per hour is termed a hurricane in the northern hemisphere and can range in strength from causing little to no damage, to destroying. These hurricanes occur most frequently between August and mid-October with their peak activity occurring in September.

Figure 6.01.3 depicts NOAA data on historic Hurricanes and Tropical Storms in the vicinity of St. Thomas.

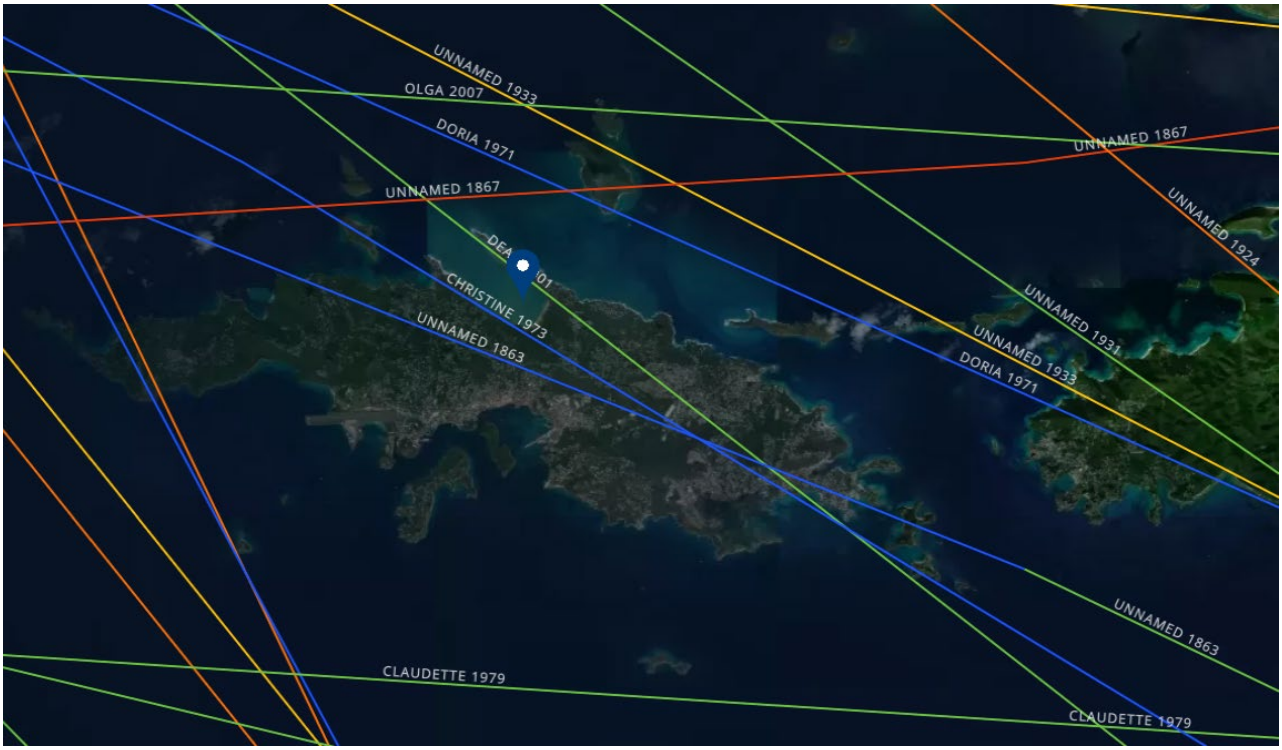


Figure 6.01.3 – Historic Tracks of Hurricanes and Tropical Storms for St. Thomas (NOAA)

Climate

The climate of St. Thomas, as well as that of the entire territory, is characterized by generally fair, tropical weather with usually consistent wind speed and direction. Temperature swings are narrow, both seasonally and diurnally.

The closest weather station to the facility that provides Monthly Climate Normals is Charlotte Amalie AP, Meteorological Station ID: VQW00011640 (a NOAA COOP Station). Climate data from this station is found below in Table 6.01.1.

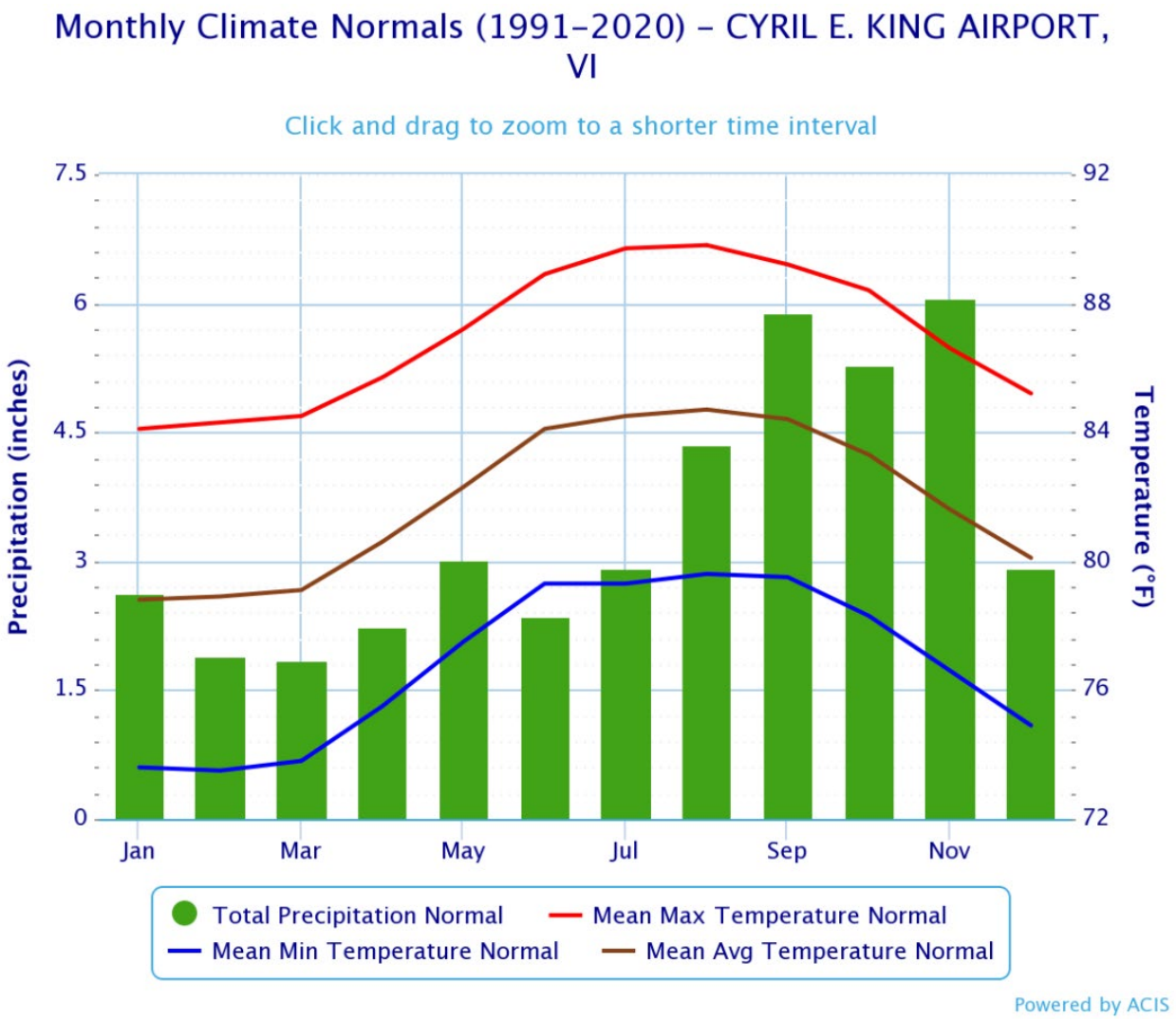


Table 6.01.1 –Average Temperatures at Cyril E. King Airport (NOAA)

The nearest NOAA National Ocean Service Weather Station is located in Charlotte Amalie, St. Thomas, Station CHAV3 – 9751639. Climate data from this station is found in the tables below. Table 6.01.2 depicts the average wind speed (in knots) during each calendar month while Table 6.01.3 illustrates the peak wind gust (in knots) for each calendar month at the above-referenced weather station.

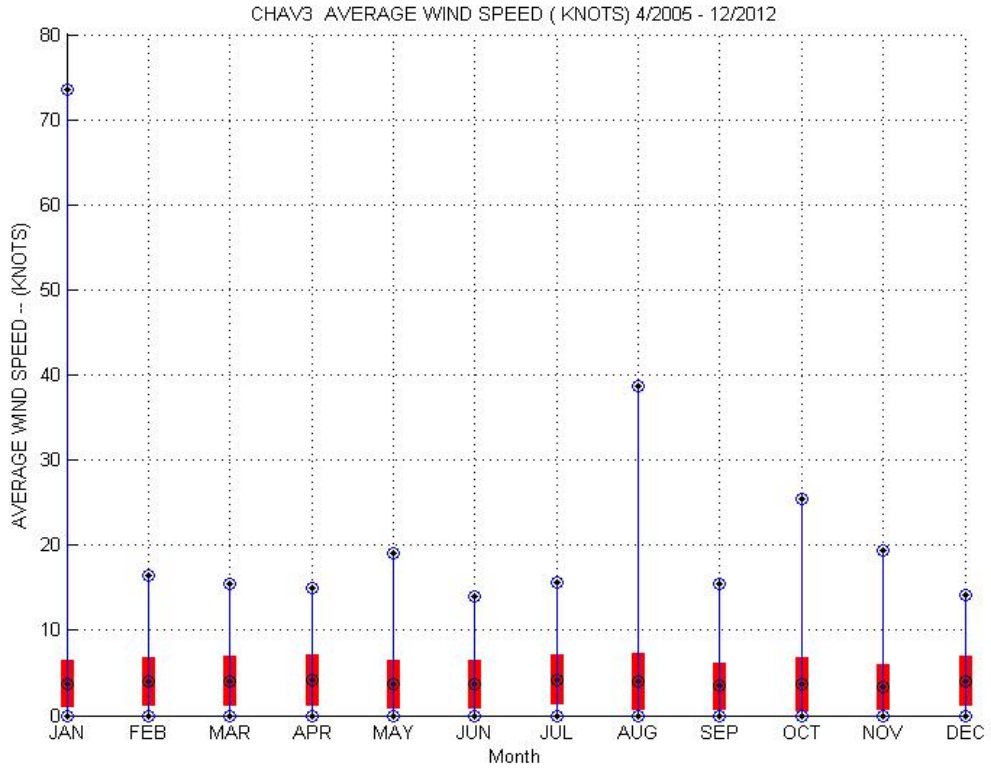


Table 6.01.2 – Average Wind Speed – Charlotte Amalie, St. Thomas (NOAA)

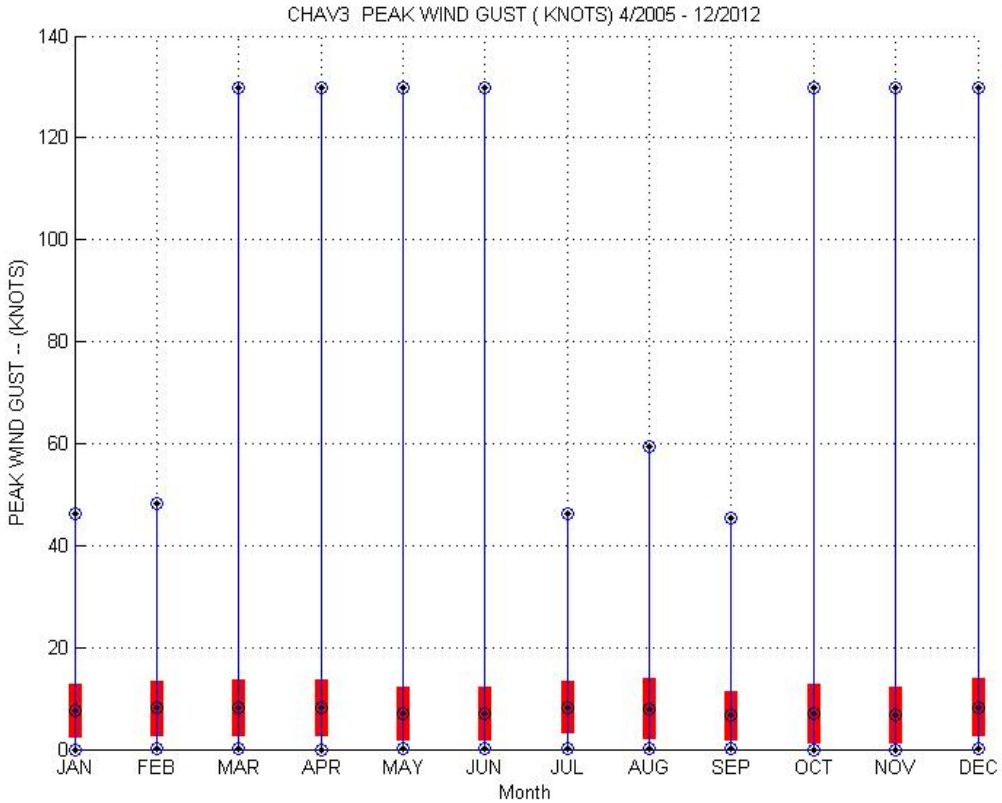


Table 6.01.3 – Peak Wind Gust – Charlotte Amalie, St. Thomas (NOAA)

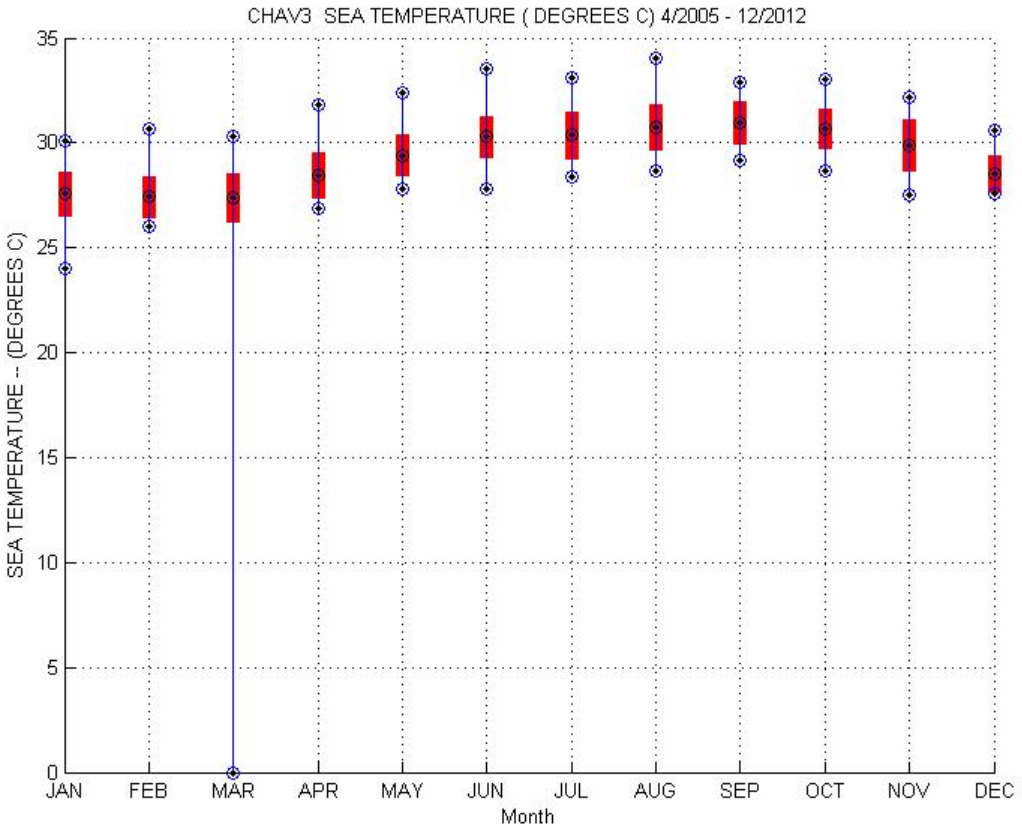


Table 6.01.4 – Average Sea Temperatures – Charlotte Amalie, St. Thomas (NOAA)

The average annual rainfall on St. Thomas is about 40 inches, ranging from about 30 inches in the east to more than 50 inches in the mountains of the northwest. Average annual temperature is a moderate 79°F, with an average low in winter of 76°F and an average high in summer of 84°F; temperatures are 2 to 3 degrees lower at altitudes of 800 to 1,000 feet. Occasionally, maximum daily temperatures will exceed 90°F and minimum temperatures will be less than 70°F. Prevailing wind direction is from the east or northeast.

Rain generally occurs in brief, intense showers of less than a few tenths of an inch. Rains exceeding one inch in 48 hours occur about 7 or 8 times a year in the central part of the island; they are slightly more frequent in the mountains of the northwest and less frequent in the eastern part. February and March are the driest months and September is the wettest. Nearly half the average annual rain falls from August through November. Large storms can occur in any month although more likely during July to November, the hurricane season. (Jordan, 1975).

Impact of Wind, Climate and Weather on the Proposed Project

The applicant has carefully analyzed both climate and weather. The proposed cable system has been designed to have structural stability to withstand wave stresses and current forces through the depth of placement and anchoring mechanisms to be incorporated at hardbottom in shallow water. No impact

from climate or weather is anticipated for the proposed project, neither from routine events nor extreme weather events such as hurricanes while the cable is laid on the seafloor.

6.02 Landform Geology, Soils and Historic Land use

Geology of St. Thomas

St. Thomas, along with St. John, make up the northern most islands of the U.S. Virgin Islands, lying 40 miles north of St. Croix and separated from it by an ocean trench 3,600 meters deep. It lies about 80 miles East of San Juan, Puerto Rico. St. Thomas is the second largest island in the USVI, with a total area of 20, 480 acres (32 square miles). The island is approximately 13 miles long, east to west and is about 4 miles at the widest. St. Thomas, along with St. John and Water Island are part of the Puerto Rican geographical bank (the Greater Antilles), while St. Croix is geographically located in the Lesser Antilles and lies completely within the Caribbean Sea

The Virgin Islands are near the northeastern corner of the present Caribbean Plate, a relatively small trapezoidal-shaped plate which is moving eastward relative to the North and South American continents carried on the American Plate. The arc of the Lesser Antilles is an active volcanic arc above a subduction zone in which Atlantic oceanic crust of the American Plate is carried downward under the Caribbean Plate. The Caribbean Plate is sliding past North and South American plates along east-west trending northern and southern boundaries. The western boundary is a subduction zone in which the Cocos Plate is being driven northeastward and down under the edge of the Caribbean Plate west of Central America (Rogers, 1988).

The land surface of St. Thomas is almost entirely sloping and extends seaward from a central ridge, that is 800 to 1 ,200 feet above mean sea level and runs the length of the island. The slopes, which commonly exceed 35 degrees, are dissected by numerous stream channels of steep gradient. The general appearance of St. Thomas is a panorama of steep interstream spurs and rounded peaks (Jordan and Cosner, 1973).

Flat land in St. Thomas is confined to the Charlotte Amalie area and a few small alluvial-filled embayments. The only variation in the general topography is in the upper valley of Turpentine Run in eastern St. Thomas. This valley has rolling hills in a basin surrounded by steep slopes and sharp ridges. Streamflow on St. Thomas is generally intermittent, however, Bonnes Resolution Gut, on the north side of the island and Turpentine Run Gut, on the southeast, have perennial reaches. (Jordan, 1973; WATER USE MAP)

The geology of St. Thomas is similar to that of St. John. The oldest rocks exposed on St. Thomas consist of keratophyres, spilites, and radiolarites, collectively called the Water Island Formation (Henry 1994). These weakly metamorphosed, uplifted, folded and faulted rocks were derived from volcanic and other narrow-trench sediments originally deposited by turbidity currents on the deep ocean floor about 70 to 80 million years ago (Adey 1977). Carbonate rock is found only rarely on St. Thomas and St. John and is composed primarily of the Outer Brass Limestone deposited during a lull in volcanic activity in the Turonian and Santonian Age (Donnelly, 1959).

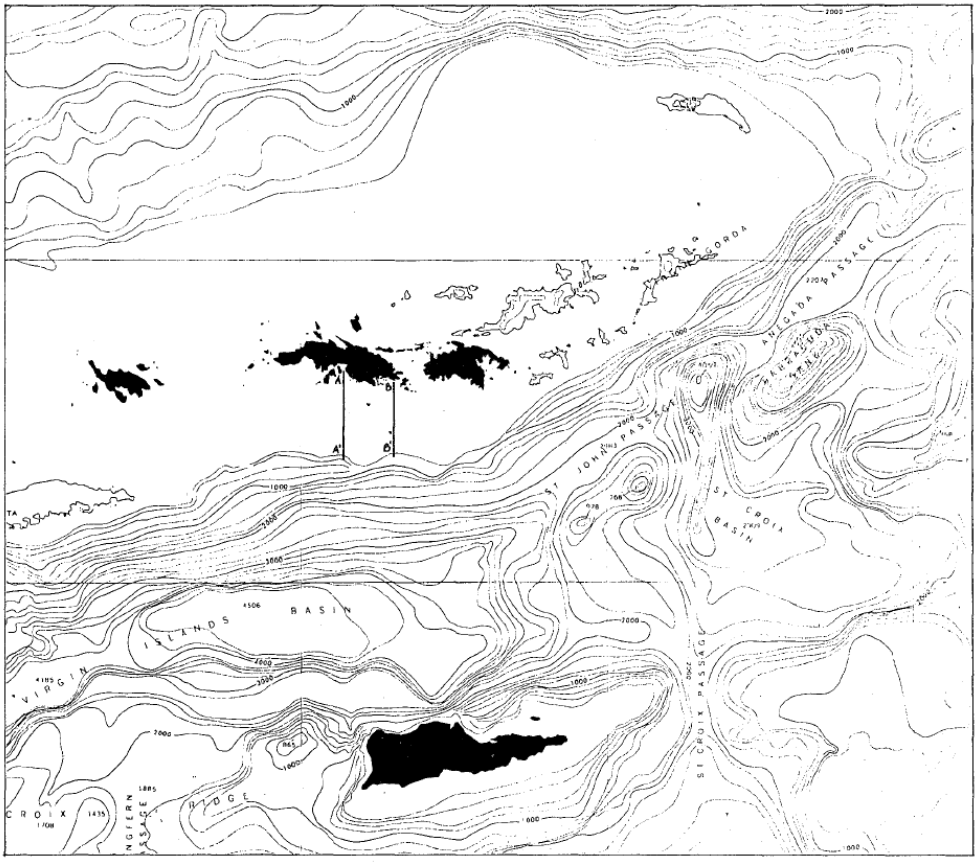


Figure 6.02.1 – Bathymetry of USVI basins and plateaus (Van Eepoel, et al, 197.)

Two large basins, the Virgin Islands Basin and the St. Croix Basin, separates St. Croix from the other Virgin Islands. Within the distance between St. Croix and St. Thomas (about 40 nautical miles), hydrographic charts show that the ascent from the sea floor north of St. Croix is as much as 70 degrees. Frasetto and Northrop (1957) indicate that this northern topographic slope extends downward to the Virgin Islands Basin at a gradient up to 43 degrees. There is an ascent of 13,656 feet within a horizontal distance of 25,800 feet, terminating with the steep north coast in the vicinity of Hams Bluff. Meyerhoff (1927) suggested that this block faulting took place during the late Pliocene or early Pleistocene, prior to which St. Croix was physically attached to the northern Virgin Islands.

The insular shelf south of St. Thomas and St. John has an average width of about 14 km. From the rocky shoreline of the islands, the bottom slopes seaward at an initial rate of about 16 m/km to depths of 25 or 30 meters, then assumes a more gradual slope to about 45 meters at which depth the central and outer platform is essentially level. In the western part of the area, the shelf edge lies at about 45 meters below which the slope increases sharply to about 275 m/km. In the eastern part of the area, the slope change occurs at about 55 meters, except where a well-developed, drowned reef with crests as shallow as 20-30 meters marks the shelf edge. The shelf can be divided into two parts on the basis of topography and shallow structure. West of a north-south line drawn through the vicinity of Charlotte Amalie, the shelf profile is smooth and no strong topographic trends are apparent. On the other hand, shelf profiles to the east are more rugged and very strong topographic trends are developed along northeast-southwest lines (Garrison, 1971)

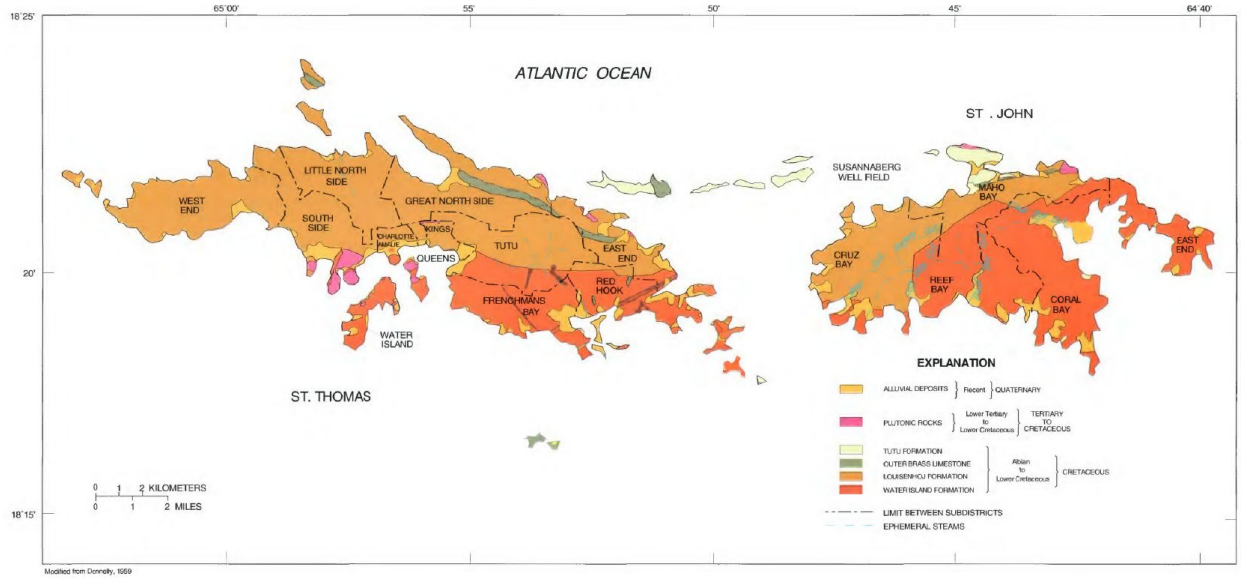
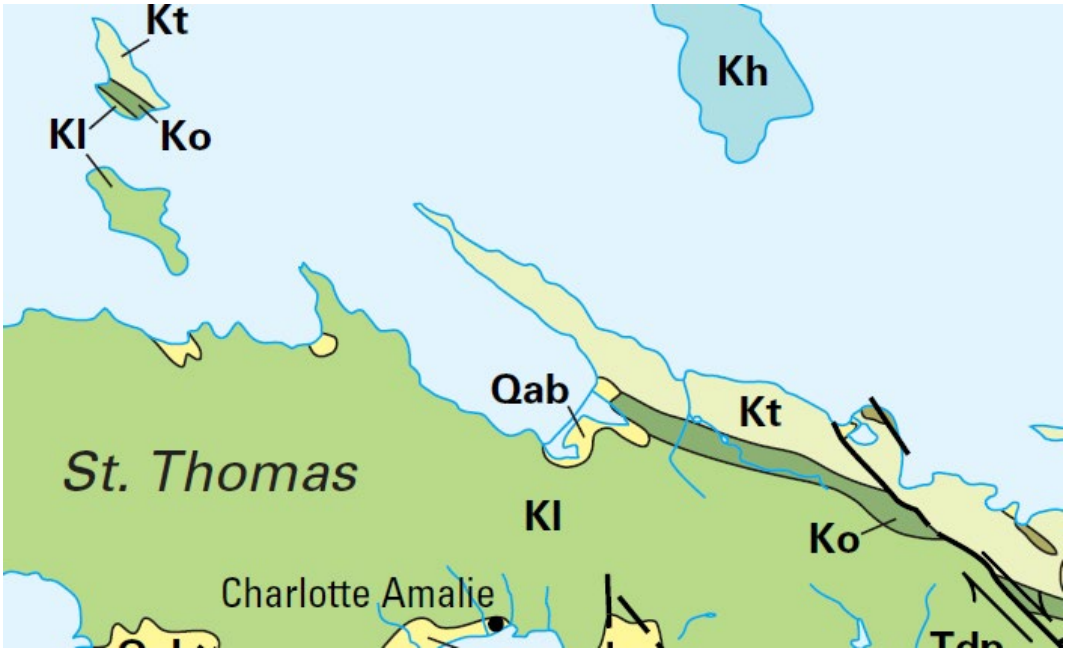


Figure 6.02.2 – Generalized surficial geology in St. Thomas, U.S. Virgin Islands (Veve & Taggart, 1996)



EXPLANATION

	Quaternary deposits	Kt	Tutu Formation
Qab	Alluvium, minor beach deposits	Ko	Outer Brass Limestone
	Early Tertiary to Cretaceous rocks	Kl	Lousenhoj Formation
Tdp	Dikes and plugs	Kdp	Dikes and plugs
	Cretaceous rocks	Kw	Water Island Formation
Kd	Dioritic rocks	U D	**Fault**—Arrows show relative horizontal movement, dashed where inferred. U, upthrown side; D downthrown side
Kh	Hans Lollik Formation		

Figure 6.02.3 –Geological formations in the vicinity of project site (Renken R., 2002)

Geology

The landing site is positioned 18°22'19.7"N 64°55'42.5"W, while the cable station is located at 18°22'26.0"N 64°55'40.4"W, both on the north coast of Magen's Bay. The Custom Soil Survey by the National Resource Conservation Service (NRCS) identifies the soil type for the landing site as Beaches, stone (BtB) and at the cable station as extremely stony Annaberg-Maho Bay complex with of 20 to 40 percent slopes (AmE) and 40 to 60 percent slopes (AmF). On the opposite side of the landing site there is Southgate-Rock outcrop complex (SrF).

Annaberg-Maho complex are well drained, moderately permeable soils and extremely stony. These soils are generally found on summits and side slopes of volcanic hills and mountains. Slopes range from 12 to 90 percent.

Elevation at the project site varies from 0 to 280 feet above sea level.

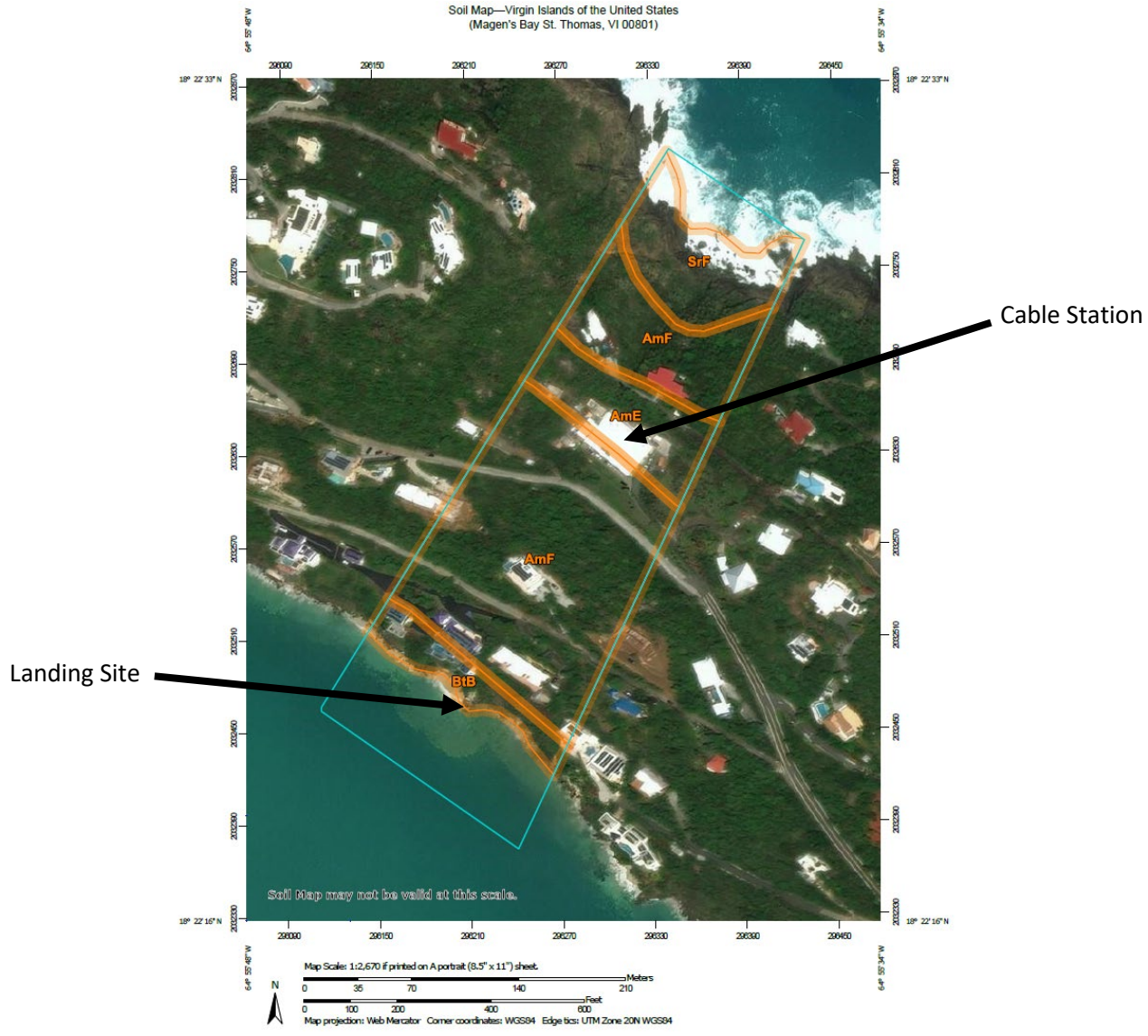


Figure 6.02.4 – Soil types in project vicinity (NRCS Soil Survey)

Historic Use

The land has been used as a communications hub for AT&T since the mid-nineties, when telecommunication cables were installed along with conduit to the shoreline to route the cables below ground.

The building structure and driveways have been built on the property since at least 1970, per satellite photos published by USGS.

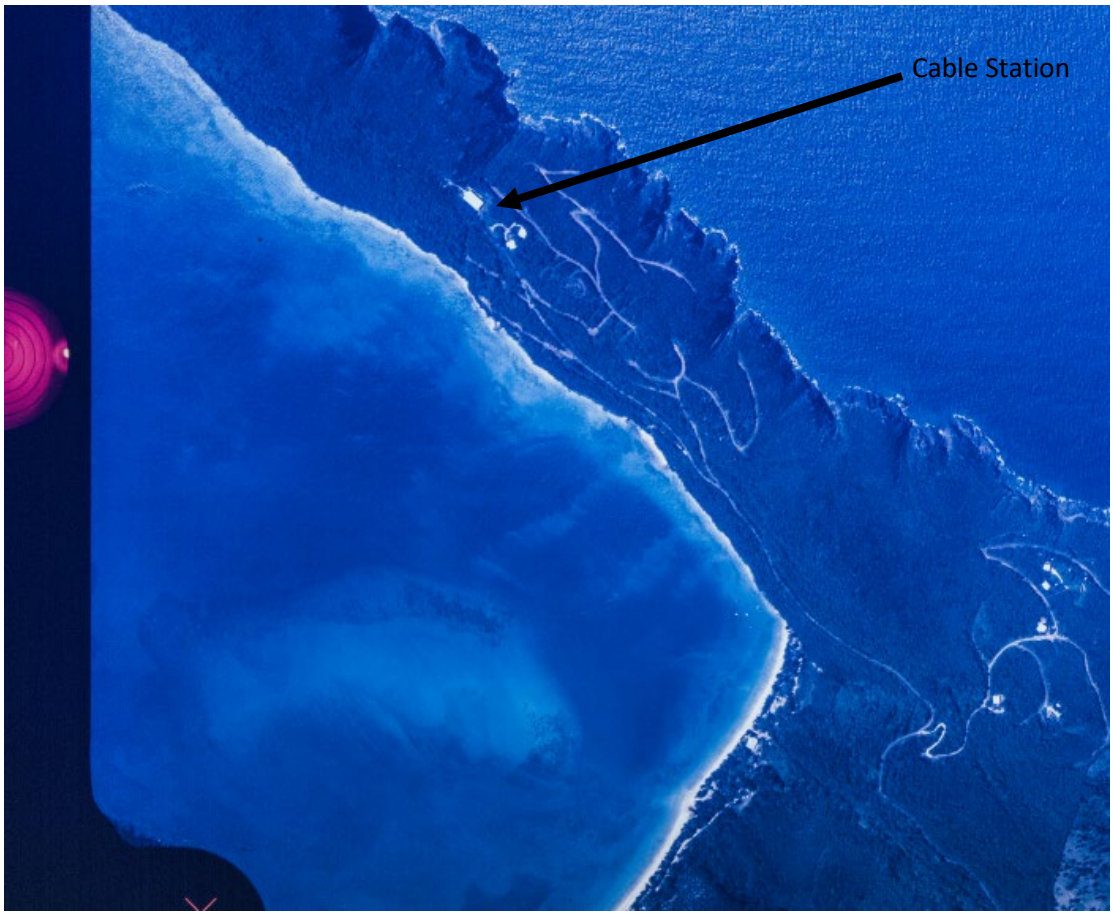


Figure 6.02.5 – 1970 Historical Photo, Magen's Bay, Source: USGS.

Seismic Activity

The Puerto Rico/Virgin Islands region is located at the northeastern corner of the Caribbean plate where motions are complex. The westward-moving North American plate is being driven under the Antilles Arc where volcanism is active. On the north side of the plate corner, the North American plate slides past the Caribbean but irregularities in the plate boundaries cause stresses that result in a complicated under thrusting of plate fragments. The interaction of plates causes the volcanism of the Antilles Arc on the

eastern boundary of the Caribbean plate and creates major stresses all along the northern boundary (Nealon & Dillon, 2001).

Since the 1867 Virgin Islands Tsunami cause by a magnitude 7.5 earthquake in the Anegada trough (USC Tsunami Research Center), there has been continuous low intensity activity all below 6.0 Richter. Over the last several years, numerous minor tremors have been felt on the island. This increased activity is associated with the volcanic eruptions that have been occurring to the southeast on the island of Montserrat.

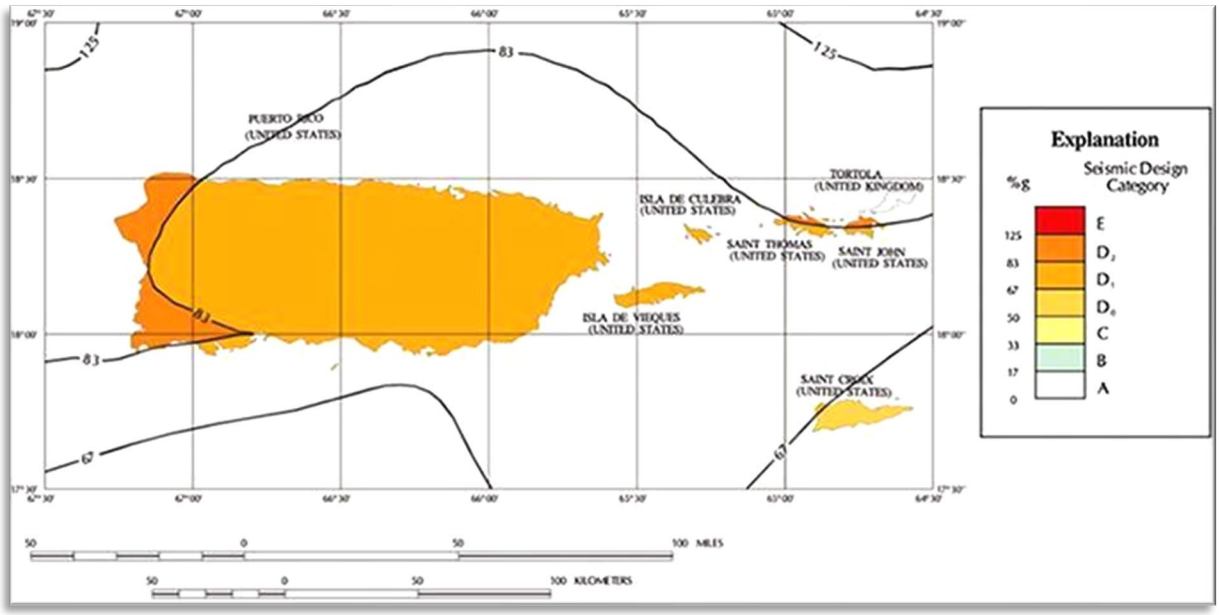


Figure 6.02.6 –FEMA Earthquake Hazard Map, Puerto Rico (FEMA Earthquake Hazard Maps)

Impact of Geology on Proposed Project

The applicant has carefully considered landform, geology, soils and historic land use. The project has been designed to be consistent with these conditions, and as the proposed project plans to utilize existing infrastructure and conduct little to no earth movement, to minimize impact on the surrounding area and geology.

6.03 Drainage, Flooding and Erosion Control

a. Impacts of Terrestrial and Shoreline Erosion

This project will not alter impervious surfaces to the site, or change topography or contours for the site. There will be no impacts to terrestrial and shoreline erosion as the cable will be routed underground to the shoreline and tie into a manhole structure and existing conduit already buried. The proposed development will not alter the existing drainage patterns of the site. If required, standard sediment and erosion control devices and BMPs will be implemented when performing any site work and will be maintained throughout the life of the project.

b. Relationship of the Project to the Coastal Flood Plain

Review of Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for U.S. Virgin Islands Index indicate that part of the project area is within flood zones rated Zone X and Zone VE. See below in Figure 6.02.6 which is a portion of FIRM Panel 0011G, increased in size for clarity, depicting site location (red box) relative to flood zones. Project location rated Zone X has been determined to be outside the 0.2% annual chance floodplain. Zone VE is known as a coastal flood zone with velocity hazard (wave action) and a base flood (100-year flood) elevation of 12 feet.

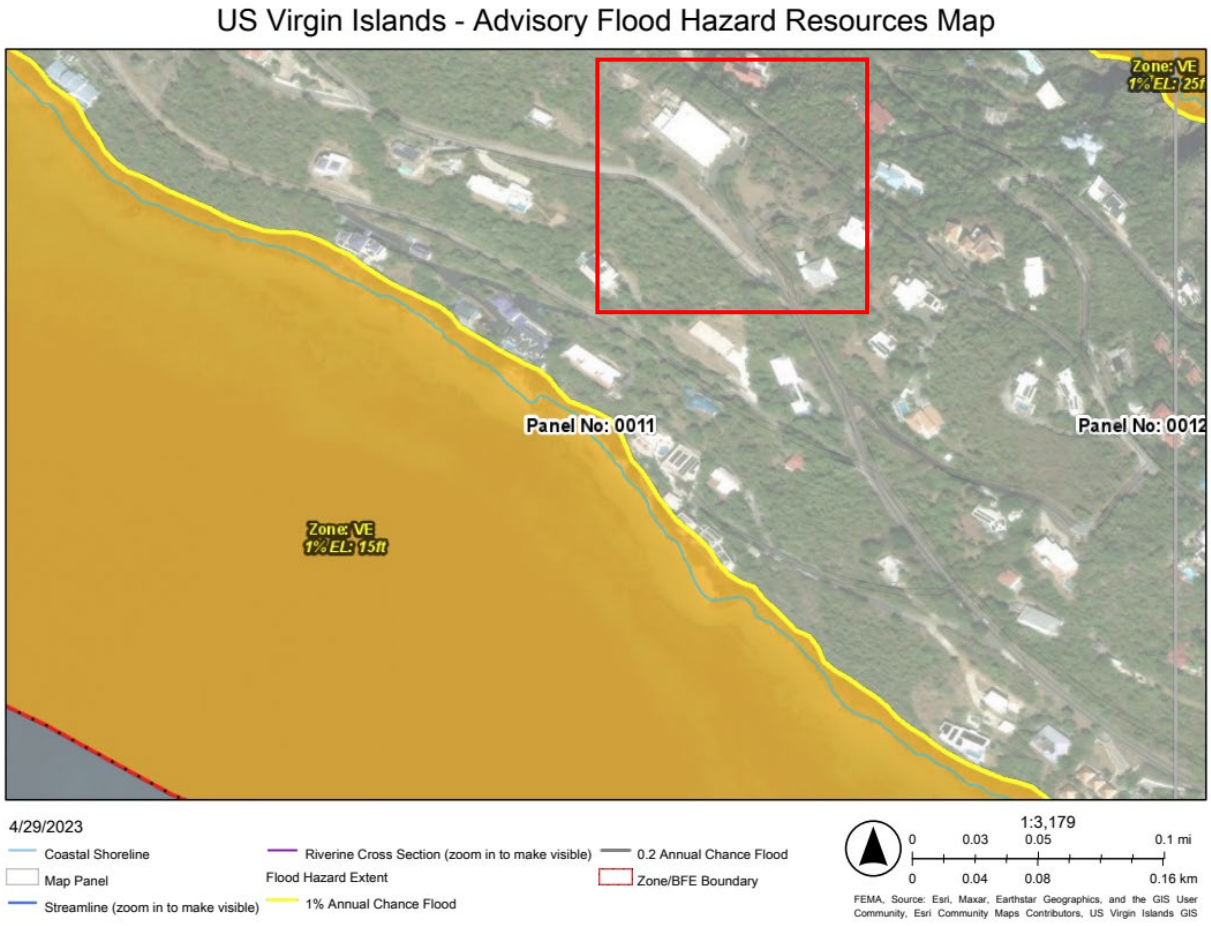


Figure 6.03.1 – Section of Flood Insurance Rate Map (FIRM) Panel 0011G, 11 of 94. 2018

6.04 Fresh Water Resources

St. Thomas, USVI is limited in the number of freshwater resources to a few wells located around the island and mostly intermittent and ephemeral streams and ponds which dry up during periods of limited rainfall. Some perennial streams and freshwater ponds/basins do exist, but not as a reliable source of freshwater. The majority of potable water is either captured by rooftops or from wells and stored in cisterns or is desalinated seawater. The project is not located or will affect any freshwater source in the area and will have no negative impact on the availability of freshwater resources.

6.05 Oceanography

a. Seabed Alteration

Laying cables can potentially lead to seabed disturbance, damage, displacement, or disturbance of flora and fauna, increased turbidity, as well as alteration and remobilization of contaminants from sediments. These effects are primarily restricted to the installation, repair and/or removal phase and are generally temporary. In addition, their spatial extent is limited to the cable corridor which can be up to 10 m width if the cable has been ploughed into the seabed; (OSPAR 2009). Some mobile benthic species (for example, crabs) are able to avoid most disturbance whereas sessile (bivalves, tubeworms etc.) and sensitive species (such as slower growing or fragile species) will be more impacted. (OSPAR 12/22/1, Annex 14)

Benthic surveys of the proposed cable route were conducted November 18-20, 2022 to identify and quantify the presence/absence of marine habitats, to include but not be limited to coral reef structures (both mesophotic and shallow-water), seagrasses, hardbottom, and fisheries habitat that may be impacted by the installation of the cable. Particular attention was paid to areas near land that may have connected or associated hard-bottom habitats that could support these deep reefs.

The benthic community was a uniform fine sand/silt for the entire route except for a short stretch of approximately 0.5km east of the north end of Outer Brass Island in 70-foot-deep water and approximately 0.08 km near the shore landing site within Magen's Bay. Those sections are noted in the attached Overview Map of the proposed cable route.

In the 70-foot-deep reef discovered, an existing cable is plainly visible with no observed disturbance of benthic habitats as with other existing cables found elsewhere, some on the reef and some well off the bottom. No evidence of habitat degradation was observed anywhere near existing cables. The reef documented at approximately 200' to 300' from shore is a mixed bottom with various habitats and benthic life, including hard corals of various species so attention must be paid as to not disturb this area during installation.

b. Tides and Currents

The Caribbean current is a powerful surface oceanic current passing west through the Caribbean Sea, then north through the Yucatan Channel, then east out to the Straits of Florida to form the Florida Current and join the Gulf Stream (See Figure 6.05.1). These surface currents are driven by the North Equatorial Current. The warm Caribbean Current, derived from the junction of the North Equatorial Current and the Guiana Current, flows at an average rate of 38 to 43 cm (15 to 17 inches) per second and transports about 27.5 million cubic meters (~1 billion cubic feet) of water per second (Britannica, 2007).

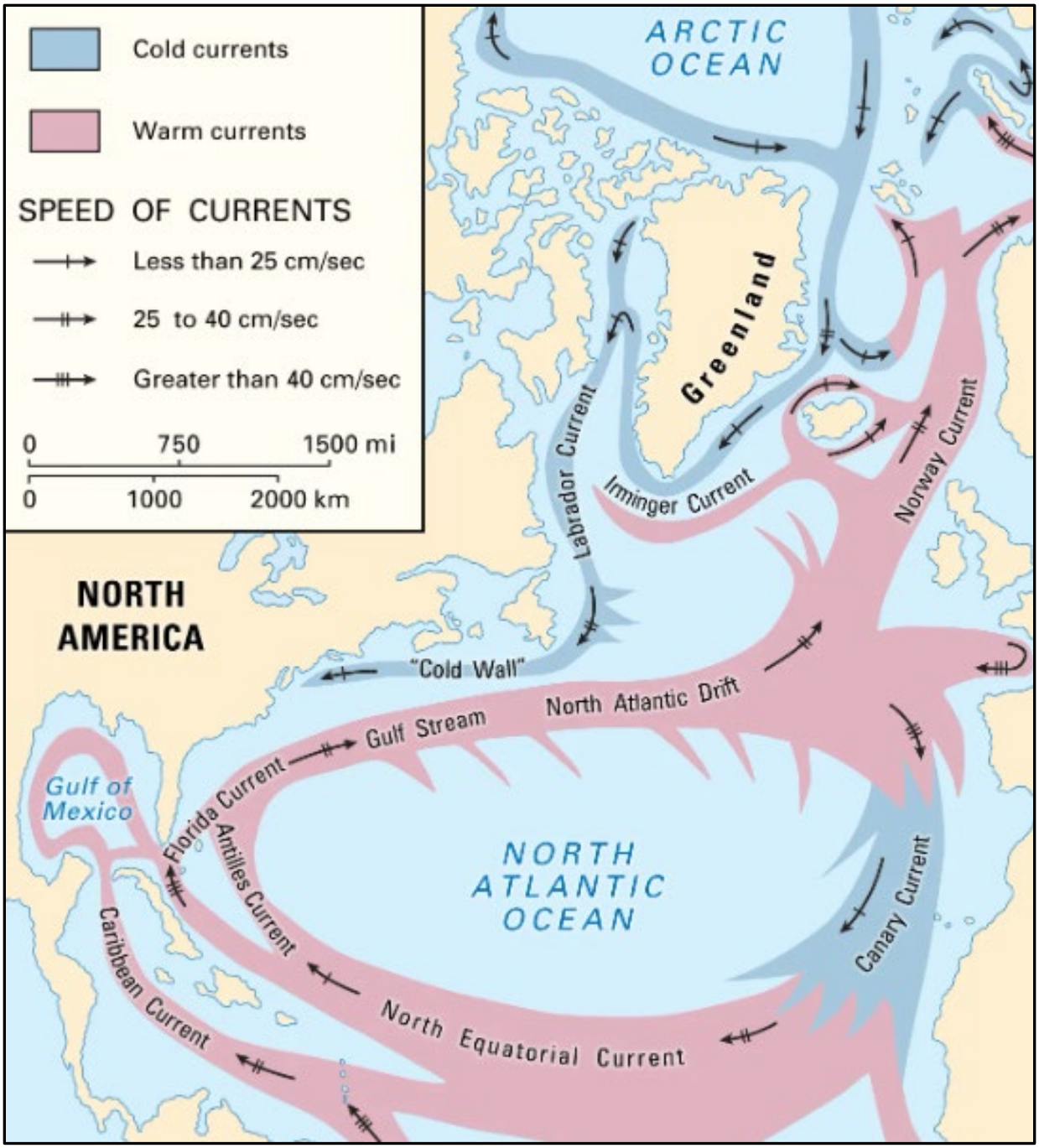


Figure 6.05.1 – Major currents, North Atlantic Ocean (LaMourie, 2021)

These currents change very little from season to season with the currents coming more from the south during the summer months (Figure 6.05.2). As the figure illustrates, there is usually a westerly current observed between St. Croix Island and St. Thomas Island (NOAA – BookletChart).

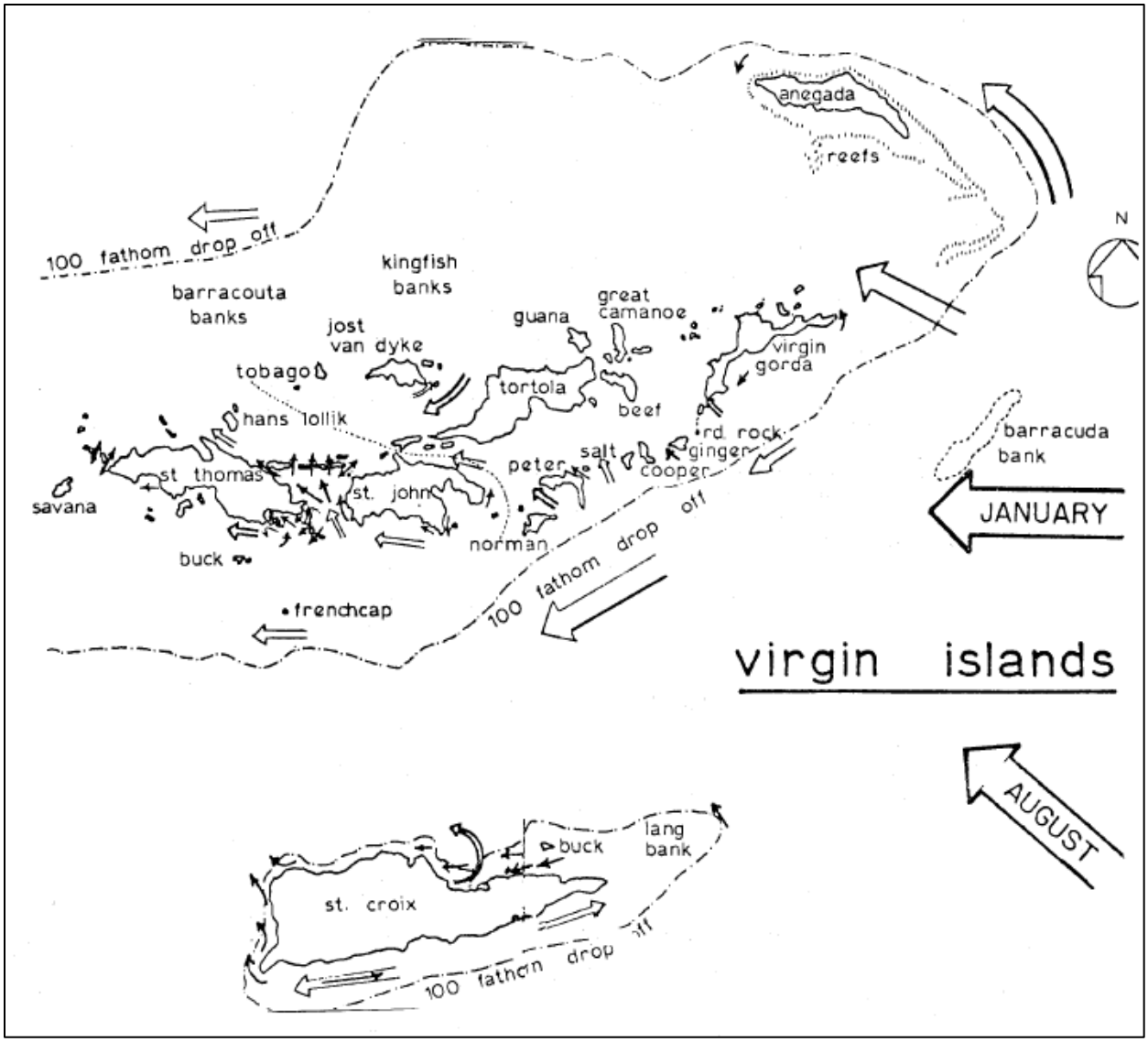


Figure 6.05.2 – General current patterns on the island platforms (Dammann, 1969)

Because of different exposures to open ocean water on one side and modified circulation of Caribbean water on the other, the north and south coasts of St. Thomas and St. John experience different tidal activities. On the north, tides are similar to the north coast of Puerto Rico, being semidiurnal (two cycles of high and low water per 24 hours). The time of tide stages in the Virgin Islands are earlier than in Puerto Rico, however. On the south coasts of St Thomas, tides typically exhibit two (bi-modal) 'peaks' during the diurnal period (24-hour day), with the second (lesser) 'peak' having relatively small ebbs and flows. The mean tides range from 0.8 feet to 1.0 feet and the spring tidal ranges reach up to 1.3 feet (IRF 1977).

In the Virgin Islands, tidal ranges and tidal currents, except in some inshore localities, are not significant. The small islands, lacking complex shoreline physiography, do not restrict changes in water level. The sea flows around the islands relatively unimpeded, resulting in tidal fluctuations of only a few inches to a foot.

Furthermore, the steep slopes of the islands rising out of the water means that the intertidal zone, the part of the shoreline regularly covered and uncovered by the tides, is very narrow. Therefore, there are no large areas of tidal flats uncovered at low tides as in other places in the world, especially along continental coastal zones.

One of the consequences of this small tidal action is that water exchange in bays due to tidal action is usually very small. For example, it is estimated that 24 to 40 tidal cycles alone would be necessary to exchange all the water in the main part of St. Thomas harbor. Fortunately, waves, swells and oceanic currents are generally successful at flushing most bays. However, these forces are considerably reduced by the time they reach the heads of deep embayments.

As a result, circulation may be poor in the inner reaches of some larger embayments. The innermost portions of the mangrove lagoon on St. Thomas, Salt River of St. Croix and Coral Bay of St. John are examples of this. To a lesser extent, similar conditions have been observed at the head of Vessup Bay (Redhook), St. Thomas and Cruz Bay, St. John, and most likely occur in other similar locations (IRF, 1977).

The closest NOAA tidal station is located in Charlotte Amalie, St. Thomas, VI and is Station ID: 9751639. The NOAA tidal station is located at Latitude: 18° 20.1' N and Longitude: 64° 55.2' W. The mean range is 0.7 ft. and the diurnal range is 0.79 ft. Tidal data from the station is shown below in Table 6.05.1.

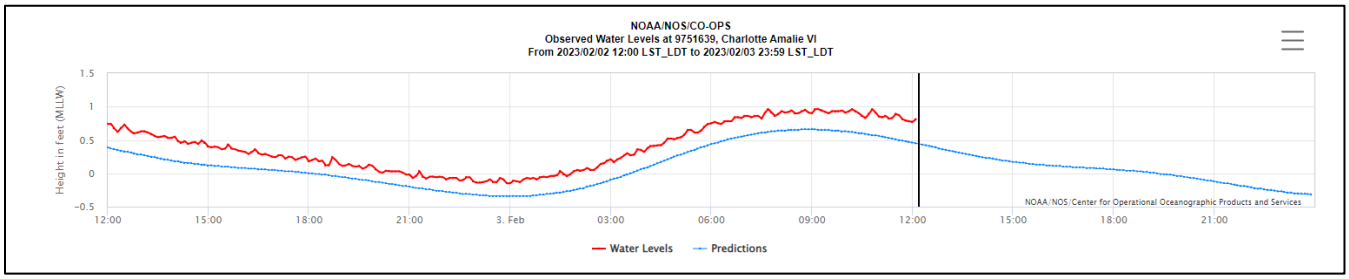


Table 6.05.1 – Observed Water Levels at Charlotte Amalie, St. Thomas (NOAA)

c. Wave and Wind Impacts

The deep-water wave regime of offshore waters is driven by the northeast trade winds most of the year. On the average, wave heights of one to three feet approach from the east 42 percent of the time throughout the year. For short periods, 0.6 percent of the time, these easterly waves reach 12 feet. In addition to the normal easterly swell that affects the windward coasts of the islands, there are two seasonal modes of wave approach that affect leeward coasts: a southeasterly chop and swell and a northern swell. The southeasterly swell with waves one to twelve feet high becomes significant in late summer and fall when the trade winds blow from the east or when tropical storms and hurricanes pass the islands at a distance to the south. The east-southeasterly wind and wave regime is associated with the doldrum belt located over the interior of Venezuela and with an intensive high-pressure area over Bermuda. By contrast, during winter when the doldrum belt is located farther south along the equator and the Bermuda High is weak, a long length and long period northern swell develops. Although the swell offshore is only one to five feet high and occurs only four percent of the time, it is significant because it gains heights of ten to twelve feet nearshore.

Waves tend to straighten the north coast of St. Croix by erosion of headlands and deposition of sand in the bays. Straightening along the north coast of St. Thomas and St. John is opposed by the variations in resistance to erosion of different rock types. For example, the projecting points on the north side of Magen's Bay, St. Thomas, at Mary's Point, St. John and of Thatch and Grass Cays owe their origin to the Tutu rock formation which is more resistant than the Brass limestone. Commonly, on the north coasts, waves approach the shore from two principal directions. Short period waves and chop approach from the east and northeast, and, at the same time, long period swells approach from the north. However, in the winter, from November through March, the northern swells are larger than in summer, and they are refracted and redirected more around points and islands.

Around islands like Dutchcap Cay, St. Thomas and Buck Island, St. Croix, the two wave types produce very complicated patterns of crossing sea and swell which can be observed on aerial photographs. Along coasts fronted by partly submerged reefs, waves play a significant role in circulating back reef water. As demonstrated in Christiansted harbor, the mass transport of waves breaking over Long Reef drives a harbor-wide circulation that flushes most of the harbor water through the entrance in about fourteen hours. Consequently, the response of waves to reefs and nearshore bathymetry is significant in reducing pollution and improving water quality. (IRF, 1977)

Figure 6.05.5 below shows current wind speed data from the Charlotte Amalie NOAA tidal station referenced in Section 6.05.b.

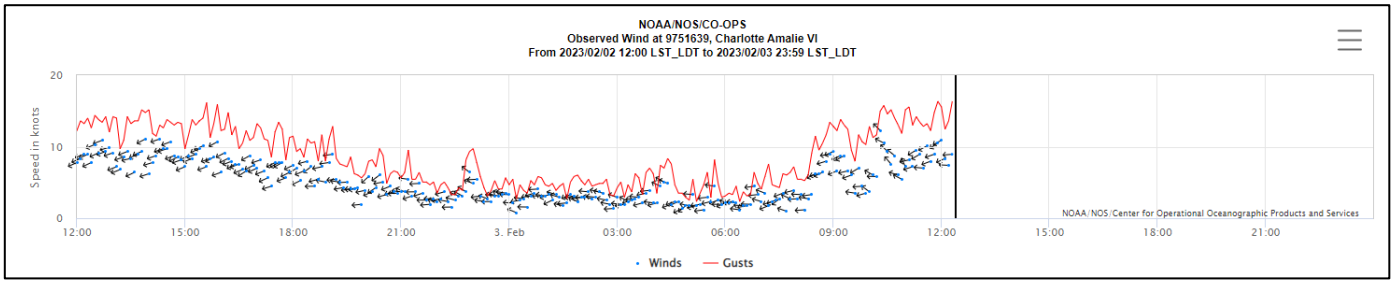


Table 6.05.2 – Observed Wind at Lime Tree Bay, St. Croix (NOAA)

d. Marine Water Quality

The water surrounding the site is classified as Class B as specified in the Amended V.I. Water Quality Standards of 12VIRR186. Class B waters have a designated use of propagation of desirable species of wildlife and aquatic life and primarily contact recreation such as swimming, fishing, etc. Water quality criteria include dissolved oxygen not less than 5.5 mg/l, exception if cause is natural forces. The pH must not vary by more than 0.1 pH unit from ambient, and at no time may the pH be less than 7.0 or greater than 8.3. Bacteria (enterococci) cannot exceed 30 CFU/100ml (30-day geometric mean), turbidity readings cannot exceed 3 NTUs, and clarity may not exceed a level where a Secchi disc cannot be visible at a minimum depth of one meter.

VI DPNR performs routine water quality measurements at select locations. The subject waterbody has four associated Water Quality Monitoring Stations as noted below:

Waterbody	Location	Sample Station Number
VI-STT-10	Magen's Bay	STT-15, STT-15A, STT-15B Magen's Bay, VI672756 Magen's Bay

According to VI DPNR's 2020 Integrated Report (IR), which entails CWA Section 305(b) water status report and the CWA 303(d) list, the VI-STT-10 waterbody, Magen's Bay, is established as a local conservation area but has been indicated as being impaired for Enterococcus and Turbidity reported for 6 years within a 10-year period. An impairment of pH was reported in this waterbody in 2010, 2012, and 2014 but has now been resolved with no exceedances since 2016 however, no reason for the water quality status recovery was specified.

6.06 Marine Resources and Habitat Assessment

Overview & Research

Magen's Bay and its surrounding areas have been classified as particularly sensitive relating to marine resources and habitats, having been classified as an Area of Particular Concern (APC) as well as a Marine Protected Area (MPA) since 1993 and in subsequent evaluations as recently as the 2020-2025 United States Virgin Islands' Coral Reef Management Priorities, having been ranked within the top 10 areas most suitable for protection and management intervention for its coral reefs.

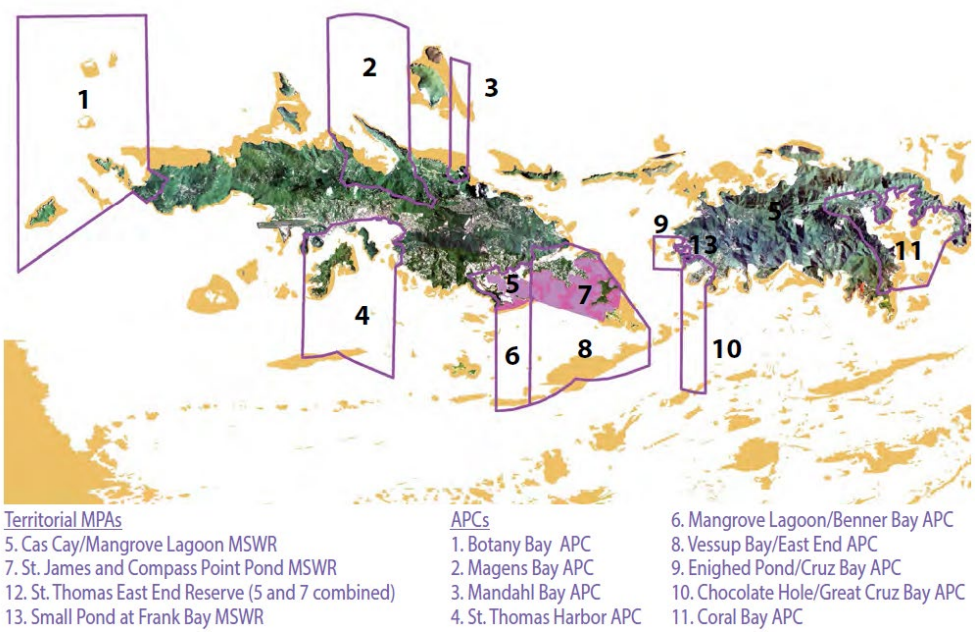


Figure 6.06.1 –St. Thomas and St. John MPAs and APCs(NOAA, October 2014)

Magen's Bay has also been previously classified as an Area of Particular Concern (APC) due to it being listed on NOAA's National Marine Protected Areas. The Magen's Bay APC is located on the north central side of the island of St. Thomas. This APC is bound by Tropaco Point in the west, the entire Peterborg peninsula in the east, and has a seaward boundary that extends directly north to the shelf edge or three-nautical mile territorial limit (whichever is closer). Valuable resources within this area include primary archaeological sites, several types of forest, fish nursery habitats, and 8 endangered species (U.S. Marine Managed Areas Inventory (2006a), NOAA's National Marine Protected Areas Center).

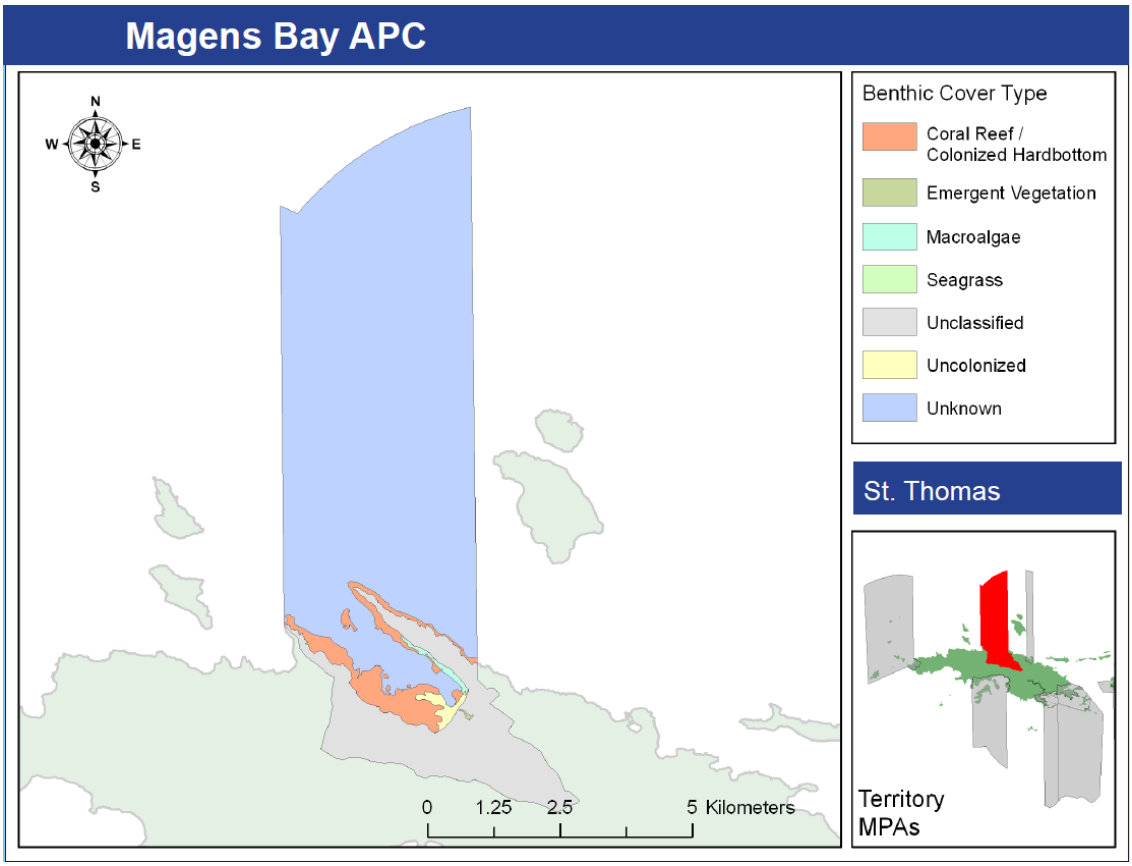


Figure 6.06.2 –Magen's Bay APC (NOAA, 2006)

The Environmental Sensitivity Index (ESI) Map (Figure 6.06.3) indicates presence of fish, octopus, gastropods (i.e., conch), lobster, dolphin and whale in nearshore as well as shelf waters closer to Outer Brass Island and the proposed cable route. Of the whale species, the humpback whale is considered federally endangered and breeding grounds are indicated to be near these waters around the months of November to May.

The map and the U.S. Fish & Wildlife Information for Planning and Consultation (IPaC) website tool also indicates that the inner Magen's Bay beach to be an area for turtle nesting, particularly in January and December, and a breeding ground for a variety of marine and terrestrial species including crab, waterfowl, wading birds, seabirds, and shorebirds. Of the bird species, three are considered endangered: the Caribbean Coot (*Fulica caribaea*), ruddy duck (*Oxyura jamaicensis*), and white-cheeked pintail (*Anas bahamensis*) all of which breeds and nests year-round. In addition, two plant species considered endangered: the *Manilkara bidentata* and the *Tillandsia lineatispica,* were noted on the ESI near the

vicinity of the project area. ESI shoreline habitats in the project area are a mix of exposed rocky cliffs and solid man-made structures with smaller areas of fine to medium-grained sand beaches and exposed wave-cut platforms in bedrock.

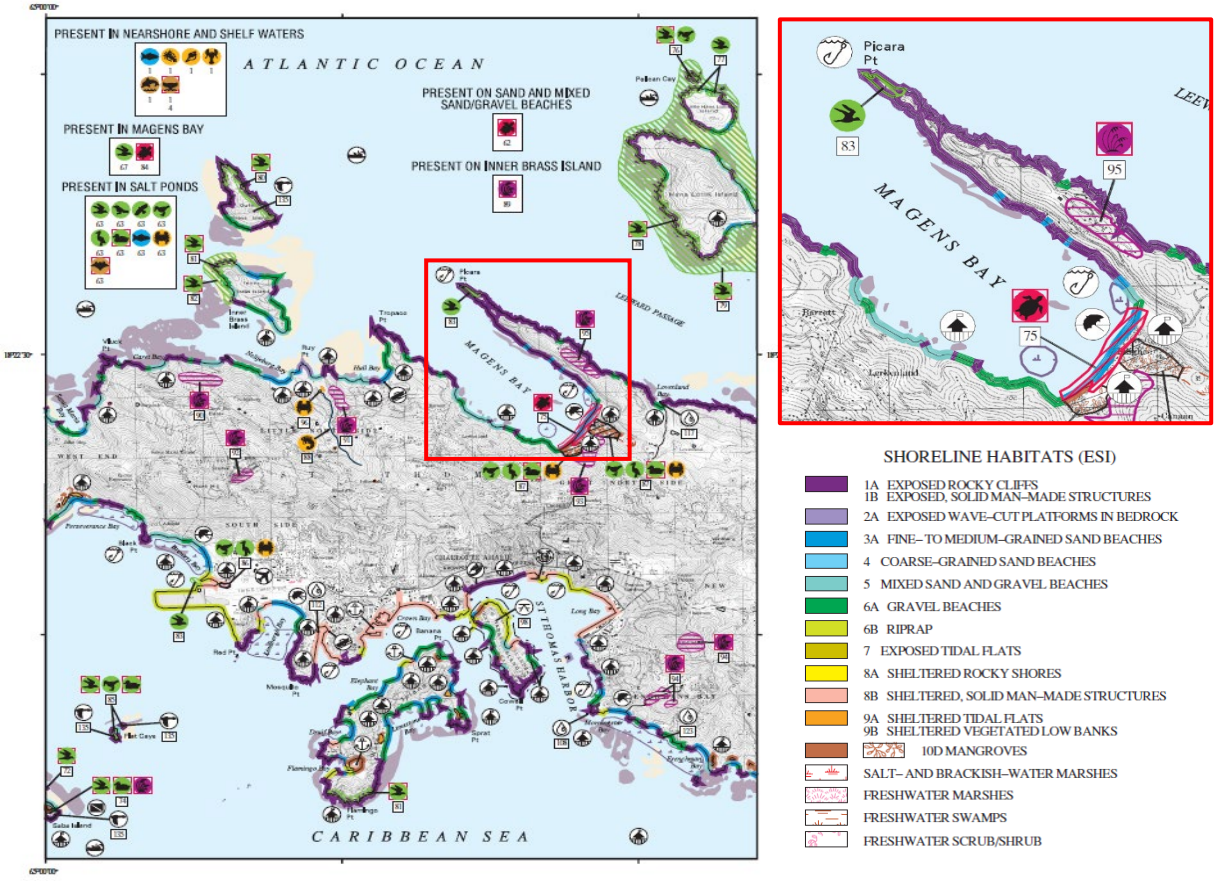


Figure 6.06.3 – Environmental Sensitivity Index Map with enlarged portion of project site (outlined in red), VI-1, St. Croix, USVI (NOAA)

A review of the 2002 NOAA Benthic Habitat Maps (Figure 6.06.4 below) shows significant diversity of benthic habitats in this region of St. Thomas. Directly at the shoreline of the landing point is classified as macroalgae/patchy/50-90% for less than 200 meters. This is followed by approximately 250 meters of reef/linear reef. Further north of the project location, the habitat transitions to reef/colonized bedrock and reef/colonized pavement also followed by reef/linear reef. Zones include bank/shelf (within the microalgae and reef/colonized habitats) and forereef (within the reef/linear reef habitat) and at the furthest distance from shore.

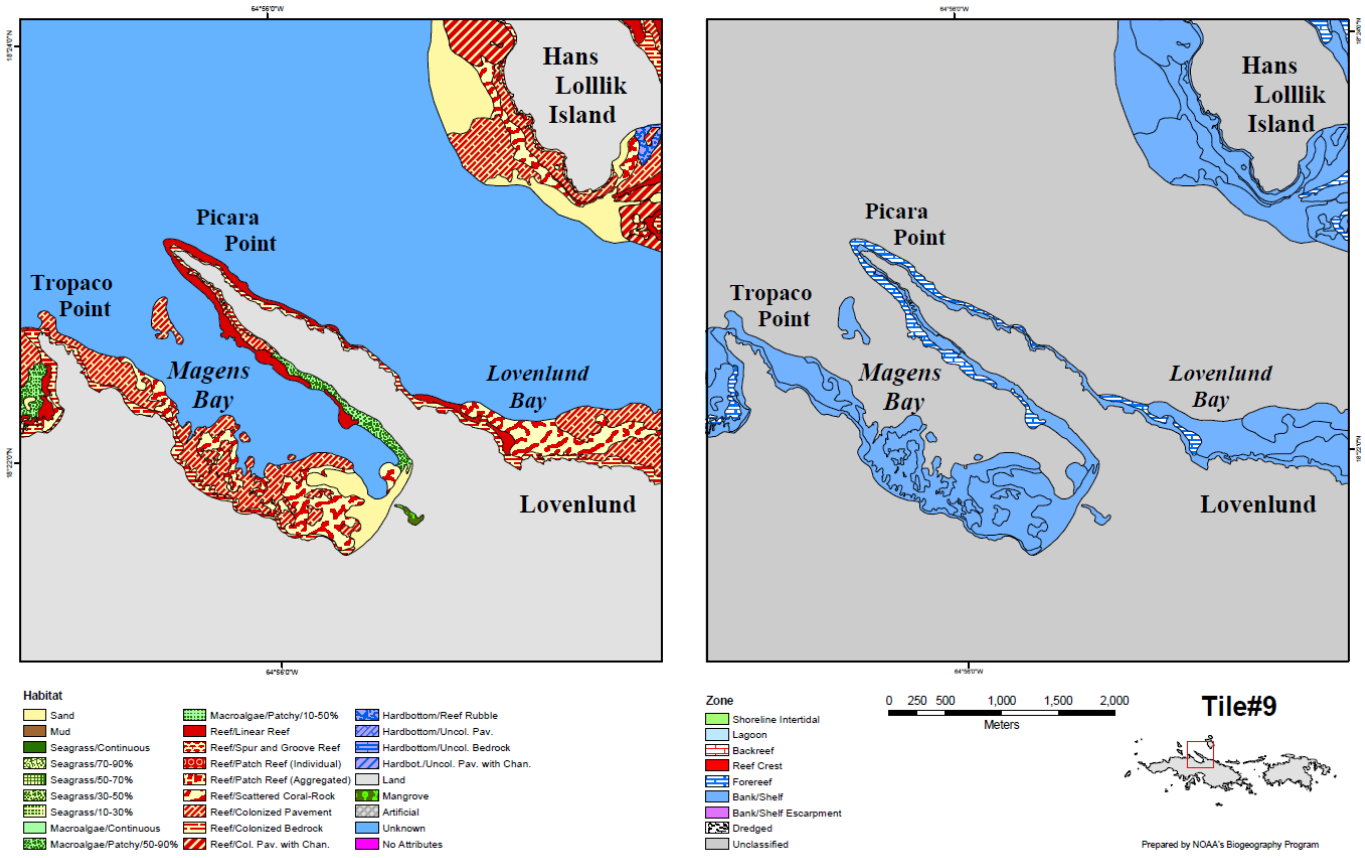


Figure 6.06.4 – Benthic Habitat in project vicinity, Tile #9 (NOAA)

Field Surveys

Benthic surveys of the proposed cable route were conducted November 18-20, 2022, with subsequent follow up surveys the following year on November 6, 2023, to identify and quantify the presence/absence of marine habitats, to include but not be limited to coral reef structures (both mesophotic and shallow water), seagrasses, hardbottom, and fisheries habitat that may be impacted by the installation of the cable. Particular attention was paid to areas near land that may have connected or associated hard-bottom habitats that could support these deep reefs.

2022/11/18 -11/20 – STT Observations and Notes

The benthic community was a uniform fine sand/silt for the entire route except for a short stretch of approximately 0.5km east of the north end of Outer Brass Island in 70-foot-deep water and approximately 0.08 km near the shore landing site within Magen's Bay. Those sections are noted in the attached Overview Map of the proposed cable route.

Of particular concern for the proposed cable route was the possibility of encountering deep water Mesophotic Coral Reefs. These little studied reefs are found elsewhere in St. Thomas, with some habitats

studied under cyclic evaluations such as the NCRMP and TCRMP programs. Areas near land that may have connected or associated hard-bottom habitats that could support these deep reefs were evaluated, but none were found (See Figure 6.06.5).

Figure 6.06.5 – Sites surveyed south of the proposed cable route that are closer to land to evaluate presence of mesophotic coral reef.

Video and still photos were collected from a mid-point on the 70-foot-deep reef discovered between GPS 24 and GPS 25 (Figure 6.06.6). Two 25 meter long transects, one running north and the other south, were laid from this center point via SCUBA with Nikon W300 and GoPro Hero 4 cameras. An existing cable is plainly visible with no observed disturbance of benthic habitats as with other existing cables found elsewhere, some on the reef and some well off the bottom. No evidence of habitat degradation was observed anywhere near existing cables.

Figure 6.06.6 – Location of reef between GPS Points 24 and 25 that is east of Outer Brass Island)

Figure 6.06.7 – Proposed Cable Route as it passes closest to Picara Point

From GPS point #55 on shore, a survey was made with a measuring tape laid along the bottom (and in view in the videos) out 100+ meters from shore to GPS 50 (See Figure 6.06.8). As with other existing cables found elsewhere, the existing cables are plainly visible here, some on the reef and some well off the bottom. No evidence of habitat degradation was observed. The reef documented at approximately 200' to 300' from shore is a mixed bottom with various habitats and benthic life, including hard corals of various species.

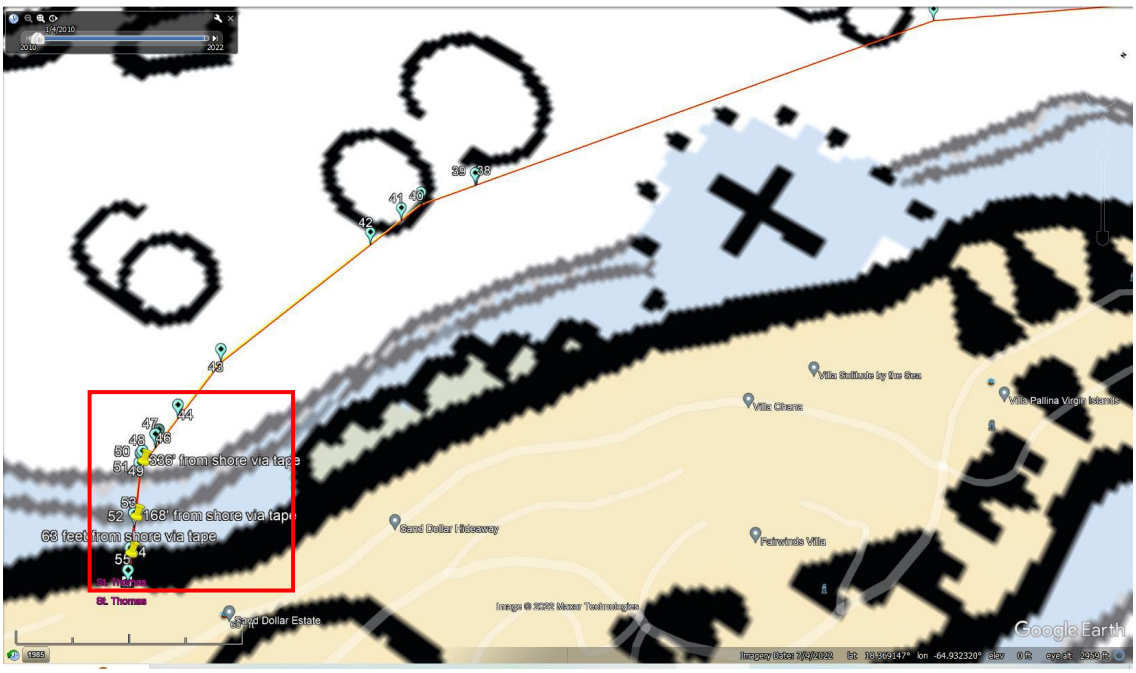


Figure 6.06.8 – NOAA Chart showing Magen's Bay Shoreline with proposed cable landing and cable route along GPS points

To document the 14.5 mile proposed route, 5 ¾ hours of video footage was captured using a professional Outland UWC-325/P Color Camera which featured very low light sensitivity (.001 lux) using a 3.6mm f1.4 lens measuring 1.62" x 5" with a depth rating of 2000 m and 750 lines horizontal resolution. 83 minutes of video footage was captured using a Deep Trekker Revolution ROV. The most common benthic feature other than sand were a few gorgonian skeletons and approximately 20 were observed.

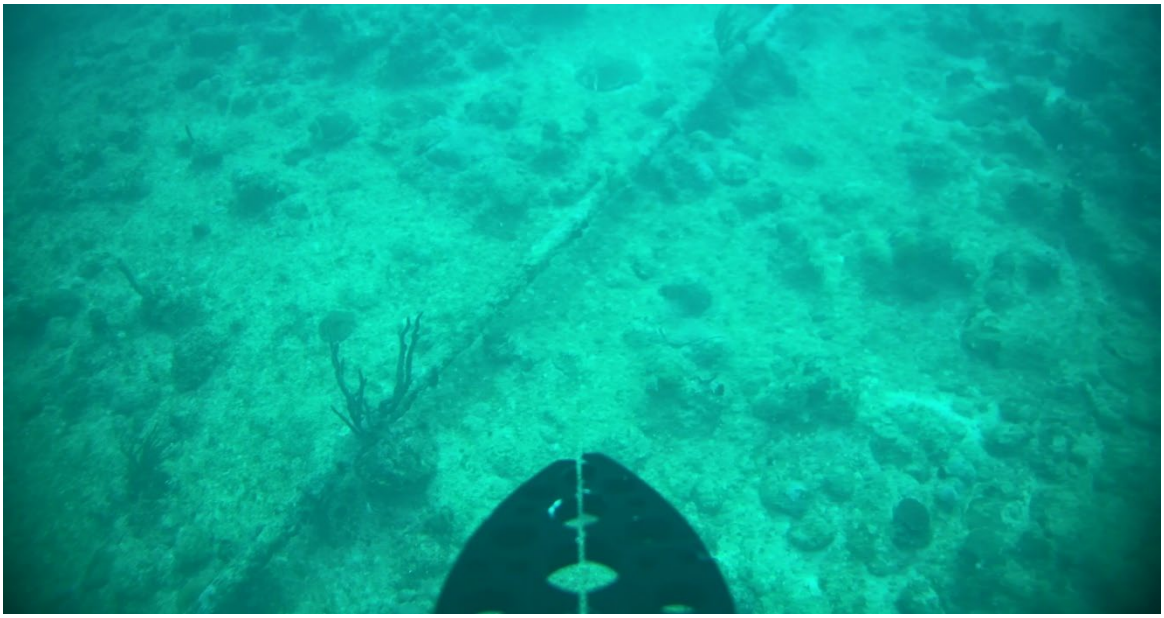


Figure 6.06.9 – Frame grab of video from ROV at area between GPS 24 and GPS 25 showing existing cable.

Figure 6.06.10 – Typical gorgonian skeleton in 170' deep water (frame grab from video camera)

2022/11/06 – STT Observations and Notes

Substantial bleaching was observed on almost all hard coral species although some color was visible. It cannot be confirmed visually if it is late bleaching or early recovery. Bleaching was occurring in soft corals as well. The last time bleaching was this pervasive was in 2005 (see graphs on page 3). At the NPS coral monitoring sites around VI National Park in St. John, bleaching combined with the coral disease white plague caused over a 60% decline in coral cover (Ref: Miller, J., et al. "Coral disease following massive bleaching in 2005 causes 60% decline in coral cover on reefs in the US Virgin Islands." Coral Reefs 28 (2009) 925-937). The coral disease white plague has not been a large problem lately, but Stony Coral Tissue Loss Disease (SCTLD) has been extremely virulent and prevalent throughout Florida and the Caribbean causing extensive coral mortality. It is impossible to predict the impact of this SCTLD-environment now combined with bleaching, but it is likely there will be a decline in coral cover from these on-going events. This loss would be unrelated to the cable laying at this time. A new baseline benthic survey should be done during or immediately after the cable laying so that the post-bleaching live coral coverage can be documented as a baseline.

GPS 24- GPS 25 site

Starting at 18.402279 N, -64.953460 W

Benthic cover estimated as follows:

Hard Coral:	4%
Octocorals:	2%
Macroalgae:	10%
Crustose coralline algae:	1%
Sand:	2%
Sponges:	1%
Turf algae:	80%
TOTAL:	**100%**

Shortly after documenting the immediate area in the middle this hardbottom area, the divers located and followed an existing cable and documented the numerous hard and soft corals and sponges growing directly “ON” the cable. It is our judgement that the corals are scattered enough that the new cable could be laid in the scattered sand channels or through this benthic community without causing damage to existing corals or habitat. This would be best accomplished if the cable laying was guided by divers during the placement and laying of the cable. A new baseline benthic survey should be made during or immediately after the cable lay so that the post-bleaching live coral coverage can be documented as a baseline.

Cable Landing Site in Magen's Bay

The inspection began at the point where existing cables begin their sharp turn to the north at GPS 50. Benthos is 100% silty mud. Most cables observed (3-4) were suspended above the benthos at this point.

Proceeding towards shore, shallower and upslope, the cables came in contact with a hardbottom community, primarily turf algae, and rose rapidly up to 20' depth.

At that 20' depth, the "shoulder of the slope" was between 20' - 12' where numerous large patch reefs were observed among a scattered coral and rock community. The three (3) Orbicella listed species (*O. annularis, O. franksi, O. faveolata*) were found here. *Orbicella annularis* colonies were abundant and large. The divers swam approximately north and south, parallel to the shoulder of the hardbottom, observing 7-9 existing cables laying among and often over the vibrant coral and fish community. There was evidence of storm damage with some coral colonies toppled, and shore debris (plastic beach chair). Other land-based pollution (bottles, cans, unidentifiable plastic) was also observed.

The overall impression is that the existing cables were laid without regard to the reef community, much of which was composed of coral species listed on the US Endangered Species List (genus Orbicella). Future cables would need to be guided through this reef community to avoid contact with existing corals.

In 10 – 12' depth, the hard bottom changed into a sand a seagrass community. The area is dominated by the invasive seagrass (*Halodule stipulacea*). (Ref: Willette, Demian A., Julien Chalifour, AO Dolfi Debrot, M. Sabine Engel, Jeff Miller, Hazel A. Oxenford, Frederick T. Short, Sascha CC Steiner, and Fabien Védie. "Continued expansion of the trans-Atlantic invasive marine angiosperm Halophila stipulacea in the Eastern Caribbean." *Aquatic botany* 112 (2014): 98-102.) The brown macroalgae (Dictyota spp.) was mixed among the invasive seagrass. This algae genus was not observed in 2022 in this area. Occasionally, native turtle grass (Thalassia testudinum) was observed. A Green Sea turtle (also on the ESA species list – *Chelonia mydas*) was also observed during this dive. Laying a new cable through this community would cause minimal disruption if placed by divers.

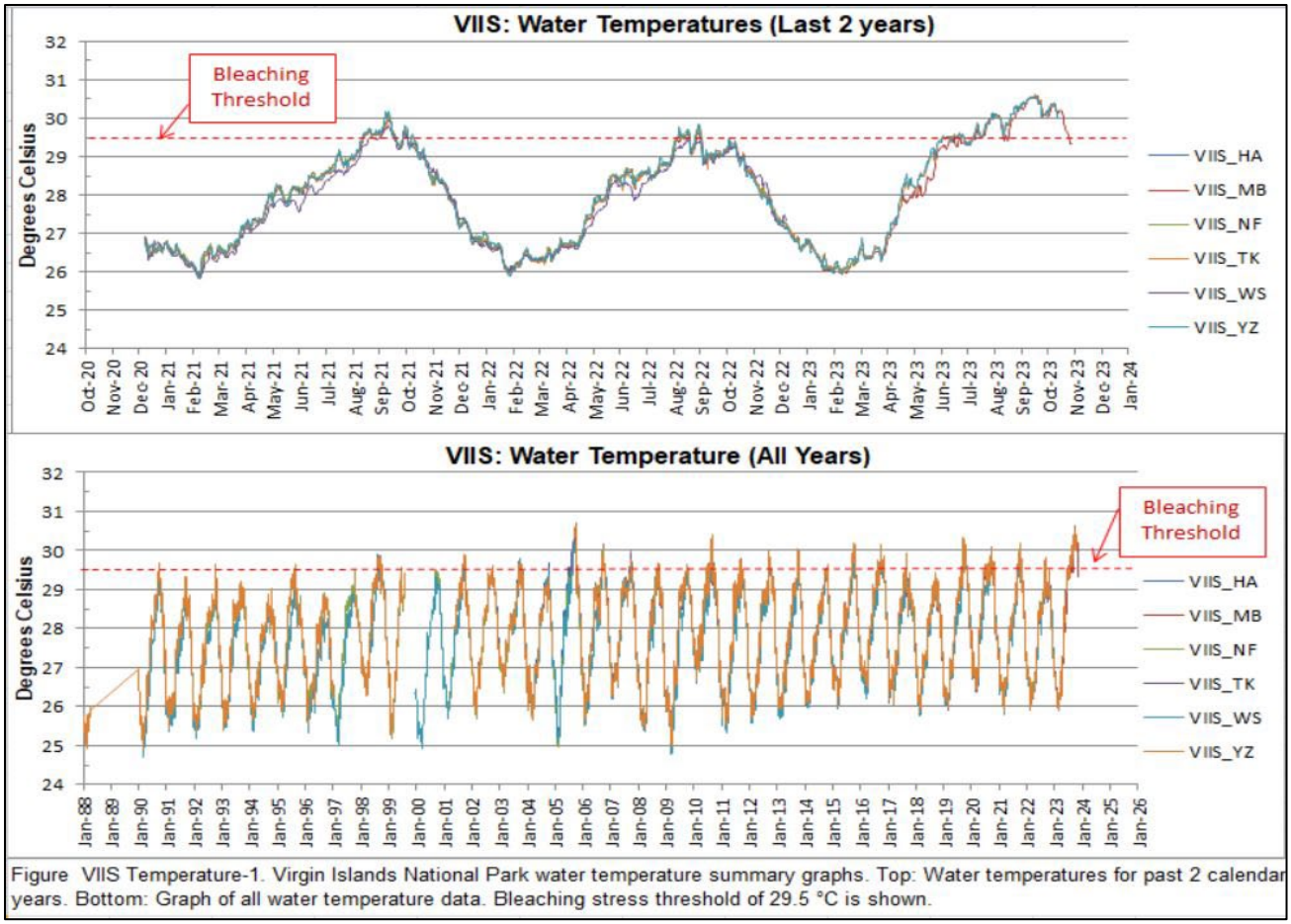


Figure VIIS Temperature-1. Virgin Islands National Park water temperature summary graphs. Top: Water temperatures for past 2 calendar years. Bottom: Graph of all water temperature data. Bleaching stress threshold of 29.5 °C is shown.

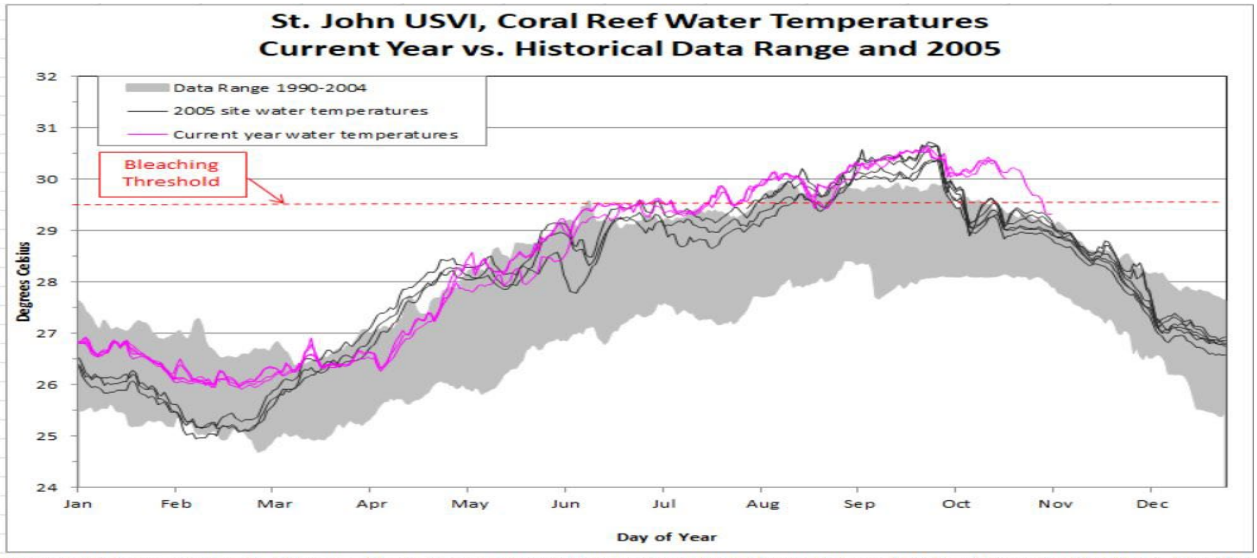


Figure VIIS Temperature-3. The current year's water temperature for Virgin Islands National Park compared with 2005 (a horrific bleaching year) and the 1990-2004 range of daily average temperatures for all sites.

6.07 Terrestrial Resources

The project does not intend to conduct any major construction, earth change, grading or digging for this project within the property or easement to shore. A manhole transition structure will be constructed at the shoreline to connect the submarine cable underground to the existing conduit with existing cables.

An existing conduit will be used to winch the cable through the easement and to the telecommunications building.

A review of the landside area of this project, which includes the shoreline transition, the public road and shoulders, and the project property itself was conducted to assess potential terrestrial resources that may be affected by the project. All terrestrial areas that will be within the project boundaries are already developed, or will not be touched, with the exception of the shoreline manhole.

Adjacent to the property, and within the property itself are several acres of brushland. However, these areas will not be removed or trimmed in the course of installing the cable. No observed wildlife or plant species were observed in the project area.

The ESI Map and IPaC assessment tool note potential nesting beaches for endangered and threatened species of sea turtles along the inner-most beachline of the bay. While the shoreline transition point is outside this area, it will require evaluation for signs of nesting before construction commences.

Particularly near the coast, it is necessary to consider temporal changes to habitat and wildlife patterns since many areas are habitats of species at certain times of the year that react sensitively to disturbances. These include resting grounds during bird migration, wintering and molting areas, feeding and coastal breeding habitats, and migration of sea turtles and sea mammals (OSPAR 12/22/1, Annex 14).

6.08 Wetlands

The U.S. Army Corps of Engineers defines wetlands as "those areas that are periodically inundated or saturated by surface or groundwater at a frequency and duration sufficient to support and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, bogs, marshes and similar areas." (Environmental Laboratory, 1987).

There are no terrestrial wetlands within or near the project area.

6.09 Rare and Endangered Species

The known rare and endangered species identified within the project area are noted in Section 6.06.

The ESI map indicated variety of marine and terrestrial species including crab, waterfowl, wading birds, seabirds, and shorebirds. Of the bird species, three are considered endangered by the state including the Caribbean Coot (*Fulica caribaea*), ruddy duck (*Oxyura jamaicensis*), and white-cheeked pintail (*Anas bahamensis*) all of which breeds and nests all year round.

Furthermore, there are indicators of fish, octopus, gastropod (i.e., conch), lobster, and dolphin and whale present in nearshore and shelf waters, such as closer to Outer Brass Island near the cable route. Of the

whale species, the humpback whale is considered federally endangered, breeding near these waters around the months of November to May.

In addition, two plant species considered endangered, the *Manilkara bidentata* and the *Tillandsia lineatispica,* were noted on the ESI near the vicinity of the project area. Both the ESI map and the U.S. Fish & Wildlife Information for Planning and Consultation (IPaC) website tool indicates that the hawksbill sea turtle (*Eretmochelys imbricata*), the leatherback sea turtle (*Dermochelys coriacea*), green sea turtle (*Chelonia mydas*), loggerhead sea turtle (*Caretta caretta*), and the Olive Ridley sea turtle (*Lepidochelys olivacea*) have been spotted swimming in the waters of Magen's Bay directly adjacent to the project area and further out. These species are listed as endangered and/or threatened on both the state and federal lists.

The IPaC webtool indicates that the West Indian Manatee (*Trichechus manatus*), a threatened species, has been found in the waters near the project site and the Virgin Islands Tree Boa (*Chilabothrus granti*) as an endangered species of reptile in the area.

In-water work will require a Water Quality Monitoring Plan that includes mitigation for sea turtles that may also be impacted by vessels and cable placement during construction. During construction of the project in order to minimize and abate impacts to the listed turtle species, NMFS's construction conditions will be followed.

To avoid and minimize injury or death to marine mammals and sea turtles, the following NMFS measures from the Vessel Strike Avoidance Measures and Reporting for Mariners will be implemented by all vessels associated with the project construction. All divers, captains and workers assisting during the in-water installation portions will be trained on the following:

1. Vessel operators and crews should maintain a vigilant watch for marine mammals and sea turtles to avoid striking sighted protected species.

2. When whales are sighted, maintain a distance of 100 yards or greater between the whale and the vessel.

3. When sea turtles or small cetaceans are sighted, attempt to maintain a distance of 50 yards or greater between the animal and the vessel whenever possible.

4. When small cetaceans are sighted while a vessel is underway (e.g., bow-riding), attempt to remain parallel to the animal's course. Avoid excessive speed or abrupt changes in direction until the cetacean has left the area.

5. Reduce vessel speed to 10 knots or less when mother/calf pairs, groups, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. A single cetacean at the surface may indicate the presence of submerged animals in the vicinity; therefore, prudent precautionary measures should always be exercised. The vessel should attempt to route around the animals, maintaining a minimum distance of 100 yards whenever possible.

6. Whales may surface in unpredictable locations or approach slowly moving vessels. When an animal is sighted in the vessel's path or in close proximity to a moving vessel and when safety permits, reduce speed and shift the engine to neutral. Do not engage the engines until the animals are clear of the area.

There may be a requirement for pinning or anchoring the cable in hardbottom areas, though it is anticipated these sections will comprise a very small percentage of the total cable path, less than 2.4%.

Sound in water moves four times faster than in air, and attenuation (sound dissipation) is much lower in water than air. Esonification of the marine environment can have a negative impact on sea turtles, marine mammals and fish. To minimize noise impacts to these species a vibratory hammer will be used to drive pins or anchors wherever possible. Vibratory hammers are recommended by NOAA as they have a lower acoustic impact.

6.10 Air Quality

No effects to air quality are anticipated as a result of the proposed project. There is no anticipated earth movement, and the use of vessels or heavy equipment in near-shore waters will be minimal.

7.00 IMPACT OF THE PROPOSED PROJECT ON THE HUMAN ENVIRONMENT

7.01 Land and Water Use Plans

The project will be connecting to existing infrastructure, following a similar approach and pathway as existing telecommunication cables. It will enter through the same transition point, installed into a new manhole structure, and be winched through an existing conduit to an existing building. No visual changes, expansion of the property or business, or change to land cover/use is anticipated, and no changes to any future land or water use plans is anticipated.

7.02 Visual Impacts

The project location is currently an AT&T telecommunications station, and the proposed project will connect an additional cable to existing underground conduit through the construction of a shoreline manhole structure. This structure will have little to no effect on the current aesthetics as this structure will be nearly flush with the surface and be minimally sized for simple access.

7.03 Impacts on Public Services and Utilities

a. Water

As noted in Part 6.04, the project will not use nor affect significant amounts of water, either from public supply or otherwise. No municipal water sources exist in this area, and the project will have no negative impact on the availability of public water.

b. Sewage Treatment and Disposal

There are no public sewage utilities in the area. The project will not affect the amount of sewage generated in the area. No expansion of the business or structures is anticipated, and the additional cable installation is not anticipated to change the staffing needs or expectations in the building.

c. Solid Waste Disposal

Domestic solid waste will be managed with onsite waste bins. It will be trucked out by a licensed waste hauler as necessary and disposed of in accordance with local and federal solid waste requirements.

d. Roads, Traffic, and Parking

During the proposed work, an insignificant number of additional vehicles will use the main road leading to the project site, Peterborg Road as part of construction. This will only be routine traffic to and from the work site. During project implementation, vehicles will be parked in the private lot on the subject

property, owned by AT&T of the Virgin Islands, Inc., where the project is located, and is not anticipated to change.

e. Electricity

There are no proposed electrical systems required for the cable line installation. All existing electrical needs for system capability are already provided at the site.

f. Schools

There are no anticipated adverse effects on the local educational system during project implementation. Ultimately, there will be no effect to the schools in the long term. A positive long-term affect will be better communication technology and infrastructure for all residents, including school-age children to be better connected to the world outside of St. Croix, USVI.

g. Fire and Police Protection

Any nighttime work will provide adequate lighting for worker safety. In the case there is an emergency, the Omar Brown Sr. Fire Station and the Virgin Islands Police Department are located less than four miles from the project site. There are several parking spots on-site for emergency vehicles, if needed.

There are no anticipated long-term burdens or increase in fire or police services. The facility is fenced and gated, and under 24-hour security, and will not change post-construction.

h. Public Health

The project will not have any adverse effect on public health, nor increase the use of public health facilities.

7.04 Social Impacts

This project has the potential to achieve a greater flow of information through public services and utilities that rely on higher telecommunication reliability thus benefiting the social lives of their consumers. Overall, it helps with the development of a regional sense of community through greater equality of information sharing across geographical regions and across groups in society.

7.05 Economic Impacts

The most notable effect is the increase in productivity and capacity. This is due to the level of individuals and organizations generated by advances in communications, connectivity and efficient access to information. Increased telecommunications in the region can create substantial amounts of consumer surplus and generate new employment opportunities particularly in remote areas as it enables a large number of workers to work from home (i.e. telecommuting) and thus reduces the challenges that come

with distances. For existing businesses, more transmission for data and voice call can result in an improvement of business performance as well as create opportunities for expansion.

7.06 Impacts on Historical and Archeological Resources

The project boundaries will be restricted to only areas that have already been evaluated and found to contain no notable archaeological resources or findings, and therefore is not expected to have any negative impact on Historical or Archaeological resources of the USVI. Should any suspected or known resources or artifacts be discovered during the development of the site, the developers will immediately notify the State Historical Preservation Offices to evaluate the findings.

7.07 Recreational Use

The project itself will not inhibit nor promote recreational activities in the vicinity of the project. The Environmental Sensitivity Index Map provided in Section 6.06 (Figure 6.06.1) indicates recreational fishing is a popular activity in the vicinity of the proposed project. Placement of cable on the surface of the seafloor may leave potential for impacts from fish pots, boat anchors or other impacts caused by fishing or boating activities. However, existing cables have run through this area for years and the potential impacts are low and not anticipated to hinder the recreational use of the area.

7.08 Waste Disposal

Any and all construction debris will be collected in appropriate roll-off containers to be transported and disposed of by a licensed waste-hauler, in accordance with solid waste requirements. Any unused or contaminated chemicals or materials will be disposed of in accordance with waste handing regulations.

7.09 Accidental Spills

Spills are not anticipated for this project. Any vessels used to guide and place cable in shallow water will be monitored for any potential spills of oil or fuel. Lubrication or chemicals will not be used for this project as an existing bore will function as the route for the cable, and drilling is not required.

7.10 Potential Adverse Effects which cannot be Avoided

The laying of cables, both telecommunication, power, or other utility types, can cause temporary damage, displacement, disturbance or stress to the seabed and marine flora/fauna, increased turbidity, and potentially release contaminants and cause alteration of sediments (Figure 7.10.1). Seabed disturbance that may impact benthic organisms can be controlled through the use of turbidity curtains and careful and methodical cable placement, but even with a high level of care, sediment plumes within the project area are expected and cannot be eliminated.

Underwater noise is most relevant for marine mammals, though may affect fish and benthic habitat. While use of low impact equipment to minimize noise will be essential, elimination of all noise or impact from

sound is unavoidable. Care to ensure all sensitive wildlife is outside the project impact area will be employed to ensure a minimization of negative impact.

The cable is anticipated to self-bury over time but will still be visible in areas with hard substrate. The visual impact will be minimal to both recreational users and marine habitat but will not be eliminated as the proposed approach is to not bury the cable.

Phase	Installation, maintenance, repair work and removal	Operational phase
Submarine Telecommunication cable	Seabed disturbance	Introdution of artificial hard surbstrate
	Damage/disturbance of organisms	
	Re-suspension of contaminants	
	Visual disturbance	
	Noise (Vessels, laying machinery…)	
	Emissions and wastes from vessels	

Figure 7.10.1 – Main Environmental Impacts Associated with Submarine Cables (IXSUREVEY, 2010)

These effects are mainly restricted to the installation, repair works and/or removal phase and are generally temporary. In addition, their spatial extent is limited to the cable corridor. Some mobile benthos can avoid disturbance, but smaller benthic communities may be impacted in the short-term. The duration, spatial extent and level of suspended sediment associated with route clearance and cable installation in this project are unlikely to cause such problems with turbidity and water clarity (IXSURVEY, 2010). Nevertheless, turbidity levels will be minimized during cable lay operations by minimizing the duration and extent of physical seabed disturbance with the use of turbidity curtains and an efficient work schedule.

At the landing location there will be a small amount of construction work and environmental impact associated with the cable installation and construction of the onshore facilities. Much of this impact will be typical of general construction activity, resulting in short term waste generation and nuisance impacts (Noise, air quality, etc). (IXSURVEY, 2010).

8.00 MITIGATION PLANS

There is no anticipated loss or damage to sea life, benthic or otherwise, and no mitigation plans are needed for this project and operation.

9.00 ALTERNATIVES TO PROPOSED ACTION

The telecommunications needs of St. Thomas, the USVI and the world are expanding and increasing due to increased number of and reliance on services that require high-speed internet. The current telecommunication bandwidth is currently limited and in a do-nothing scenario will soon be a limiting factor in productivity of the St. Thomas community. As computer use increases, both in the population as well as percentage of individual use, reliability and stability of the network will start to decrease, and network speeds will reduce. Assuming that no other cable was installed, in this scenario the region would continue to be constrained by the lack of telecommunications capacity. The demand for capacity would continue to grow along with the overall economic growth (IXSSYSTEM, 2010)

Another alternative is to use wireless ways to increase bandwidth and the telecommunication system on the island, such as satellite or microwave tower transmissions. However, the use of fiber optic networks has a number of advantages over satellite and microwave transmissions. Radio has largely been phased out due to restricted bandwidth and poor data transmission while modern fiber optic networks transmit high volumes of voice and data traffic with higher security and reliability and at lower cost than satellite systems. Cable also has a more dependable installation and repair record. Bandwidth demand, particularly as a result of internet activity far exceeds satellite capacity (Hogan and Hartson, 1999).

An alternative to the placement of the existing cable is to install in another location that has little to no benthic life on the seafloor, and little to no critical areas for protection of environmental resources or recreational uses. However, that would require the installation of new bores, or construction of some form of shoreline transition structure, as well as all new shoreline infrastructure and buildings to house the land hub that would connect to the existing telecommunications system. The massive increase in construction and/or drilling and digging requirements will far outweigh the small and temporary impact to marine life found in the project area and cable path proposed.

Lastly, burying the cable along the entire route as opposed to surface placement was considered. This would require, however, more seafloor disturbance, first by ROV in deeper waters, and then by divers assisted by equipment to dig, cut or bore a trench to bury the cable along the intended path. This would increase suspension of sediments and construction time significantly, for a small benefit of having the cable buried. With careful placement of the cable, and pinning or anchoring where necessary, there is no anticipated impact in the long-term of having an exposed cable.

10.00 RELATIONSHIPP BETWEEN SHORT & LONG TERM USES OF MAN'S ENVIRONMENT

The cable is designed, and path planned to have the least amount of impact to marine life, environmental resources and recreational uses. Most of the impacts will be temporary and short term during the placement and installation of the cable and pinning or anchoring for long term use. Once in place, the cable will require minimal to no maintenance, and have no effect on existing or future marine or terrestrial habitats in the project area. As a result of this project, St. Thomas will have a significant improvement to the existing telecommunication capabilities with minimal impact to existing natural, cultural or functional resources of the island.

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EGS SURVEY REPORT

SURVEY REPORT
FOR CABLE ROUTE DESIGN AND ENGINEERING

FOR

TRANS CARIBBEAN FIBER SUBMARINE CABLE SYSTEM (TCFS)

SEGMENT BUSTT

BU ST. THOMAS to BMH ST. THOMAS

Rev	Date	Description	Prepared by	Checked by	Approved by
0	18 May 2022	Preliminary	Jacky Lee	-	Even Mak

EXECUTIVE SUMMARY

Submarine Cable System: Trans Caribbean Fiber System (TCFS)

Segment: BUSTT

Connection: BU St. Thomas to St. Thomas

Cable length: 23.390km

Client: LW Subsea Inc.

Surveyed by: EGS Survey Pte. Ltd.

Landfall survey date: NA

Inshore survey date: 9th to 10th May 2022

Vessel: *SL GR-2 (SL GR-2)*

Offshore Survey date: 8th to 11th May 2022

Vessel: *RV Geo Resolution* (*RV GR*)

Cable crossing: 9 IS, 24 OOS, 0 P

Pipeline crossing: 0 IS, 0 OOS,0 P

Burial: 1.0m

RPL: TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls

The Trans Caribbean Fiber Submarine Cable System (TCFS) configuration comprises a trunk linking Vero Beach, USA to St. Croix, USVI with branches connecting Panama, Colombia, Puerto Rico, St. Thomas (USVI) and Tortola (BVI). Its configuration comprises the following segments:

Segment VBSTC: Vero Beach, USA to St. Croix, USVI

Segment BUPUR: BU Puerto Rico to San Juan, Puerto Rico

Segment BUTOR: BU Tortola to Tortola, BVI

Segment BUSTT: BU St. Thomas to St. Thomas, USVI

Segment BUPAN: BU Panama to Panama

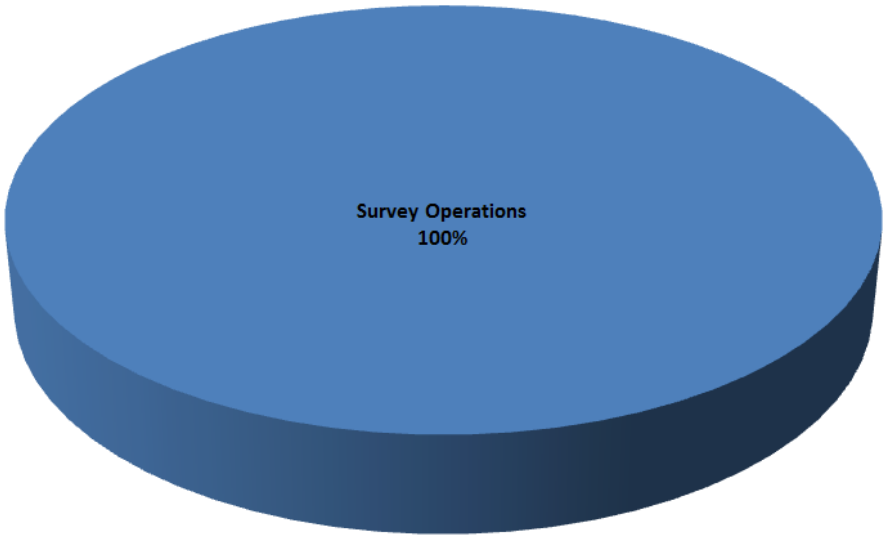
Segment BUCTG: BU Colombia to Cartagena, Columbia

Segment BUBAQ: BU Colombia to Barranquilla, Columbia

This report discusses the survey results achieved by *RV Geo Resolution* and *Survey Launch GR-2* along TCFS Segment BUSTT. The total route length of the TCFS Segment BUSTT is 23.390km.

The report comprises descriptive text and charts showing the bathymetry, geomorphology and shallow seabed geology along the route, together with appendices of supporting information.

Breakdowns of the survey operations by *RV Geo Resolution* and *Survey Launch GR-2* are presented below.



Summary diagram of Segment BUSTT offshore and inshore survey operations by the *RV GR* and *SL GR-2*

The following table summarizes the operations performed by the landfall and inshore survey team and the offshore vessel *RV Geo Resolution*.

Vessel/Landfall	SSS	SBP	MBES	MAG	CPT	GC	GS	DIVER	TOPO	SBES
RV GR	✓	✓	✓	✓	-	-	-	-	-	✓
SL GR-2	✓	✓	✓	✓	-	-	-	-	-	-

The pre and post survey route position lists (RPLs) are discussed in **Section 3** of this report and are summarized below:

	Cable Type	Survey Route *2022-04-06_CX*	Post Survey Route	Change (km)
Overall Route	-	23.390	NA	-
Overall Cable	-	23.390	NA	-
By Cable Type	DA	NA	NA	-
	SA	NA	NA	-
	LWS	NA	NA	-
	LW	NA	NA	-

Four days were worked by the survey team in offshore area by *RV Geo Resolution* and three days for inshore area. There were no reportable incidents during the surveys.

Introductions for health and safety issues were given to all crew onboard within 24 hours of the survey operation for all survey crew. Safety drills were held regularly onboard the *RV Geo Resolution*. Job Hazard Analysis (JHA) meetings and pre job toolbox talks were held for the back deck operations.

The following table summarizes the hazards and issues encountered during the survey:

Hazards/Issues	Yes	No	Comments	Recommendations
Easy access to landing site			NA	NA
Obstacles along the land section of the route			NA	NA
Can the beach sustain an Excavator			NA	NA
Obstacles along the diver swim section of the route			NA	NA
Presence of CORAL reef		✓	None	None
Presence of seagrass	✓		Possible numerous marine growth KP22.4-KP23.3	Necessary precaution should be taken
Presence of ROCK on proposed route	✓		ROCK KP23.3-KP23.4 ROCK with intermittent sediments KP9.58-KP9.60 KP9.63-KP9.68 KP18.4-KP18.9 KP19.1-KP19.5 Veneer of Sediment over ROCK KP18.9-KP19.1 KP21.0-KP21.1	No burial; adequate cable protection
Presence of ROCK within target burial zone		✓	None	None
Presence of HARDGROUND on proposed route		✓	None	None
Presence of HARDGROUND within target burial zone		✓	None	None
Presence of pockmarks and gas seepage	✓		Depressions were locally observed KP0-KP12 Scattered depressions KP20.3-KP21.02	Plough/install with caution
Presence of very soft sediments with low bearing capacity		✓	None	None
Presence of sonar contacts within the survey corridor	✓		Debris Patch KP0.30-KP0.33 Area with scattered debris KP11.3-18.4	Debris clearance and route deviation if necessary

Hazards/Issues	Yes	No	Comments	Recommendations
			KP21.3-KP22.4 60 sonar contacts	
Presence of megaripples and sandwaves	✓		Megaripples KP9.58-KP9.60 KP9.63-KP9.68 KP19.5-KP19.8 KP19.96-KP20.03 KP21.0-KP21.1	None
Indication of slumping		✓	None	None
Presence of in-service cables crossing	✓		9 IS cables	Seek crossing agreement and as-laid cable information from cable owners
Presence of in-service pipelines crossing		✓	None	None
Presence of out of service cables/pipelines crossing	✓		24 OOS cables	Caution should be taken during cable installation
Indication of fishing activities (Trawl scars, FADs, etc...)		✓	None	None
High level of shipping activity		✓	None	None
The route traverses traffic separations schemes (TSS)		✓	None	None
Presence of anchorage areas along the route		✓	None	None
Presence of wrecks along the route	✓		1 possible wreck at KP23.27 (63m south of the route)	Avoid as far as possible
Presence of dumping areas along the route		✓	None	None
High level of military activity		✓	None	None
The route traverses military exercise areas		✓	None	None
The route traverses hydrocarbon concessions		✓	None	None
The route traverses mineral/sand extraction/dredging		✓	None	None
Risk of piracy		✓	None	None
Presence of adverse currents		✓	None	None
Occurrence of adverse weather (monsoon,		✓	Tropical cyclone seasons occurs	Pay attention to the weather forecast and

Hazards/Issues	Yes	No	Comments	Recommendations
typhoon, hurricane, etc…)			between June and November	seasonal currents before operations

REPORT LIMITATIONS

EGS has carefully interpreted, quality controlled and cross checked the data presented in the report and charts. Even so, it should be noted that survey results are subjected to physical limitations imposed by the equipment and methods used and are also affected by individual interpretation.

The accuracy of the survey data is based on the technical specifications and technical capabilities of the required/agreed survey systems. Survey equipment and software are kept up to date (where applicable), calibrated and maintained to manufacturer's specifications. The survey data has been correlated, edited and assessed in order to produce graphic and digital models as close to reality as possible. The interpretation is carried out by experienced personnel with appropriate academic qualifications.

All distances referenced in this report are based on the project geodetic projection and are not true distances on the earth's surface.

Contours and slopes are derived from the specified grid cell size of the processed Multi Beam Echo-Sounder (MBES) and Single Beam Echo-Sounder (SBES) bathymetry data. Processing parameters and sounding density are outlined in the technical specifications of the project.

Seabed morphological analysis based on Side Scan Sonar (SSS) images and MBES data gives a complementary presentation for localised terrain features. Due to equipment and operational constraints, such as the footprint size effect, sounding density limitation and safe altitude requirement of towed systems etc., the resolution degrades with increasing water depths and some small seabed features may not be fully resolved.

Geotechnical information used to derive sedimentology and stratigraphy can only be obtained at specific sample/in-situ test (Cone Penetration Test) locations. The lateral correlation and interpretation are carefully and appropriately performed by experienced geoscientists. However, there remains a risk that some sub bottom layers will remain undetected.

Magnetometer data are very sensitive to environmental conditions. When background noise is high in very shallow water environment or the tow sensor is too high from the seabed in irregular terrain, the data resolution may not be sufficient to identify small anomalies associated with some types of cable.

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DRAWINGS

North-Up Charts	Scale	Chart Numbers	Start KP	End KP	Book
Branching Unit Chart	1:50000	TCFS_BUSTT_BU001	0.00	2.38	-
Shallow Water Chart	1:10000	TCFS_BUSTT_NU001	0.00	4.82	-
Shallow Water Chart	1: 10000	TCFS_BUSTT_NU002	3.81	13.65	-
Shallow Water Chart	1: 10000	TCFS_BUSTT_NU003	12.42	22.46	-
Inshore Chart	1:5000	TCFS_BUSTT_NU004	19.69	23.39	-
Land Topographic Chart	1:1000	TCFS_BUSTT_NU005	22.89	23.39	-

Strip Charts	Scale	Chart Numbers	Start KP	End KP	Book
Strip Chart	1:10000	TCFS_BUSTT_SC001	0.00	23.39	-

ABBREVIATIONS

Abbreviation	Meaning
ABxx	As-Built
AC	Alter Course
AF	As-Found (cable)
AP	Articulated Pipe
AL	Alignment
ALxx	As-Laid
ASL	Archipelagic Sea Lanes
BAS	Burial Assessment Survey
BJ	Joint Box
BJT	Technical Joint Box
BMH	Beach ManHole
BP	Beach Probe
BS	Beach Sample
BU-xxx	Branching Unit
CA	Cable Allowance (Beach/Final Splice)
CB	Concession Block
CC	Cable Corridor
CD	Chart Datum
C.M.	Central Meridian
cm	Centimeter
CPT	Cone Penetration Testing
CR	Client Representative
CRE	Cable Route Estimate
CRS	Cable Route Study
CT	Comment
CX	Cable Crossing
CZ	Contiguous Zone
DA	Double Armor
DB	Database Position
DD MM.mmm	Degrees minutes. decimal minutes
DE	Duct End
DGPS	Differential Global Positioning System
DP	Diver Probe
DPR	Daily Progress Report
DS	Diver Sample
DS	Duct Start
DTM	Digital Terrain Model
DTS	Desk Top Study
EA	Earth Plate
EEZ	Exclusive Economic Zone
EOB	End of Burial
EZ	Economic Zone
FAD	Fishing Aggregation Device
FS	Final Splice
FZ	Fishing Zone
GC	Gravity Core

Abbreviation	Meaning
GcGPS	Globally Corrected Global Positioning System
GPS	Global Positioning System
GS	Grab Sample
HDD	Horizontal Directionally Drilled
HOP	Hand Over Point
hPa	hectoPascal
HSE	Health and Safety Executive
HWM	High Water Mark
ID	Identification name/number
IFSR	Infield Selected Route
IS	In-Service (cable)
IS	Initial Splice
kHz	kiloHertz
KM	Kapal Motor
km	kilometer
kPa	kiloPascal
KP	Kilometer Point
LAT	Lowest Astronomical Tide
Lat	Latitude
LC	Land Cable
Long	Longitude
LP	Landing Point
LW	Lightweight
LWM	Low Water Mark
LWP	Lightweight Protected
m	Meter
MAG	Magnetometer
MB	Maritime Boundary
MBES	Multibeam Echo Sounder
MC	Magnetic Contact
MCB	Mineral Concession Block
MCPT	Miniature Cone Penetrometer System
MDA	Medium Double Armor
ML	Mean Level
MPa	MegaPascal
MSL	Mean Sea Level
MV	Motor Vessel
NA	Not Applicable
nmh	No measurable height
NU	North Up
OCB	Oil Concession Block
OOS	Out of Service (cable)
OV	Overview Chart
PC	Planning Chart
PEP	Project Execution Plan
PLB	Post Lay Burial
PLDN	Plow Down
PLGR	Pre-Lay Grapnel Run

Abbreviation	Meaning
PLI	Post-Lay Inspection
PLIB	Post-Lay Inspection and Burial
PLN	Planned (cable)
PLUP	Plow Up
PL-xxx	Post Load
POL	Point on Line
POW	Plan of Work
PSR-xxx	Post Survey Route
PWC	Plow with Caution
PX	Pipeline Crossing
REH	Route Engineering Handbook
RPL	Route Position List
R-xxx	Repeater
ROV	Remotely Operated Vehicle
RTCM	Radio Technical Commission for Maritime Services
RTK	Real Time Kinematics
RV	Research Vessel
S xx	Segment xx
SA	Single Armor
SAL	Single Armor Light
SBES	Single Beam Echo Sounder
SBP	Sub-bottom Profiler
SC	Slack Change
SC	Sonar Contact
SCB	Sand Concession Block
SDMP	Seabed Data Management Package
SEI	Seismic Contact
SEQ-xxx	Shape Equalizer
SJ-YYY-xxx	Ship Joint
SLD	Straight Line Diagram
SOB	Start of burial
SOW	Scope of Work
SRxx	Survey Route
SSE	Separate Shore End
SSS	Side Scan Sonar
ST	Seabed Temperature
SVP	Sound Velocity Profile
TEQ-xxx	Tilt Equalizer
TM	Transverse Mercator Projection
TR	Transition
TS	Terminal Station
TS	Territorial Sea
TSS	Traffic Separation Scheme
TW	Territorial Waters
UCS	Unconfined Compressive Strength
USBL	Ultra Short Baseline
UTM	Universal Transverse Mercator
WD	Water Depth

Abbreviation	Meaning
WGS84	World Geodetic System 1984
XBT	Expendable Bathythermograph

DEFINITIONS

Terminology	Definition
Customer	LW Subsea Inc.
Survey contractor	EGS Survey Pte. Ltd.
Acoustic penetration	The ability of acoustic waves to travel through the subsurface.
Acoustic reflector	A subsurface that causes the velocity of seismic waves to change.
Beach landing areas	The area immediately surrounding the Beach Manhole location extending down to the LWM Landing Point (Shoreline). This is also referred to as the onshore area.
Bedding/layering	A stratified or layered feature associated with sedimentary rocks and/or loose sediments.
Bedform	Any oscillatory topographic deviation from a flat seabed produced by fluid movement including wave and current activity, generally in a sandy domain.
Bedrock	The solid rock lying beneath superficial material such as gravels or soils.
Boulder	A separated rock mass larger than a cobble, having a diameter greater than 200mm. It is rounded in form or shaped by abrasion.
Burial Area	All segments. From shore to 500m WD where burial is possible, except the route off Vero Beach and Puerto Rico. No burial off Vero Beach and Puerto Rico.
Carbonate	A mineral type containing the carbonate radical (CO_3).
Chart Datum	A level so low that the tide will not frequently fall below it. British Hydrographic Office interprets it as the approximate level of Lowest Astronomical Tide (LAT).
Clay	A complex mineral assemblage with particle size <0.002mm.
Coarse sediment	Sediment composed of mainly sand and gravel.
Cobble	Detrital sediment with particle size between 63mm and 200mm diameter.
Cohesive sediment	Sediments, typically clay and/or silt that resist separation due to the nature of bonds between fine-grained particles.
Concretion	Lumps or nodules found in loose sediment, rounded or irregular in shape, usually harder than the surrounding medium.
Continental shelf	A gently sloping, shallow-water platform extending from the coast to a point where there begins a comparatively sharp descent down the continental slope to the Abyssal floor.
Coral reef	Hard material composed predominantly of corals and calcareous algae.

Terminology	Definition
Corestone	Rounded boulder, occurring individually or in piles at the ground surface, or in exposed sections. It results from an initial phase of subsurface chemical weathering, of a joint-bounded block, followed or accompanied by surface erosion that exposes the corestone.
Debris	Sonar contacts attributed to human activity. Generally angular and distant from areas of rock outcrop and high energy environments.
Deep water areas	Water depths greater than 1,000m.
Diagenesis	Process by which chemical and physical properties of soils change.
Escarpment	A high continuous cliff or long, steep slope situated between a lower, more gently inclined surface and a higher surface.
Fine sediment	Sediment composed mainly of silt and clay.
FAD	A fish-aggregating device comprising a sinker/weight with lines and attached buoys, possibly palm fronds designed to attract fish.
Gas seepage	Escape of fluids (gas) from the seabed.
Gravel	An unconsolidated accumulation consisting of particles larger than sand (diameter 2mm - 63mm).
Hardened seafloor (Hardpan/Hardground)	Loose sediment covering the seafloor partially affected by diagenetic processes that produce a hard surface (with variable geotechnical properties).
Inshore Water Areas	Nominally those areas shallower than 15m or shallower than the safe working limit of the primary survey vessel.
Induration	Process where soft sediment becomes hard rock
LAT	This is the lowest level to which sea level can be predicted to fall under normal meteorological conditions and under any combination of astronomical conditions. LAT is not an extreme level, as meteorological conditions can cause a lower level: the level under these conditions is known as a storm surge or negative surge.
Loose sediment	Not cemented sediment, either cohesive or not.
Megaripples	Undulations produced by fluid movement (waves and currents) over sediments, generally with wavelength of 0.5m to 25m.
Offshore water areas	Water depths from 15m or the safe working limit of the primary survey vessel to maximum water depths.
Overlaps	500m between Shallow Water and Deep Water Surveys and also between Inshore Water and Shallow Water surveys
Plateau	A comparatively flat-topped seafloor elevation, usually rising at least 200m above its surroundings.

Terminology	Definition
Pockmark	Shallow seabed depression typically several ten meters across and a few meters deep. Generally formed in soft fine-grained seabed sediments by the escape of fluids (gas and/or liquids) into the water column.
Quartz	Crystalline silica, SiO_2, the principal mineral in unconsolidated sand and gravel.
Ridge	A long narrow raised portion of the seafloor, relatively to its surroundings.
Ripples	Undulations (wavelength < 0.5m) produced by fluid movement (waves and currents) over sediments.
Rock outcrop	Rock that is exposed at the seafloor.
Sand	A detrital particle larger than a silt grain and smaller than a gravel, having a diameter in the range of 0.063mm to 2mm.
Sand Concession	Sand Extraction License
Sandwaves	Undulations produced by fluid movement (waves and currents) over sediments, generally with wavelength > 25m.
Silt	A detrital particle, finer than very fine sand and coarser than clay, in the range of 0.002mm to 0.063mm.
Shallow water areas	Water depths from 15m to the end of burial.
Slumping area	The slipping or sliding down of a mass of sediment relatively soon after its deposition in a sub-aqueous slope.
Subcropping	Where a rock/basement lies within the project and area specific target burial depth.
Target burial depth	1.0m
Veneer	Superficial sediment too thin to be resolved with the seismic profiling system and may show as high reflectivity in side scan sonar data in the cases of soft/loose sediments over rock or hardground. The thickness is typically up to 50cm and could be significantly less than that in favorable surveying situations. Resolution of veneer depends on seismic profiler's dominant signal frequency, seabed nature, and weather conditions during the survey.

1 INTRODUCTION

1.1 Description

The Trans Caribbean Fiber Submarine Cable System (TCFS) configuration comprises a trunk linking Vero Beach, USA to St. Croix, USVI with branches connecting Panama, Colombia, Puerto Rico, St. Thomas (USVI) and Tortola (BVI). Its configuration comprises the following segments:

Segment VBSTC: Vero Beach, USA to St. Croix, USVI

Segment BUPUR: BU Puerto Rico to San Juan, Puerto Rico

Segment BUTOR: BU Tortola to Tortola, BVI

Segment BUSTT: BU St. Thomas to St. Thomas, USVI

Segment BUPAN: BU Panama to Panama

Segment BUCTG: BU Colombia to Cartagena, Columbia

Segment BUBAQ: BU Colombia to Barranquilla, Columbia

An overview of the TCFS submarine cable system is presented in **Figure 1**.

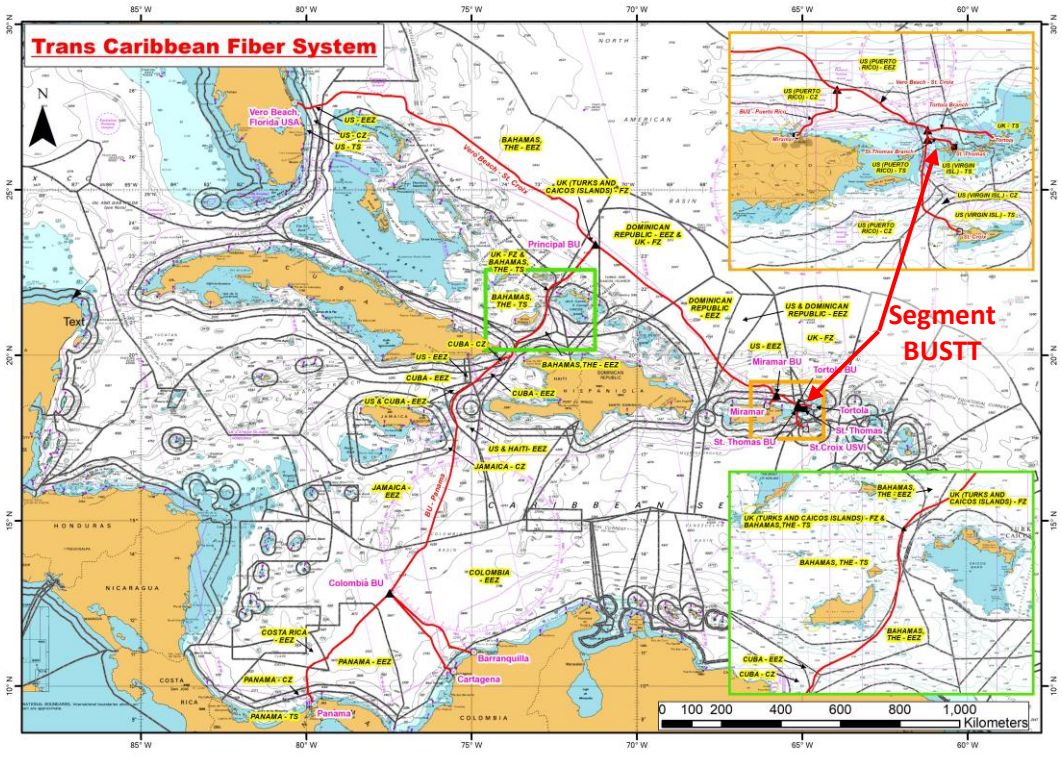

Figure 1: Overview of TCFS submarine cable system

1.2 Purpose

EGS was contracted by LW Subsea Inc. to supply topographic, hydrographic, geophysical and geotechnical survey services to provide data to enable LW Subsea Inc.to carry out engineering, construction and subsequent maintenance of the TCFS project. The primary objective of the cable route survey activities was to identify hazards and thereby allow LW Subsea Inc. to engineer a secure, technically and economically viable route for the system. This enables exact cable lengths, cable design and installation parameters to be defined to minimize problems over the designated service life of the system.

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2 SURVEY PROCEDURES

2.1 General

The TCFS Segment BUSTT survey comprised an investigation of the bathymetry, seabed features and shallow geology and a subsequent geotechnical sampling program along the survey route. Topographic surveys were executed at the landfall sites.

2.2 Project Survey Parameters

2.2.1 Geodetic Parameters

To minimize the scale factor associated with Mercator projection, the St. Thomas landfall survey operations were conducted using Universal Traverse Mercator Zone 20N with the parameters below:

Datum Parameters	
Datum	WGS-84
Spheroid	WGS-84
Semi-Major Axis (a) (meters)	6 378 137.000
Inverse Flattening (1/f)	298.257 223 563
Projection Parameters	
Grid Projection	UTM (Zone 20N)
Latitude of Origin of Projection	0° (Equator)
Longitude of Origin of Projection	63° W
False Easting (meters)	500 000
False Northing (meters)	0
Scale Factor along Central Meridian	0.9996

Table 1: Geodetic parameters for St. Thomas landfall survey

To accord with project specifications, all charts and reports are presented in Mercator projection with the geodetic parameters are summarized in **Table 2** below.

Datum Parameters	
Datum	WGS-84
Spheroid	WGS-84
Semi-Major Axis (a) (meters)	6 378 137.000
Inverse Flattening (1/f)	298.257 223 563
Projection Parameters	
Grid Projection	Mercator
Latitude of Origin of Projection	0° N (Equator)
Longitude of Origin of Projection	73° W
False Easting (meters)	1 000 000
False Northing (meters)	6 000 000
Standard Parallel	21° N
Scale Factor along Standard Parallel	1.000000 at Standard Parallel

Table 2: Geodetic parameters for the offshore survey and charting

To ensure the geographic transformation parameters were applied accurately, the numerical data was checked against the ones shown (if applicable) in **Table 3**.

Name	Input/Output WGS84 Geographical		Input/Output Mercator Grid	
Vero Beach, Florida, USA (Approx. BMH)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Miramar, Puerto Rico (BMH)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Tortola, British Virgin Islands (Approx. BMH)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Magens Bay, St. Thomas, US Virgin Islands (Cable Landing)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Bulter Bay, St. Croix, US Virgin Islands (BMH)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Barranquilla, Colombia (BMH)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Cartagena, Colombia (BMH)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Panama (BMH)	Latitude: Longitude:	1° 23.1870'N 104° 00.0160'E	Northing: Easting: Scale factor:	1 144 130.934 m 5 465 087.114 m 0.94033422
Origin at Standard parallel	Latitude: Longitude:	21° N 73° W	Northing Easting: Scale factor:	3 219 676.157 m 6 000 000.000 m 1.0000

Note: Positions are referred from the source listed as below.

Miramar (BMH), Magens Bay (Cable Landing) & Bulter Bay (BMH) are taken from *TCFS Landing Coordinates.pptx*
Vero Beach (Approxx BMH) is taken from *TCFS_Vero Beac-St.Croix_West_2021-12-02.xls* based on *TCFS-Routes_2021-12-02.shp*
Tortola (Approxx BMH) is taken from *TCFS_Tortola Branch_2021-12-02.xls* based on *TCFS-Routes_2021-12-02.shp*
Panama (BMH) is taken from Panama Landing Coordinates email dated 22-Dec-2021
Barranquilla (BMH) Cartagena (BMH) are taken from approx. existing cable point in the area

Table 3: Numerical data for checking transformation computation

2.2.2 Vertical Datum

The vertical datum for this project is Lowest Astronomical Tide (LAT).

2.2.2.1 Bathymetric data reduction

Shallow water bathymetry was reduced to Lowest Astronomical Tide (LAT) using the datum relationship and tide predictions calculated from the tide stations of Anegada, Tortola, Saint Thomas (Charlotte Amalie), Saint Thomas (Benner Bay) and Culebra. The particulars of the Tide Stations are shown in **Table 4**, as published in the Admiralty Tide Tables, Volume 2, 2022.

Harmonic Constants											
Port	Lat (N)	Lon (W)	Z0 (m)	M2 (°)	M2 (m)	S2 (°)	S2 (m)	K1 (°)	K1 (m)	O1 (°)	O1 (m)
Anegada (2460)	18°44’	64°23’	0.28	245	0.08	291	0.01	179	0.06	140	0.03
Tortola (2461)	18°26’	64°37’	0.44	266	0.06	312	0.01	164	0.07	157	0.05
Saint Thomas (Charlotte Amalie) (2462)	18°20’	64°55’	0.12	269	0.04	253	0.01	171	0.08	167	0.06
Saint Thomas (Benner Bay) (2462A)	18°19’	64°52’	0.13	272	0.04	259	0.01	168	0.08	167	0.06
Culebra (2464)	18°18’	65°17’	0.12	256	0.09	277	0.01	167	0.08	165	0.06

Table 4: Harmonic constants of the tide stations used for TCFS Segment BUSTT

In order to produce contours and bathymetry statistics (i.e. slope angles), the following grid cell sizes were used:

Area	Depth Range (m)	Cell Size (m)
Shallow Water	0-60	2

Table 5: Summary of grid cell sizes for bathymetric data presentation for TCFS Segment BUSTT

2.3 Summary of Survey Design

The survey plans were based on the survey Route Position Lists (RPLs) provided by LW Subsea Inc. The pre-survey RPLs are presented in Appendix A1 of this report.

The following criteria were agreed between LW Subsea Inc. and EGS representatives before the start of the survey.

Water Depth (LAT)	Survey Corridor Width	Survey Line Spacing	No. of Survey Lines	SSS Range	Nominal Vessel Speed
50m behind BMH to 0m	250m	NA	NA	NA	NA
0m to ~3m	10m	NA	NA	NA	NA
3m to 15m	500m	50m	9	75m	3-4 knots
15m to 20m	500m	75m	7	100m	3-4 knots
20m to 50m	500m	100m	5	125m	3-4 knots
50m to 500m	500m	125m	3	150m	4-5 knots
500m to 1,000m	500m	150m	3	200m	4-5 knots

Water Depth (LAT)	Survey Corridor Width	Survey Line Spacing	No. of Survey Lines	SSS Range	Nominal Vessel Speed
WD >1,000m	3x WD or 10km max.	NA	1	NA	Full survey speed
BU WD <200m	1km x 1km	TBC	TBC	TBC	TBC
BU WD 200m to 500m	2km x 2km	TBC	TBC	TBC	TBC
BU WD 500m to 1,000m	4km x 4km	TBC	TBC	TBC	TBC
BU >1000m	5x WD	TBC	TBC	TBC	TBC

Table 6: Summary of survey design for TCFS survey of Segment BUSTT

Sample/Data Type	Interval (km)
Grab Sample	0.5
Gravity Core*	10
CPT **	10

Table 7: Sampling interval for TCFS Segment BUSTT

Note:* If there are two (2) unsuccessful gravity core attempts with no recovery then one (1) grab sample will be acquired. A successful core requires the collection of at least 1.0m of material.

** If the CPT fails or refuses to penetrate to 1.0m, a second attempt is required.

2.3.1 Change of Scope of Work

In the commencement of the survey operations, projection execution plan (PEP), *R34722_TCFS_PEP_Rev2.doc*, was followed.

For the BU survey, the following survey design line plan has been agreed:

Water Depth (LAT)	Survey Corridor Width	Survey Line Spacing	No. of Survey Lines	SSS Range	Nominal Vessel Speed
BU <200m	1km x 1km	100m	9	125m	3-4 knots

These changes were discussed and deemed acceptable to the on-site Client Representatives.

2.4 Summary of Operations

EGS performed the TCFS Segment BUSTT survey by the *RV Geo Resolution* and the *Survey Launch GR-2*. The inshore and offshore survey was conducted from 8th to 11th May 2022.

The full daily progress reports (DPRs) are presented as Appendix A of this vessel-specific operational report, presented in Volume O. The sections below summarize the completed work.

2.4.1 Offshore Survey by the *RV Geo Resolution* and inshore survey (St. Thomas landfall) by *Survey Launch GR-2*

The following table is taken from the survey DPRs gives the breakdown of offshore and inshore survey operations performed by the *RV Geo Resolution* and *Survey Launch GR-2*.

Description	Total Hours	Total Percent
Survey Operations	62:19	100.0%
Sum Totals	**62:19**	**100.0%**

Table 8: Summary table of offshore survey operations by *RV GR* and inshore survey operations by *SL GR-2*

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3 RPL VERSIONS AND DEVIATIONS FROM THE SURVEY ROUTE

The survey RPL, *TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls,* was used to define the survey corridor for the start of Segment BUSTT survey operations by *RV GR* and *SL GR-2*. The survey RPL is presented in Appendix A1 of this report.

The survey RPL was also used to the determination of KPs, offsets and points on line within this report.

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4 SURVEY RESULTS

4.1 Introduction

The following narrative summarizes the topography, bathymetry, seafloor morphology and shallow seabed geology along the route. Examples of the survey records are provided to show distinctive features.

The British Standards BS 5930:2015 and International Standards ISO 14688-2:2004 are referenced to describe sediment samples and strength classification. A summary of the descriptive terms and definitions used is provided as Appendix B1 of this report.

For the purposes of reporting, the survey results have been described according to the areas surveyed:

1. Offshore shallow water survey from BU St. Thomas at 18°25.757'N, 65°7.334'W (KP0.0) in 51.5m WD to inshore/offshore HOP at 18°23.588'N, 64°56.794'W (KP20.0) in 31.2m WD

2. Inshore and St. Thomas landfall surveys from inshore/offshore HOP at 18°23.588'N, 64°56.794'W (KP20.0) in 31.2m WD to RPL BMH St. Thomas at 18°22.320'N, 64°55.700'W (KP23.4)

4.2 Offshore Shallow Water Survey

From BU St. Thomas at 18°25.757'N, 65°7.334'W (KP0.0) in 51.5m WD to inshore/offshore HOP at 18°23.588'N, 64°56.794'W (KP20.0) in 31.2m WD

The following table summarizes the operations performed within this survey area.

SSS contacts	MAG contacts	GC	GS	CPT
34	47	-	-	-

Table 9: Summary of contacts and samples in offshore shallow water survey

4.2.1 Samples

A nominal spacing of 10km was used as basis for establishing the seabed geotechnical programs. Locations were selected to ground truth the seabed to assist with the primary interpretation of the geophysical survey. These locations also factored route engineering concerns whenever possible.

No sampling was performed as the relevant permit was not obtained during the survey period.

4.2.2 CPT

A nominal spacing of 10km was used as basis for establishing the seabed geotechnical programs. Locations were selected to ground truth the seabed to assist with the primary interpretation of the geophysical survey. These locations also factored route engineering concerns whenever possible.

No CPT was performed as the relevant permit was not obtained during the survey period.

4.2.3 Sonar Contacts

Sonar contacts were identified as any anomalous target on the seabed that was not confidently attributed to a natural phenomenon. An interpretation was assigned to the target with the detail of that description being a function of how well the target was resolved and the characteristics observed.

A total of thirty four sonar contacts were identified within the survey area. All of them were identified as debris. The sonar contact summary is presented in Appendix D.

4.2.4 Magnetometer Contacts

Magnetic contacts were identified as any metallic objects detected by the magnetometer which was deployed close to the seabed during the in-service pipeline/cable crossing survey. An interpretation was assigned to the target with the detail of the magnetic anomaly dimension and the origin whenever possible.

A total of forty seven magnetic contacts were detected within the survey area during the magnetometer survey. Thirty of them are related to the IS and OOS cables, sixteen from the unknown origin and the remaining one as debris. The magnetic contact summary is presented in Appendix E.

4.2.5 Route Description

The BU box of BU St. Thomas was located on a very gentle seabed characterized with loose to dense silty SAND (**Figure 2**). Scattered sonar contacts identified as debris were mapped within the BU box. A debris patch was mapped in the eastern part of the box as a magnetic anomaly (TCFS-BUSTT-GR-MC001) was also identified in place. The BU St. Thomas is located at 18°25.757'N, 65°7.334'W (KP0.0) in 51.5m WD.

The route first heads to east for about 5km and alters course slightly to an east southeast direction. At around KP17, the route turns to the south southeast and heads towards the St. Thomas landing site. The seabed is generally very gentle except the two rocky areas in the vicinity of KP9.7 and KP18.6 where moderate to very steep slopes were observed (**Figure 3** and **Figure 4)**.

In the first 18km of the survey corridor, the seabed is predominantly characterized with loose to dense silty SAND. A rocky area was mapped in the northern part of the corridor around KP9.6 (**Figure 5**). Sonar contacts and scattered debris were observed more frequently when the route gets closer to St. Thomas Island. Occasional depressions were mapped within the corridor.

For the last 2km, rocky areas were dominant as a rocky step of 20m high grows across the corridor (**Figure 4**, **Figure 6** and **Figure 7**). Apart from the rocky area, loose to dense SAND is present with intermittent veneer cover of loose gravelly SAND and megaripples (wavelength: <2m, height: <0.5m).

With this section, thirty four sonar contacts were identified, all of them were marked as debris (**Figure 8**). Forty seven magnetic contacts were mapped and thirty of them are related to the IS and OOS cables (**Figure 9**), sixteen from the unknown origin and the remaining one as debris.

There are sixteen cable crossings in this section including three IS cables (AMERICAS 1 seg N, TAINO-CARIB and COLUMBUS 2 seg B) and ten OOS cables (St. Thomas-San Juan, US-Venezuela No2), St.Thomas-Dominican Republic, Florida-St.Thomas No2, Florida-St. Thomas No3, COLUMBUS 2 seg B, Florida-St.Thomas No1, COLUMBUS 2 Seg C1, AMERICAS 1 seg S1, BRUS, St.Thomas-St.Maarten-Curacao). The alignments of three IS cables and three OOS cables were identified by the magnetometer survey and one of them was also observed in the side scan sonar data. Details of the cable crossings are present in Section 6.1.

In this section, the route runs inside the United States Territorial Sea and it crosses United States 3nm line. Details of the maritime boundaries and special areas are present in Section 6.2.

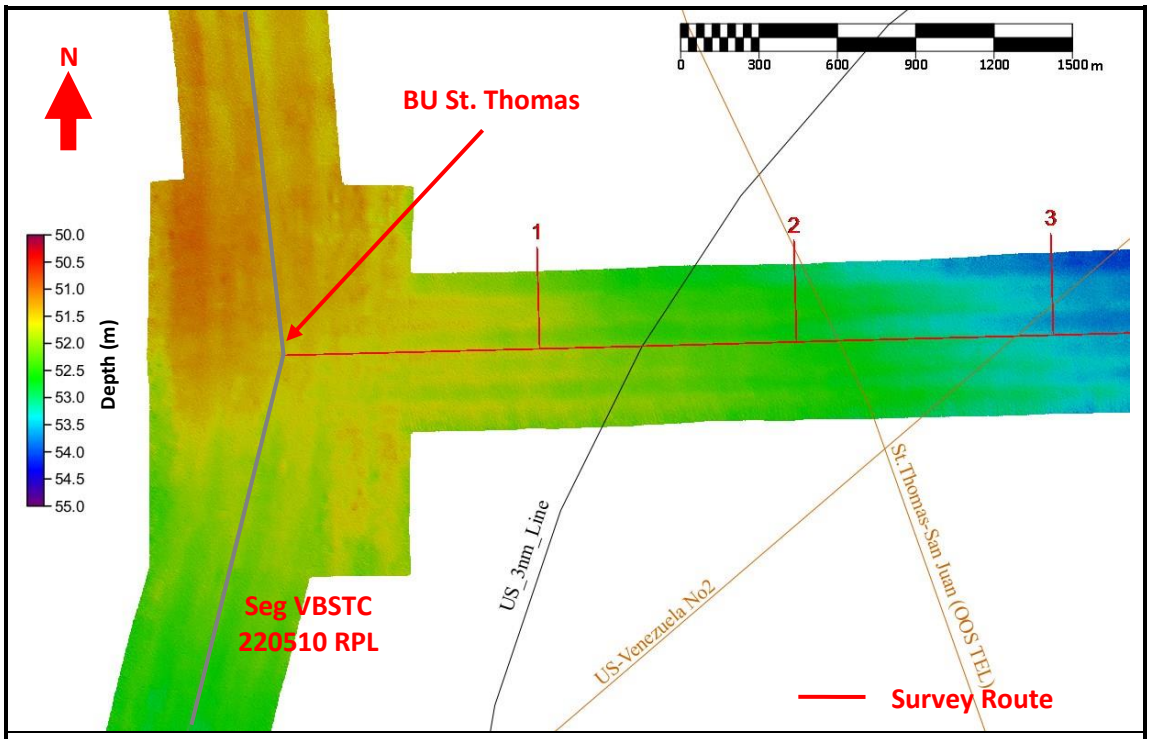

Figure 2: Sun-illuminated MBES data example between KP0 and KP3

NB: 1km between KP flags, vertical exaggeration x3

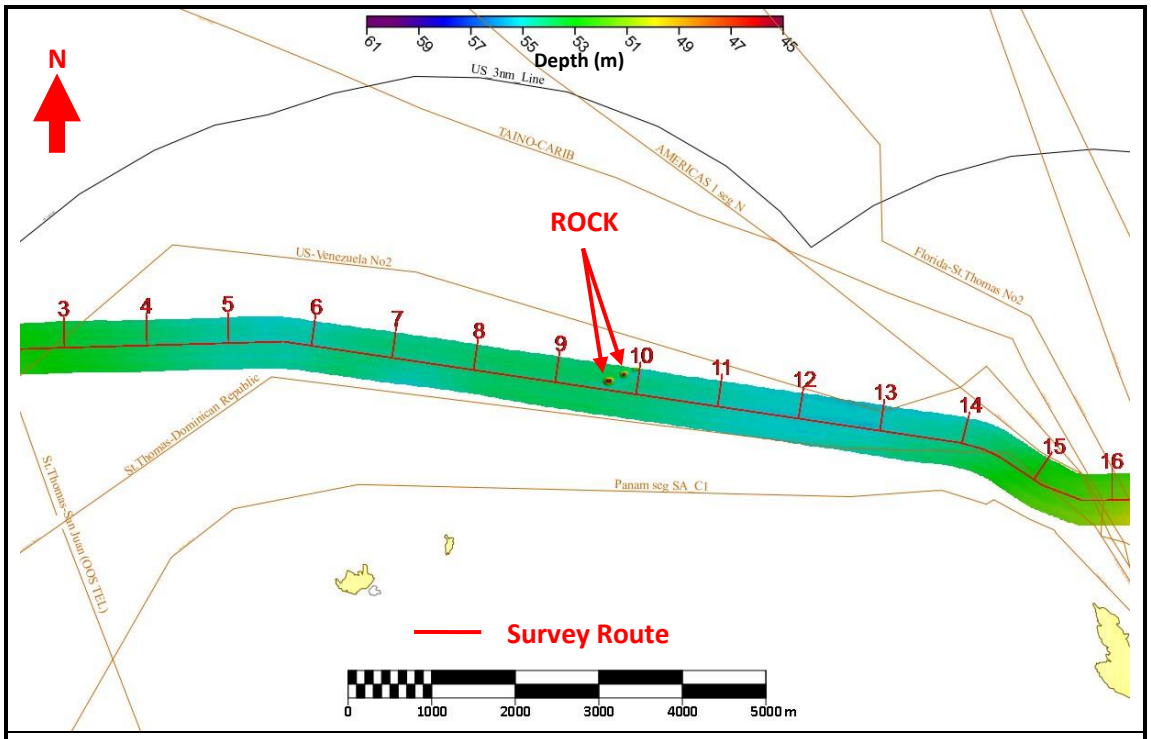

Figure 3: Sun-illuminated MBES data example between KP3 and KP16

NB: 1km between KP flags, vertical exaggeration x3

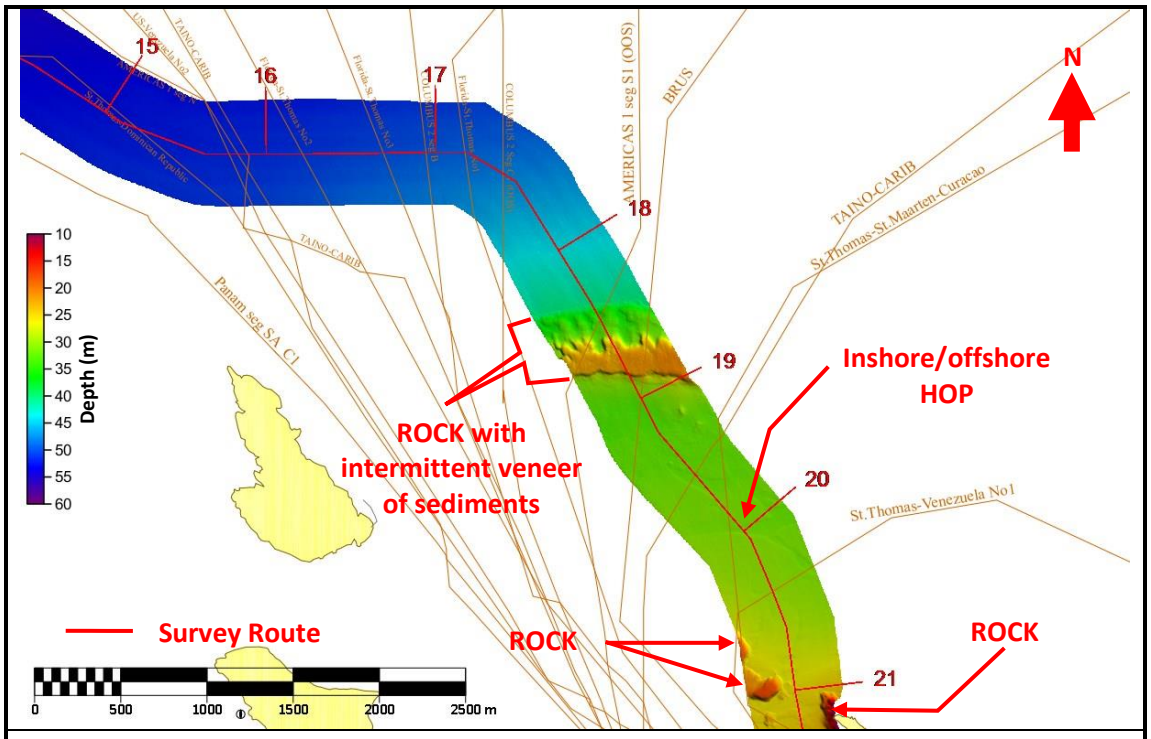

Figure 4: Sun-illuminated MBES data example between KP15 and KP21

NB: 1km between KP flags, vertical exaggeration x3

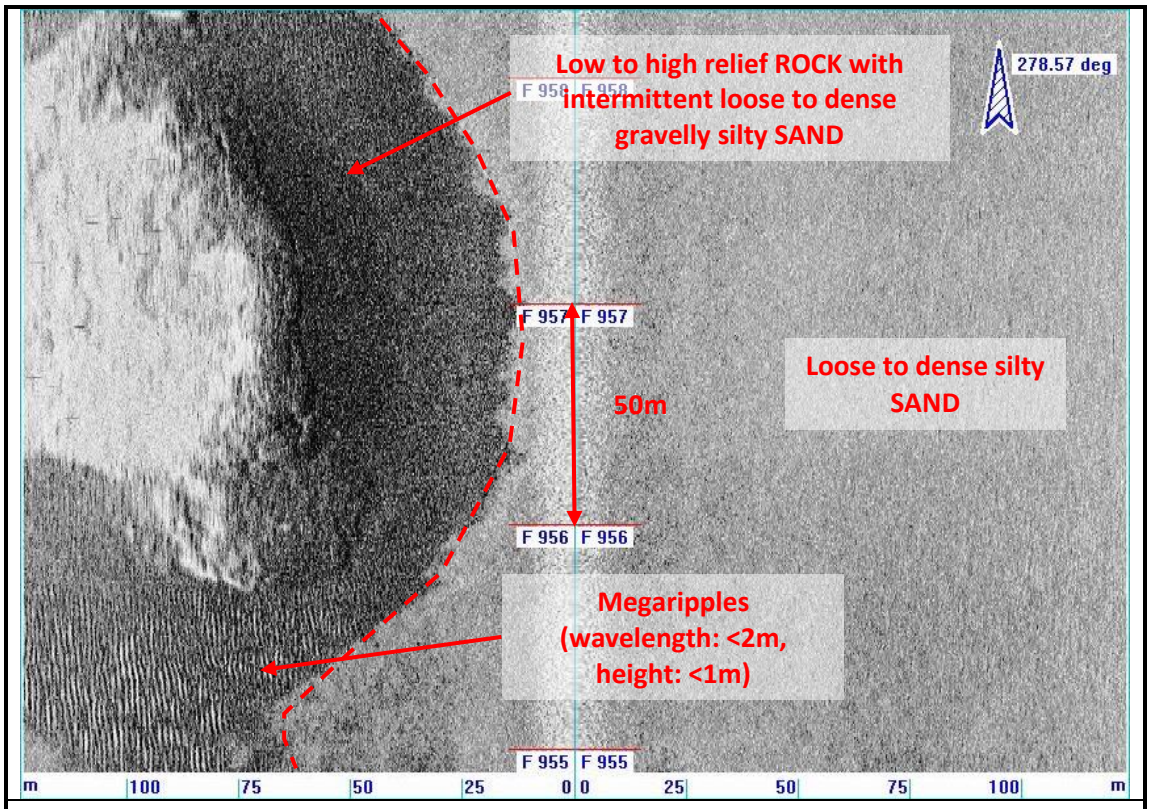

Figure 5: Rectified SSS data example of showing rocky areas at KP9.7

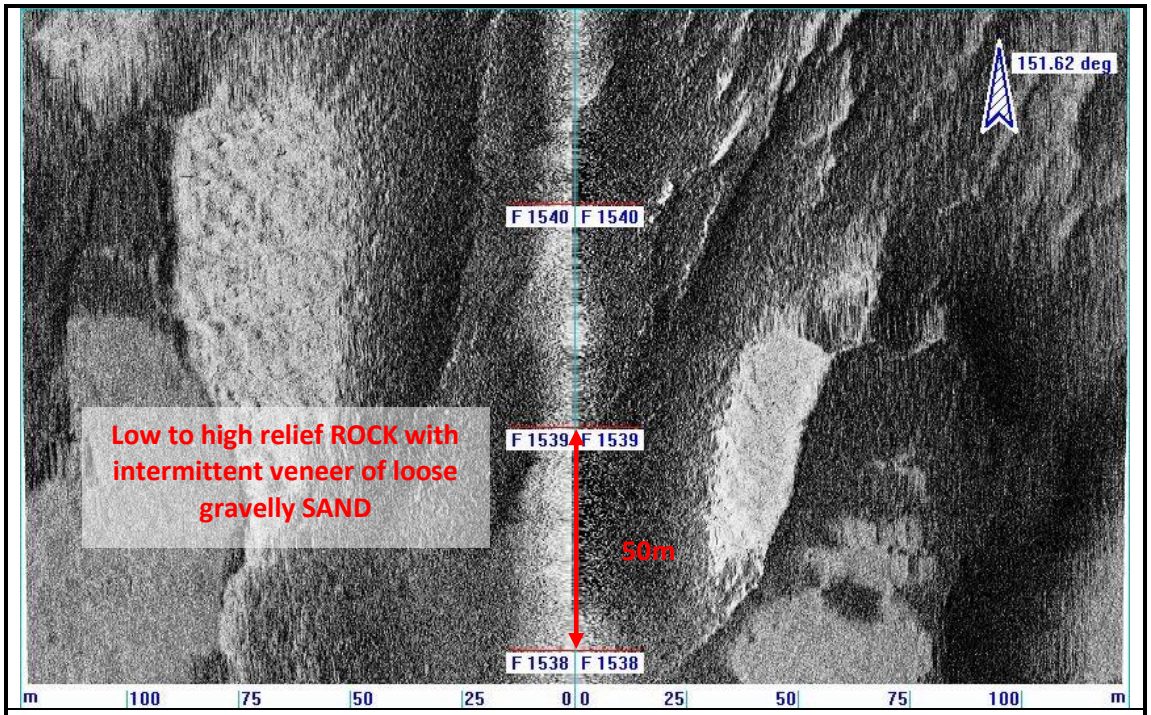

Figure 6: Rectified SSS data example of showing rocky area at KP18.7

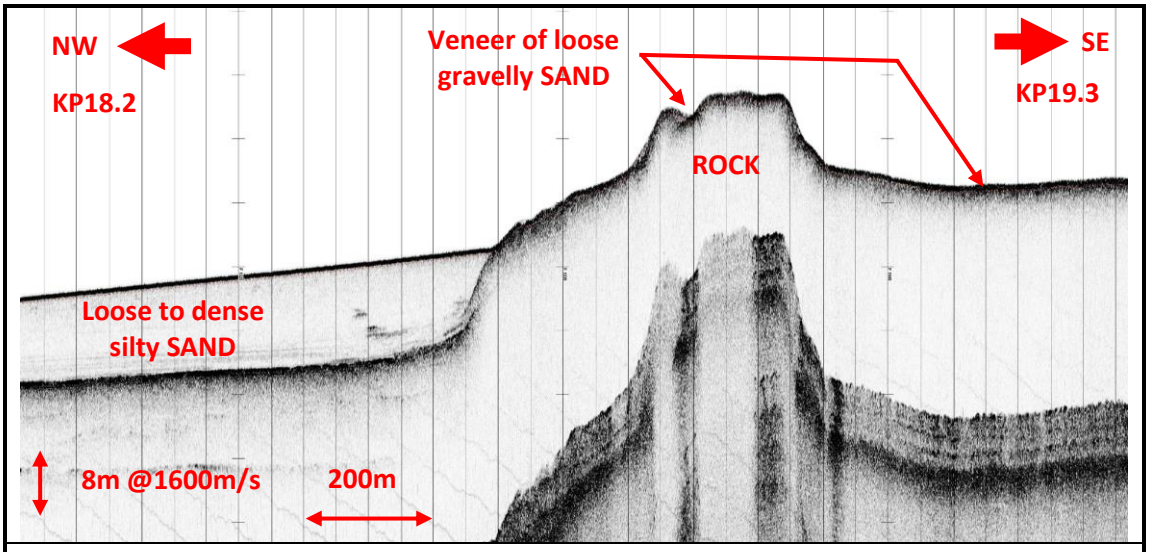

Figure 7: SBP data example of survey CL between KP18.2 and KP19.3

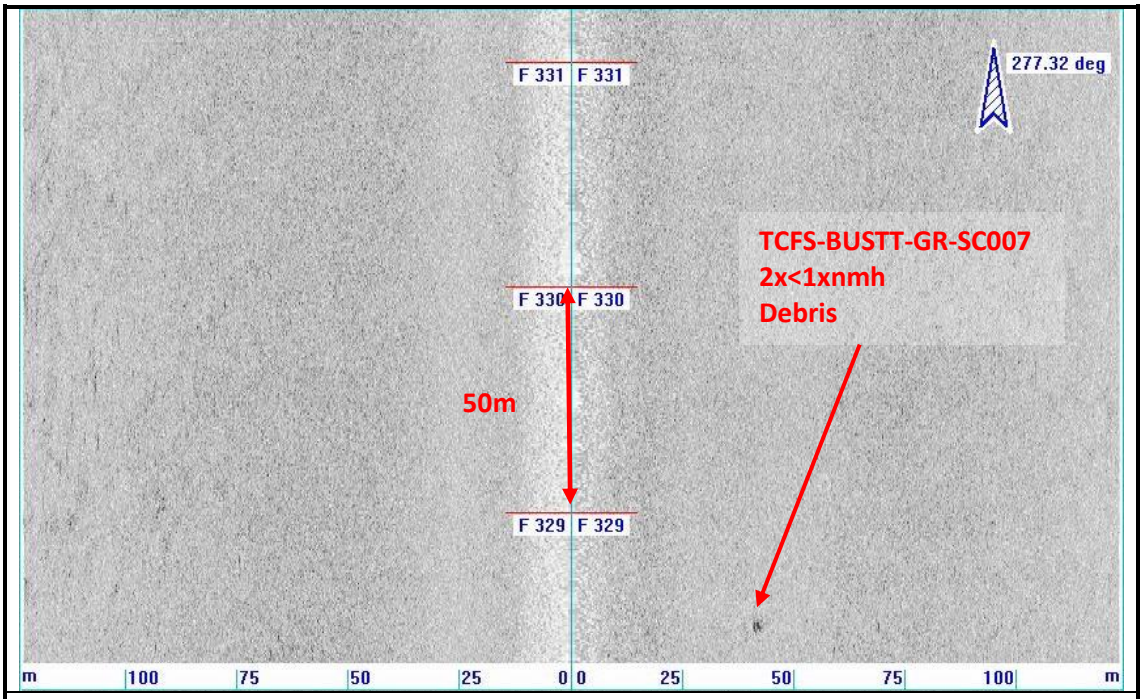

Figure 8: Rectified SSS data example showing sonar contacts at KP6.0

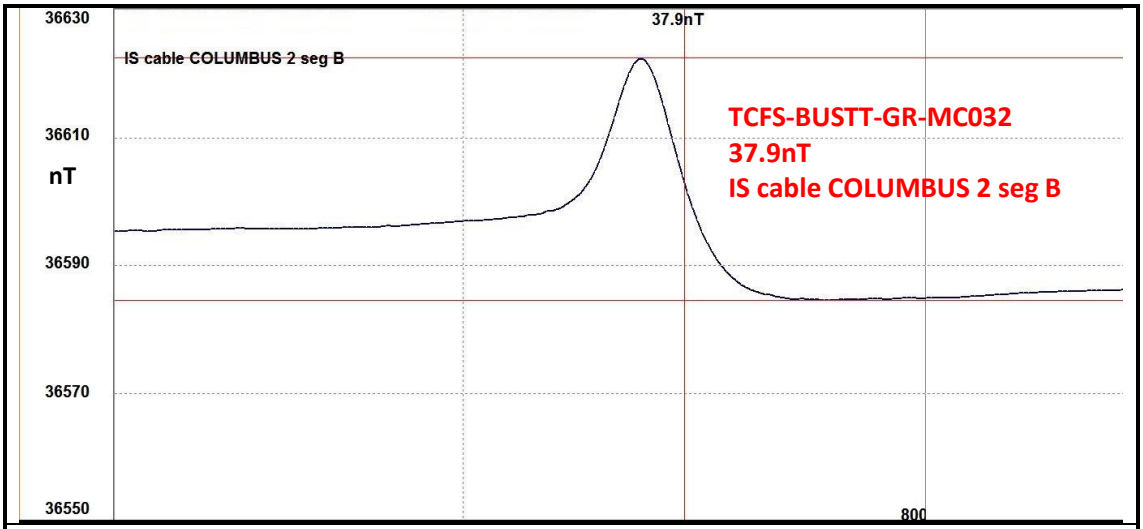

Figure 9: Magnetometer data example showing magnetic contact at KP16.9

4.3 Landfall and Inshore Survey at Puerto Rico

Inshore/offshore HOP at 18°23.588'N, 64°56.794'W (KP20.0) in 31.2m WD to RPL BMH at 18°22.320'N, 64°55.700'W (KP23.4)

The following table summarizes the operations performed within this survey area.

SSS contacts	MAG contacts	BP	DS	DP	GS
26	29	-	-	-	-

Table 10: Summary of contacts and samples of St. Thomas landfall

4.3.1 Samples

A nominal spacing of 500m and 25m were used as a basis for establishing the grab sampling and diver sampling programs respectively.

No sampling was performed as the sampling permit was not obtained during the survey period.

4.3.2 Sonar Contacts

Twenty six sonar contacts were identified within the inshore survey area. All of them are identified as debris except two as linear object and the other one as possible wreck. The sonar contacts summary is presented in Appendix D.

4.3.3 Magnetometer Contacts

Magnetic contacts were identified as any metallic objects detected by the magnetometer which was deployed close to the seabed during the in-service pipeline/cable crossing survey. An interpretation was assigned to the target with the detail of the magnetic anomaly dimension and the origin whenever possible.

Twenty nine magnetic contacts were detected within the inshore survey area. Twenty of them corresponded to the database positions of the existing cables and nine are from unknown origin. The magnetic contacts summary is presented in Appendix E.

4.3.4 Route Description

From the inshore/offshore HOP at 18°23.588'N, 64°56.794'W (KP20.0) in 31.2m WD to the inshore geophysical survey limit at 18°22.318'N, 64°55.703'W (KP23.4)

The route first heads southeast and then curves gradually towards northeast until the landing site (**Figure 10** and **Figure 11**). The seabed is generally very gentle in the middle of the survey corridor and very steep slopes were observed mainly on the both sides of the corridor where rocky areas were mapped.

The seabed is mainly characterized with loose to dense SAND with intermittent veneer of loose sandy GRAVEL. Rocky areas were mapped along the coast of St. Thomas Island, which is on the eastern side of the survey corridor (**Figure 11**). Another rocky area was mapped in the vicinity of KP21 which spreads across the survey corridor (**Figure 12**). The remaining rocky areas are mainly scattered around the sides of the corridor with some isolated BOULDERS. Areas with possible marine growth were mapped in the between KP22.0 and KP23.3 where the corridor gets to the inner part of the bay area (**Figure 13**). In addition, scattered depressions (diameter: <2.5m, height: <0.5m) and megaripples (wavelength: <2m, height: <0.5m) were mainly observed between KP20 and KP21 (**Figure 12**).

Twenty six sonar contacts were identified within the inshore survey area. Twenty three of them were regarded as debris, two as linear object and one as possible wreck (**Figure 12** and **Figure 14**). The two linear objects could be possibly attributed to OOS cables as several OOS cables were present according to the database. The possible wreck is located close to the landing site at 18°22.250'N, 64°55.754'W (KP23.3) in 17.0m WD, which is about 63m south to the proposed route.

Twenty nine magnetic contacts were detected within the inshore survey area (**Figure 15**). Twenty of them corresponded to the database positions of the existing cables and nine of them are from unknown origin.

There are four cable alignments have been identified in the side scan sonar and magnetometer data. However, as ten cables are in close proximity to each other according to database position (**Figure 11**), thus only one as-found cable (OOS Florida-St.Thomas No2) was being differentiated from others.

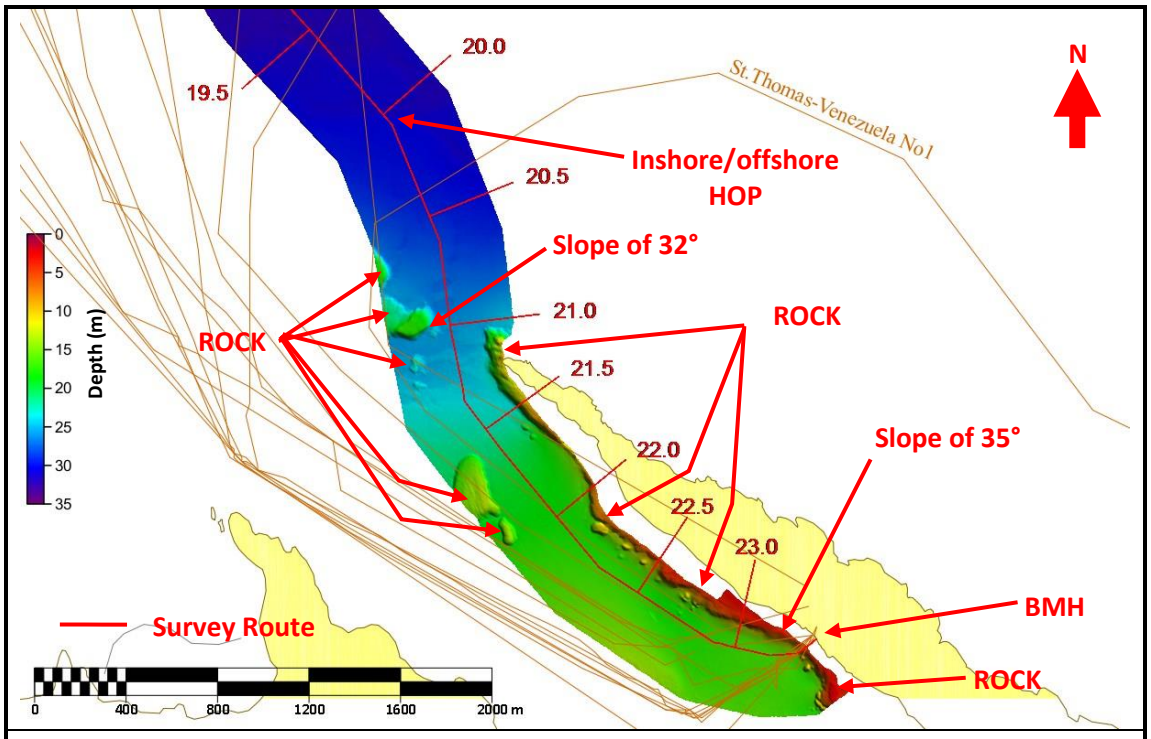

Figure 10: Sun-illuminated MBES data example between KP19.5 and KP23.4

NB: 0.5km between KP flags, vertical exaggeration x3

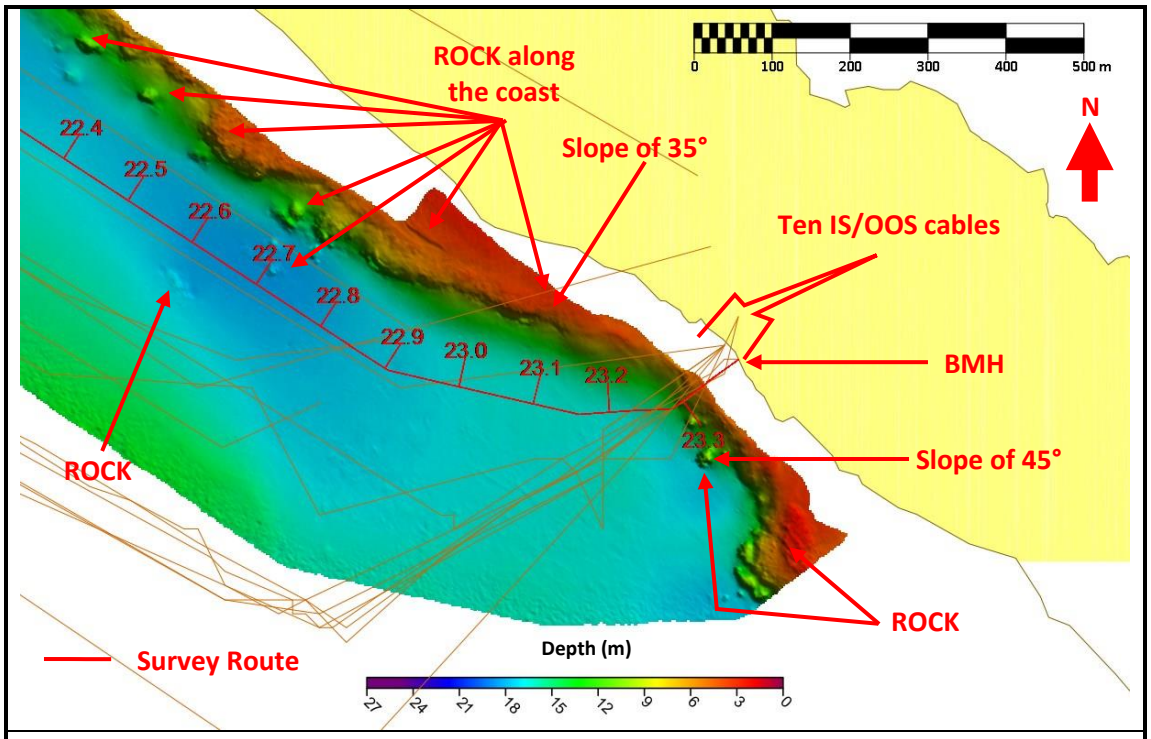

Figure 11: Sun-illuminated MBES data example between KP22.4 and KP23.4

NB: 0.1km between KP flags, vertical exaggeration x3

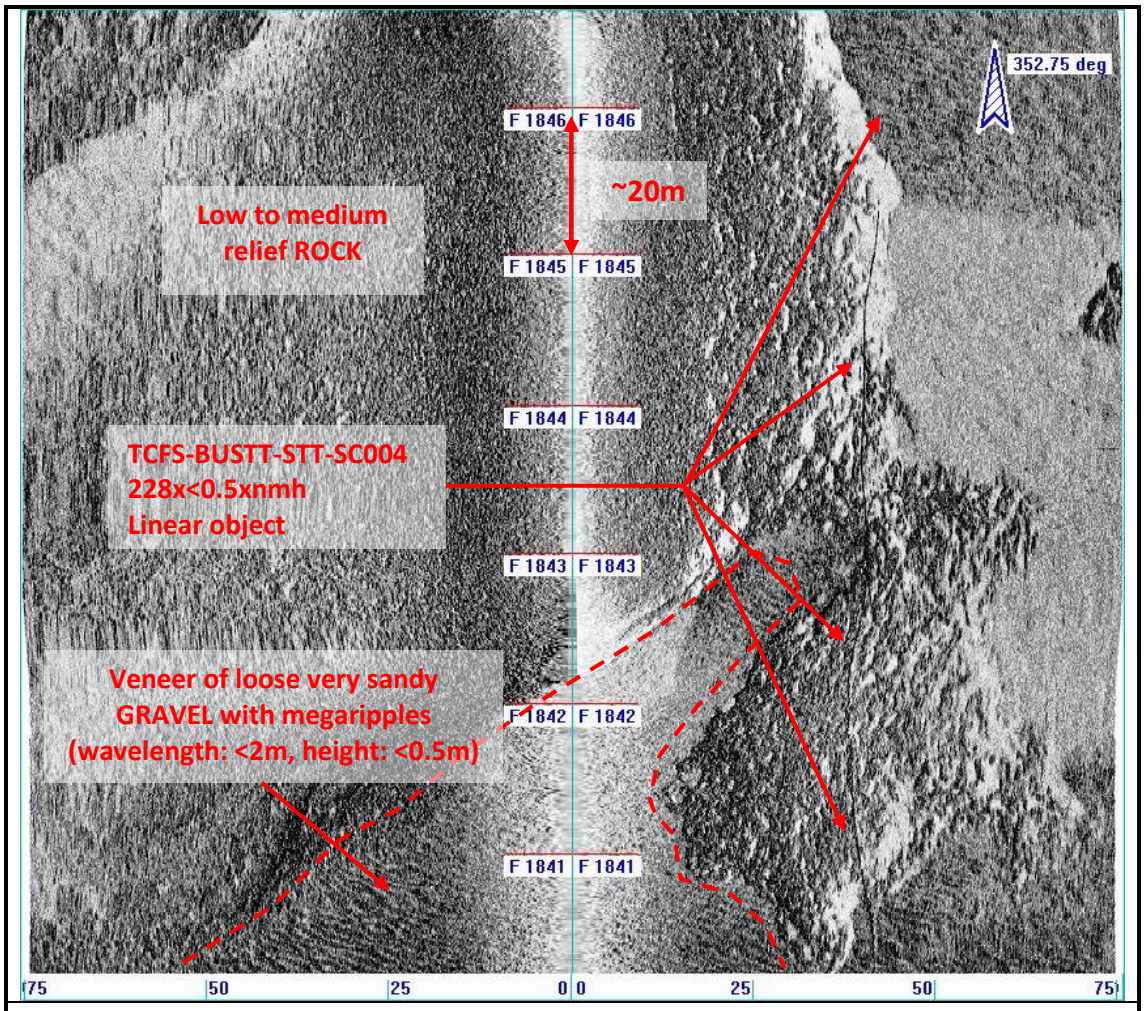

Figure 12: Rectified SSS data example showing sonar contact at KP21.0

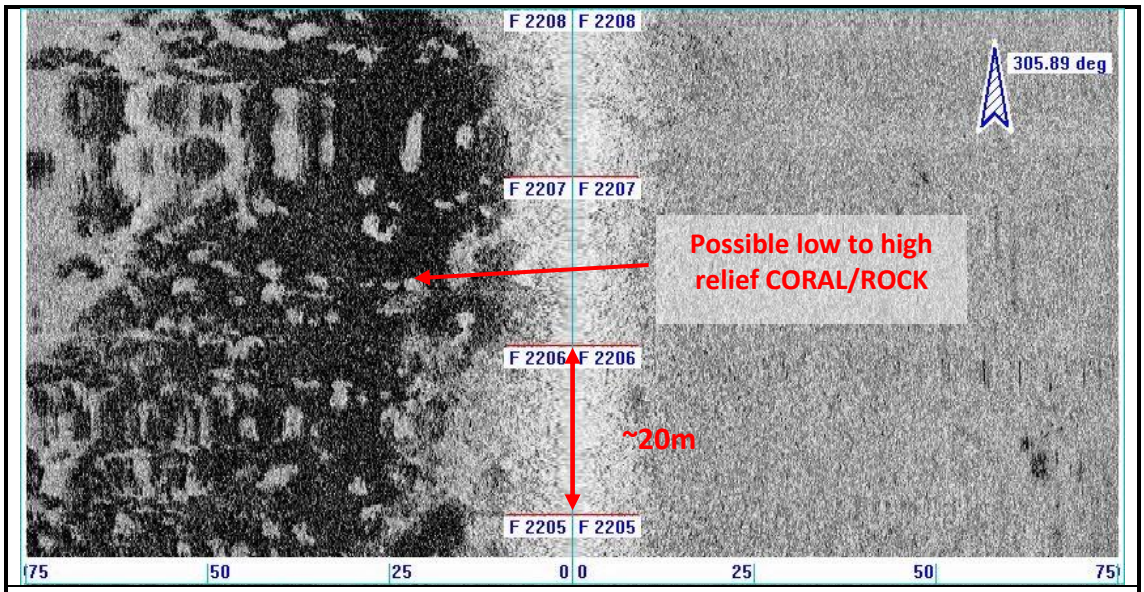

Figure 13: Rectified SSS data example showing possible CORAL area at KP22.6

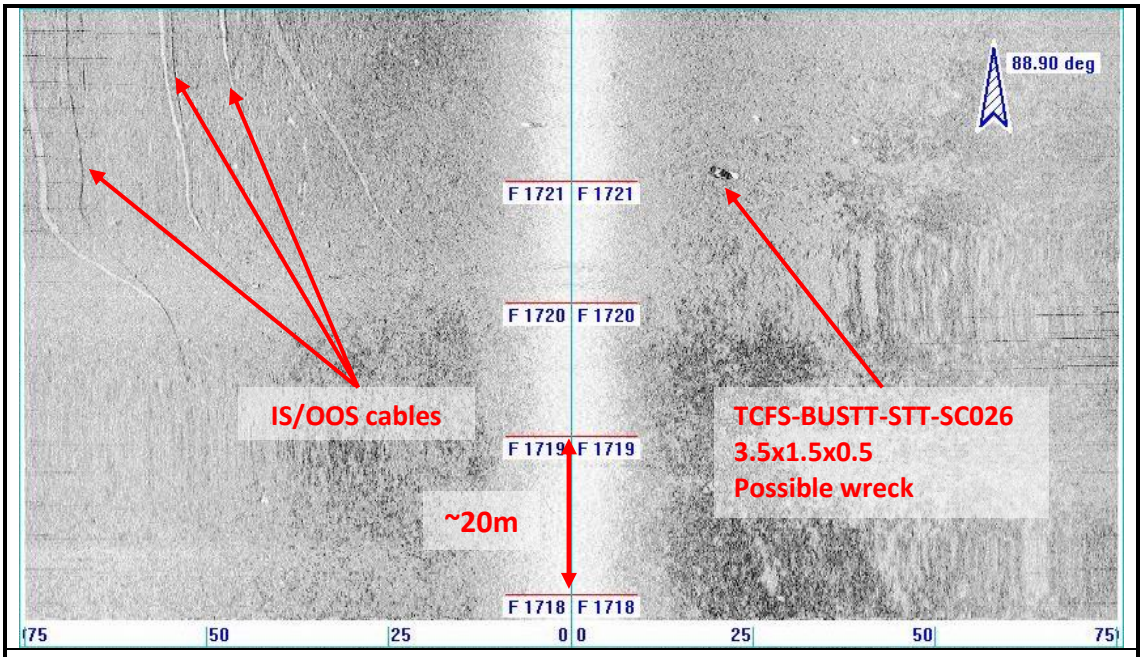

Figure 14: Rectified SSS data example showing IS/OOS cables at KP23.3

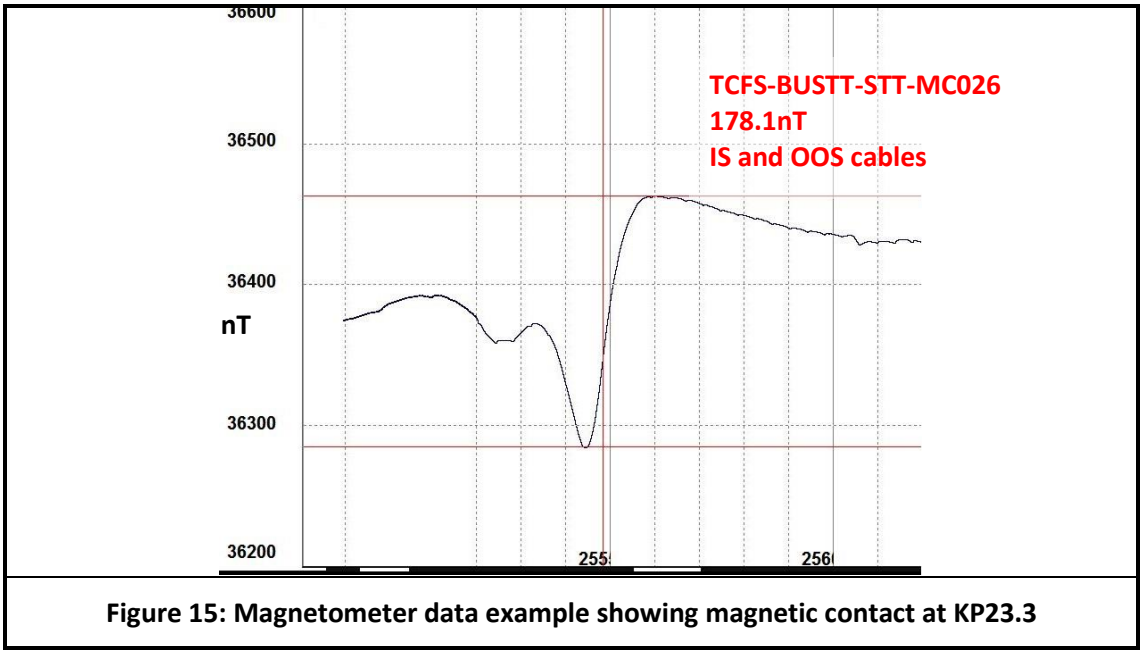

Figure 15: Magnetometer data example showing magnetic contact at KP23.3

4.3.5 Diver Survey

The diver survey will be carried out at a later stage.

4.3.6 Topographic Survey

The topographic survey will be carried out at a later stage.

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5 BURIAL ASSESSMENT SURVEY (BAS)

Due to the absence of the permit, EGS did not perform the Burial Assessment Survey (BAS) with gravity cores and CPTs. LW Subsea Inc. is responsible for the burial assessment and cable engineering.

The target burial depth is specified as 1.0m below seabed in water depths shallower than 500m.

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6 HAZARD AND OBSRUCTIONS

6.1 Cable and Pipeline Crossings

There are thirty three cable crossings including nine IS cable crossings and twenty four OOS cable crossings in Segment BUSTT. These crossing positions are based on the EGS database locations with the addition of the as-found positions confirmed by the magnetometer survey. There are seven as-found IS and OOS cable alignments crossing the proposed route.

The following table summarizes the cable crossings of TCFS Segment BUSTT.

Crossing	Status	KP	Chart number	Latitude Longitude	WD (m)	Cable armor	Crossed cable armor	Crossing angle (°)	Distance to system repeater (km)	Distance to existing repeater (km)
St.Thomas-San Juan (telegraph)	OOS	2.165	BU001, NU001	18° 25.788' N 65° 6.105' W	52.7	NA	Telegraph	66	NA	NA
US-Venezuela No2	OOS	2.853	NU001	18° 25.797' N 65° 5.714' W	53.3	NA	NA	39	NA	NA
US Venezuela No2 (as-found)	OOS	2.661	NU001	18° 25.795' N 65° 5.823' W	53.1	NA	NA	42	NA	NA
St.Thomas-Dominican Republic	OOS	14.359	NU003	18° 25.112' N 64° 59.242' W	54.1	NA	NA	24	NA	NA
St.Thomas-Dominican Republic	OOS	15.228	NU003	18° 24.874' N 64° 58.818' W	52.5	NA	NA	19	NA	NA
US-Venezuela No2	OOS	15.786	NU003	18° 24.795' N 64° 58.517' W	51.8	NA	NA	66	NA	NA
AMERiCAS 1 seg N	IS	15.837	NU003	18° 24.796' N 64° 58.487' W	51.7	NA	NA	59	NA	NA
AMERICAS 1 seg N (as-found)	IS	15.846	NU003	18° 24.796' N 64° 58.483' W	51.7	NA	NA	64	NA	NA
TAINO-CARIB	IS	15.897	NU003	18° 24.796' N 64° 58.454' W	51.6	NA	NA	60	NA	NA
Florida-St.Thomas No2	OOS	16.218	NU003	18° 24.797' N 64° 58.271' W	51.1	NA	NA	62	NA	NA
Florida-St.Thomas No3	OOS	16.695	NU003	18° 24.799' N 64° 58.001' W	50.1	NA	NA	62	NA	NA
As-found OOS Florida-St.Thomas No3	OOS	16.696	NU003	18° 24.800' N 64° 58.000' W	50.1	NA	NA	79	NA	NA
COLUMBUS 2 seg B	IS	16.946	NU003	18° 24.801' N 64° 57.858' W	49.6	NA	NA	84	NA	NA
COLUMBUS 2 seg B (as-found)	IS	16.957	NU003	18° 24.801' N 64° 57.852' W	49.5	NA	NA	83	NA	NA
Florida-St.Thomas No1	OOS	17.176	NU003	18° 24.802' N 64° 57.728' W	49.2	NA	NA	83	NA	NA

Crossing	Status	KP	Chart number	Latitude Longitude	WD (m)	Cable armor	Crossed cable armor	Crossing angle (°)	Distance to system repeater (km)	Distance to existing repeater (km)
COLUMBUS 2 Seg C1	OOS	17.434	NU003	18° 24.732' N 64° 57.601' W	47.9	NA	NA	59	NA	NA
AMERICAS 1 seg S1	OOS	18.477	NU003	18° 24.265' N 64° 57.278' W	35.3	NA	NA	52	NA	NA
Possible AMERICAS 1 seg S1 (as-found)	OOS	18.649	NU003	18° 24.182' N 64° 57.233' W	24.0	NA	NA	33	NA	NA
BRUS	OOS	19.008	NU003	18° 24.009' N 64° 57.139' W	32.3	NA	NA	33	NA	NA
TAINO-CARIB	IS	19.560	NU003	18° 23.767' N 64° 56.958' W	32.1	NA	NA	72	NA	NA
TAINO-CARIB (as-found)	IS	19.550	NU003	18° 23.772' N 64° 56.962' W	32.1	NA	NA	73	NA	NA
St.Thomas-St.Maarten-Curacao	OOS	19.859	NU003, NU004	18° 23.645' N 64° 56.847' W	31.0	NA	NA	39	NA	NA
St.Thomas-Venezuela No1	OOS	20.397	NU003, NU004	18° 23.394' N 64° 56.700' W	29.7	NA	NA	80	NA	NA
St.Thomas-St.Maarten-Curacao	OOS	21.281	NU003, NU004	18° 22.928' N 64° 56.595' W	24.0	NA	NA	49	NA	NA
St.Thomas-Venezuela No1	OOS	21.970	NU003, NU004	18° 22.628' N 64° 56.368' W	18.5	NA	NA	11	NA	NA
Florida-St.Thomas No2	OOS	22.844	NU004	18° 22.330' N 64° 55.989' W	17.6	NA	NA	41	NA	NA
Florida-St.Thomas No1	OOS	22.846	NU004	18° 22.330' N 64° 55.988' W	17.6	NA	NA	49	NA	NA
BRUS	OOS	22.974	NU004, NU005	18° 22.304' N 64° 55.921' W	16.9	NA	NA	20	NA	NA
AMERICAS 1 seg S1	OOS	23.228	NU004, NU005	18° 22.283' N 64° 55.780' W	16.4	NA	NA	32	NA	NA
AMERICAS 1 seg N	IS	23.228	NU004, NU005	18° 22.283' N 64° 55.780' W	16.4	NA	NA	32	NA	NA

Crossing	Status	KP	Chart number	Latitude Longitude	WD (m)	Cable armor	Crossed cable armor	Crossing angle (°)	Distance to system repeater (km)	Distance to existing repeater (km)
IS/OOS cable (as-found)	IS/OOS	23.255	NU004, NU005	18° 22.284' N 64° 55.764' W	15.6	NA	NA	28	NA	NA
Panam seg SA C1	IS	23.256	NU004, NU005	18° 22.284' N 64° 55.764' W	15.6	NA	NA	33	NA	NA
COLUMBUS 2 Seg C1	OOS	23.261	NU004, NU005	18° 22.284' N 64° 55.761' W	15.4	NA	NA	40	NA	NA
US-Venezuela No2	OOS	23.261	NU004, NU005	18° 22.284' N 64° 55.761' W	15.4	NA	NA	28	NA	NA
TAINO-CARIB	IS	23.280	NU004, NU005	18° 22.285' N 64° 55.750' W	14.5	NA	NA	25	NA	NA
COLUMBUS 2 seg B	IS	23.282	NU004, NU005	18° 22.285' N 64° 55.749' W	14.4	NA	NA	50	NA	NA
TAINO-CARIB	IS	23.292	NU004, NU005	18° 22.288' N 64° 55.745' W	13.3	NA	NA	8	NA	NA
US-Venezuela No2	OOS	23.338	NU004, NU005	18° 22.303' N 64° 55.724' W	4.7	NA	NA	12	NA	NA
Florida-St.Thomas No3	OOS	23.339	NU004, NU005	18° 22.303' N 64° 55.723' W	NA	NA	NA	25	NA	NA
US-Venezuela No2	OOS	23.370	NU004, NU005	18° 22.313' N 64° 55.709' W	NA	NA	NA	39	NA	NA

Table 11: Cable crossing list

6.2 Maritime Boundaries and Special Areas

The following table lists the maritime boundaries and special areas crossed by the route.

Event Name	Chart No.	KP	Latitude	Longitude
Cross US 3nm Line	BU001, NU001	1.399	18° 25.777' N	65° 6.540' W

Table 12: Marine boundaries and special areas

6.3 Fishing Activities

No fishing activities were observed during the survey period.

6.4 Shipping

No shipping activities were observed during the offshore survey period, however, low shipping activities with leisure boats around the inshore area were observed during the inshore survey period.

6.5 Anchorages

No anchorage areas were charted within the survey area.

6.6 Piracy

There was no piracy incident reported during the survey operations for TCFS Segment BUSTT.

The International Maritime Bureau (IMB) of the International Chamber of Commerce has established a Piracy Reporting Center (PRC) in Kuala Lumpur. The contact details of the IMB PRC are given below:

ICC IMB (Asia Regional Office)
PO Box 12559
50782 Kuala Lumpur
Malaysia

Tel: +60 3 2078 5763
Fax +60 3 2078 5769
E-mail: imbkl@icc-ccs.org / piracy@icc-ccs.org
Tel. +60 3 2031 0014 (24-hour Anti-Piracy HELPLINE)

6.7 Dumping Grounds

The proposed route of Segment BUSTT did not pass through any dumping grounds.

6.8 Wrecks

A possible wreck was identified close to the landing site at 18°22.250'N, 64°55.754'W (KP23.3) in 17.0m WD, which is about 63m south to the proposed route (**Figure 14**).

6.9 Dredging

No dredging activities were observed during the survey period and there were no charted dredging areas.

6.10 Hydrocarbon Exploitation

The route did not cross any hydrocarbon exploitation areas within the survey area.

6.11 Military Activity

The proposed route of Segment BUSTT did not pass through any military exercise areas, and no military activity was observed during survey operations.

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7 OCEANOGRAPHIC AND METEOROLOGICAL OBSERVATIONS

Regular environmental and meteorological observations were recorded in the ship's log during the survey. These observations include temperature, sea state, atmospheric pressure, and wind (direction and strength).

7.1 Sea Temperatures

Profiles of the water temperature and the associated speed of sound were collected at regular intervals during the survey. This information is required primarily for the USBL and MBES systems, although information on seabed temperatures is also an important consideration when engineering submarine cable system. Profiles are generally collected at the start and end of each survey block, approximately one per day with extra profiles in areas where variable speed of sound is encountered. Profiles are collected using Valeport Midas CTD on the *RV GR*.

The Valeport CTDs profiler system measures the water temperature, water conductivity, and water pressure (depth) continuously, logging the measurements in internal memory. Measurements are recorded throughout the water column as the equipment is lowered to close to the seabed and also as the system is being recovered back to the surface. The speed of sound in water is calculated automatically using the Chen & Millero formula in the software. Then the surface sound velocity is compared with mini sound velocity equipment which is installed on the ship hull.

These observations are presented in Appendix H of this report. The temperatures recorded at the maximum depths reached at each location are tabulated below.

SVP number	Chart number	Latitude Longitude	Max. depth reached (m)	KP RPL Offset	Temp. at lowest depth measured (°C)
TCFS-BUSTT-GR-SV001	BU001, NU001	18° 25.902' N 65° 8.238' W	32.5	-1.585 1590m W	26.8
TCFS-BUSTT-GR-SV002	NU003	18° 23.782' N 64° 57.301' W	49	19.231 438m SW	26.7
TCFS-BUSTT-STT-SV001	NU003	18° 23.872' N 64° 57.286' W	31.8	19.114 340m SW	26.7

Table 13: Summary of bottom temperatures at SVP locations

Note: Generally, the deepest reading is close to the seabed, but this is not always the case. The tabulated temperature values were recorded at the stated depth - not necessarily the actual seabed at that location.

7.2 Currents

The study of Currents along the proposed system is presented in the Desktop Study for this project in detail.

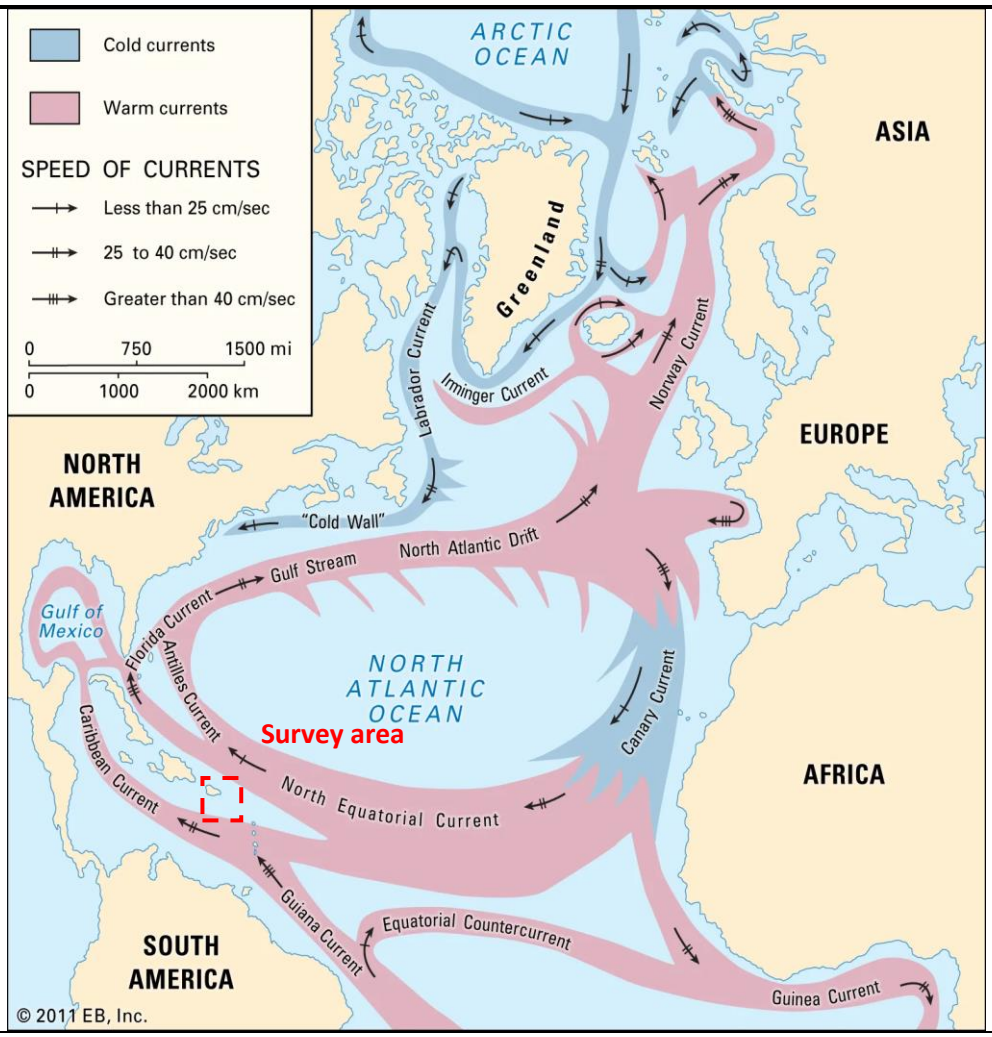

Figure 16: Major currents in North Atlantic Ocean

Source: (https://www.britannica.com/place/Atlantic-Ocean/Hydrology#/media/1/41191/157706)

The major current along the proposed route is Antilles Current.

The Antilles Current (**Figure 17**) flows northwesterly by passing through the island chain separating the Atlantic Ocean and Caribbean Sea. It divides at the Turks and Caicos Islands, with most of the flow directed northwestward to join the Florida Current past the outer Bahamas. Its waters are concentrated into a strong jet about 80-100 km wide. A lesser, more erratic tongue of the current turns west above Puerto Rico and passes north of the Greater Antilles, sending offshoots southwest through Mona and Windward Passages.

There does appear to be a significantly variable current flow in this portion of the Antilles Current. The Antilles flow does not contribute in a major way to inter-basin exchange and it is not a continuous flow along the Bahamas and Antilles island chain. The Antilles Current appeared more as an eddy field along the Bahamas-Antilles arc rather than as a continuous jet.

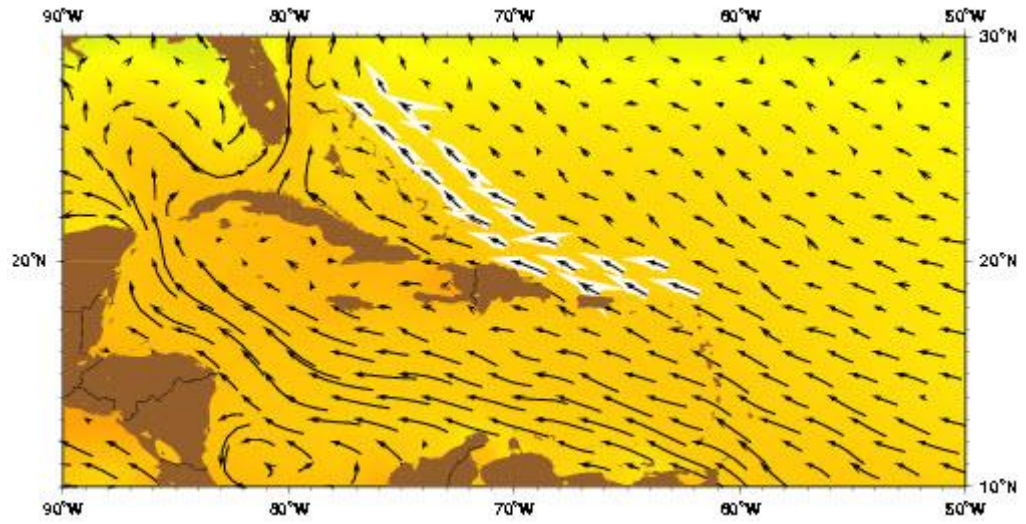

Figure 17: Antilles Current

Source: (https://oceancurrents.rsmas.miami.edu/atlantic/antilles.html)

Impact during the survey: No impact was noticed during the survey operations

Possible impact for cable installation and maintenance: The surface and mid-water currents can affect cable-laying operations. Bottom currents can cause abrasion to a cable laid over obstacles and hence having a free-span. In areas with strong currents, the cable may end up being laid well away from the track of the cable-laying vessel because of the current action.

7.3 Sea State, Swell and Wind Direction

The *RV GR* conducted the offshore survey between BU St. Thomas and St. Thomas from 8th to 11th May 2022. The wind direction and wave height were also recorded in the DPRs. Observations are summarized in the figures below.

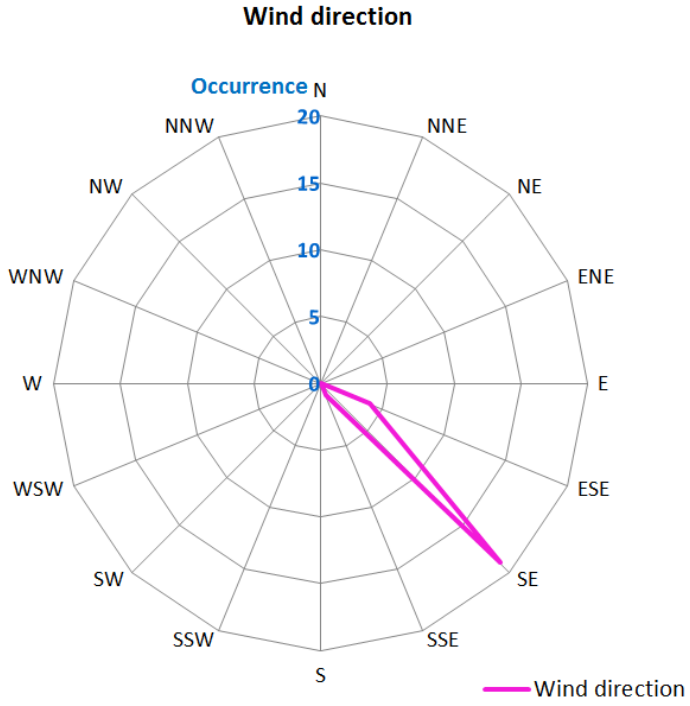

Figure 18: Rose diagram presenting wind direction during offshore operations for Segment BUSTT survey period by the *RV GR*

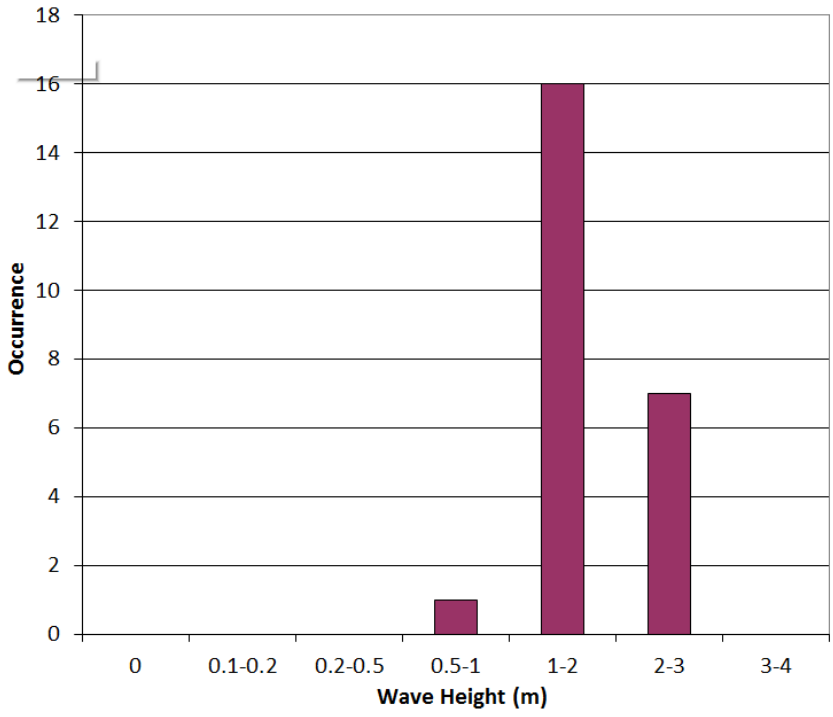

Figure 19: Graph showing the occurrence of observed wave heights during offshore operations for Segment BUSTT survey period by the *RV GR*

Impact during the survey:	No weather downtime was recorded during the survey period.
Possible impact for cable installation and maintenance:	According to the DTS, tropical cyclone seasons are from June to November. Pay attention to weather forecast before and during the operations.

7.4 Meteorological Observations

The wind speed and atmospheric pressure were also recorded in the DPRs. Observations are summarized in the figures below.

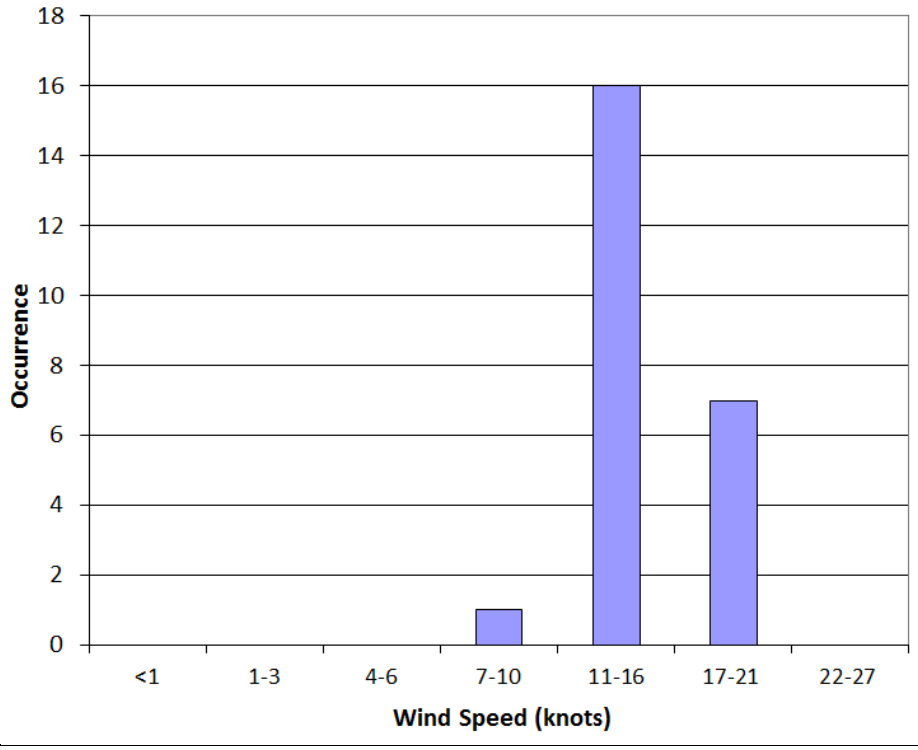

Figure 20: Histogram of observed wind speeds during offshore operations for Segment BUSTT survey period by the *RV GR*

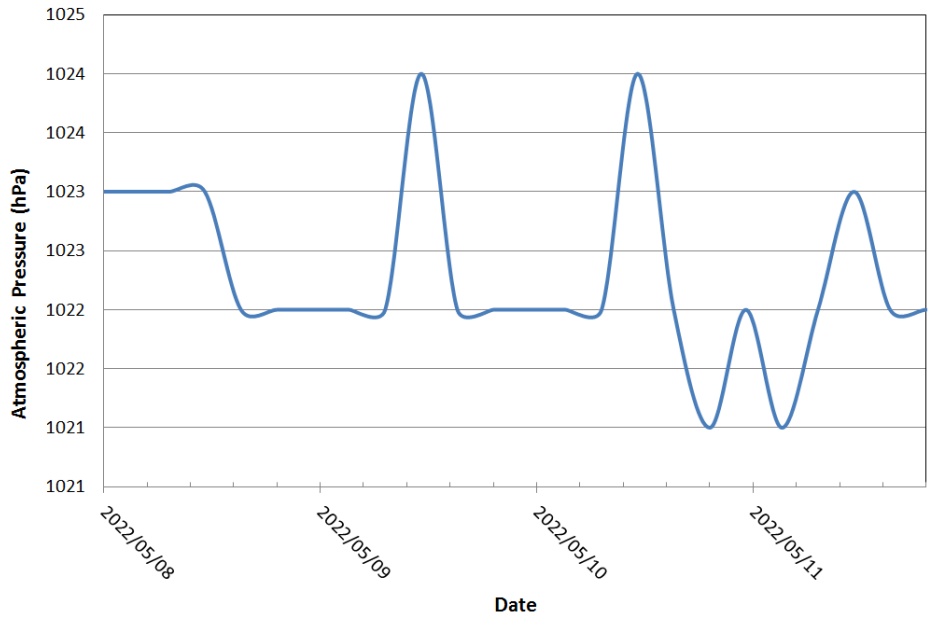

Figure 21: Graph showing atmospheric pressure during offshore operations for Segment BUSTT survey period by the *RV GR*

During the survey of the TCFS Segment BUSTT by the *RV GR*, the wind direction was mainly from the southeast with strengths of 4 to 5 on the Beaufort scale. The observed wave height was mostly between 1m and 3m. The air pressure ranged from 1021 to 1024 hPa.

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8 ENVIRONMENT CONSIDERATIONS

No reportable environmental concerns were noted in the landfall area except the presence of possible marine growth. Consultation with the local authority should be sought prior to cable installation regarding the possible environmental concerns.

No environmental consideration was observed during the reroute survey of TCFS Segment BUSTT by the *RV GR*.

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9 SAFETY

Four survey days were conducted for the offshore and inshore survey by the crew onboard the *RV Geo Resolution* with *Survey Launch GR-2*. There were no reportable incidents during these survey periods.

Introductions for health and safety issues were given to all crew onboard within 24 hours of sailing from the port for the survey operations. Safety meetings were held regularly on a weekly basis on the offshore survey vessels. This was to ensure that all ship and survey crew were familiar with the safety measures in case of emergencies. A vessel hazard identification card system was operated for reporting any hazard observed.

In view of the current Covid-19 pandemic situation, the body temperatures of all personnel onboard were taken twice a day to ensure all personnel health and precaution measures against the pandemic. In addition, face masks were provided onboard and it was compulsory for all personnel to wear masks in public spaces and during public operations.

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10 ENGINEERING CONSIDERATIONS AND RECOMMENDATIONS

This report provides the findings of the hydrographic and geophysical surveys undertaken for TCFS Segment BUSTT The findings in this report are supplementary to the Cable Route Desktop Study and should be read in conjunction with that report.

In the shallow water area, proper cable armor should be utilized at the rocky areas. Route deviation shall be considered to bypass the rocky areas, sonar contacts whenever possible. Megaripples and depressions were observed within the survey corridor in some of the sections. Moderate to very steep slopes were mainly observed in the rocky area and the area where the route approaching the landing site.

The route crosses nine IS cables and twenty four OOS cables in this segment. And the landing site is congested with five IS cables and five OOS cables.

A summary table of hazards and issues encountered during the survey together with recommendations is presented at the beginning of this report in the Executive Summary section.

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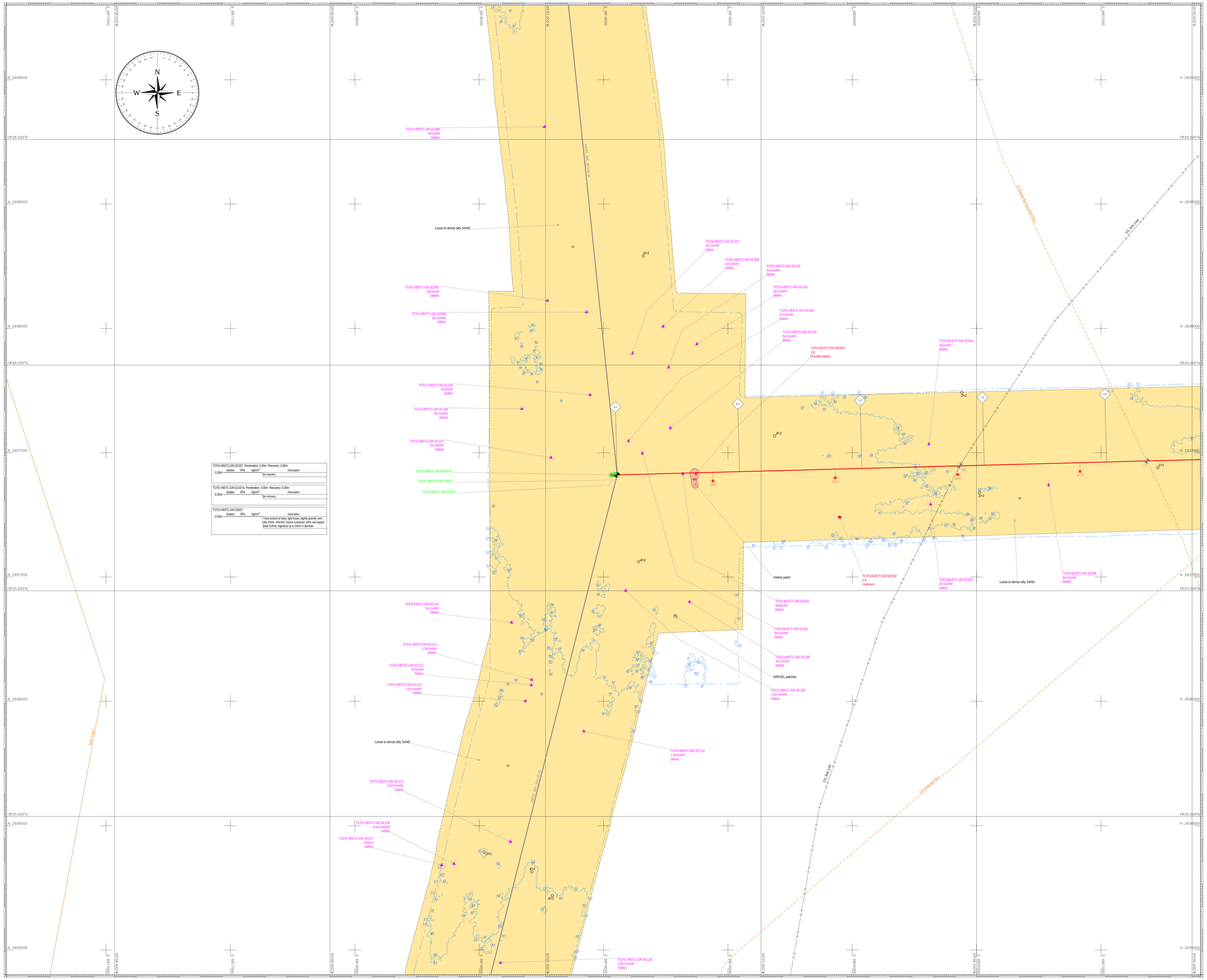


CARTOGRAPHIC SYMBOLS

- Post survey route with kilometre post and reverse kilometre post
- Adjacent route
- Beach manhole / Alter course / Branching Unit
- Point on line / Cable crossing / Pipeline crossing
- Coastline (from Admiralty charts)
- Chart matchline
- Telecommunications cable position, In-service/Out of service/Planned (as-found in magenta)
- Pipeline position, In-service/Out of service/Planned (as-found in magenta)
- Power cable position, In-service/Out of service/Planned (as-found in magenta)
- Maritime boundaries
- Restricted zones and special areas
- Concession block
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives dumping ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY

- Bathymetric contours in metres. Contour interval may be reduced to aid in clarity.
- Downslope gradient in degrees (°) as measured over the shortest significant distance
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)

SEABED FEATURES

Sediments: cor CORAL; hcs/sves Gas seepage area with predominant sediment classification; hcs/sves Boulder field with predominant sediment classification; fs Fine sediment (predominantly CLAY/SILT); cs Coarse sediment (SAND and GRAVEL); vcs Very coarse sediment (COBBLES and BOULDERS)

Rock: hcs/sves Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth); r ROCK outcrop (with veneer of sediments); hg HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth)

- Sediment or feature boundary
- Inferred sediment or feature boundary
- Approximate limit of side scan sonar coverage
- Seabed scar (trawl or anchor)
- Isopach contours shown at 1m interval with labels every 1m
- BP001 / BS001 Beach probe (BP)/ Beach sample (BS) location with reference number
- DP001 / DS001 Diver probe (DP)/ Diver sample (DS) location with reference number
- SC001 5x5x1 Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height)
- SCnn5 x4 5.0x0.5x0.1 Linear sonar contact, dashed where partially buried
- SE001 2.5 Pipeline contact determined by seismic profiling system with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed)
- MC001 5.0 Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla)
- MC002 5.0 Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla)
- SO001 30x10x3 Located wreck with reference no. (length x width x height in metres where measurable)
- GC001 Gravity core (GC); Grab sample (GS) location with reference number
- CP001 MiniCPT (CP) location with reference number
- 0.5 Small ROCK outcrop with height in metres if discernible
- d/D Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible
- 50/3 General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres)
- 4/0.8 Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres)
- 22 Orientation of sediment ribbon
- Orientation of current lineation
- -25 Fault with depth below seafloor (Hachures on footwall)

CHART COMMENT

Cable and Pipeline Crossings
- OOS St.Thomas-San Juan (telegraph)

Hazards and Obstructions
A debris patch was charted in the middle part of the chart.
GRAVEL patches were identified in the southern part of the BU Box.
Scattered depressions were mapped throughout the survey area.
Twenty-eight (28) sonar contacts were identified throughout the chart.
Two (2) magnetic contacts were mapped in the middle part of the chart and the east of the middle part of the chart where one is possibly related to the debris patch and the other one is unknown.
The route runs in United States Territorial Sea and crosses US 3nm Line.

GENERAL NOTES

	Shallow and Deep Water	Inshore
Survey vessel	RV Geo Resolution	Survey Launch GR-2
Surface positioning system	Octopus F185+ GPS, Veripos LD6 DGPS, QinSy Navigation System	Applanix POS MV, Veripos LD900 DGNSS, Qinsy Navigation System
Underwater positioning system	Kongsberg HiPAP 501P USBL System	-
Bathymetry	Reson Seabat 7150-F MBES, Kongsberg Simrad EA400 SBES	Norbit iWBMS System
Morphology and stratigraphy	EdgeTech 4200 SSS, EdgeTech DSS-2000 combined towfish, GeoAcoustics 4x4 Array Pinger	EdgeTech 4200 SSS, GeoAcoustics 2x1 Array Pinger
Magnetometer survey	Geometrics G-882 Marine Magnetometer	Geometrics G-882 Marine Magnetometer

Target burial depth: 1m burial up to 500m water depth
Descriptive terms and definitions: The criteria used for interpretations and descriptions are presented in survey reports

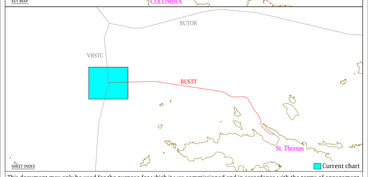
GEODETIC PARAMETERS

Datum Parameters
Datum : WGS84
Ellipsoid : WGS84
Semi-major Axis (a) (m) : 6 378 137.000
Inverse Flattening (1/f) : 298.257 223 563

Map Projection Parameters
Projection : Mercator
False Northing : 1 000 000
False Easting : 6 000 000
Latitude of Origin : 0° (Equator)
Longitude of Origin : 73° W
Standard Parallel : 21° N
Scale Factor along Standard Parallel : 1

VERTICAL DATUM

In Landfall and Inshore Survey charts: Bathymetry data has been reduced to Lowest Astronomical Tide (LAT) using predictions from the Admiralty Tide Tables - South West Atlantic Ocean and South America, Volume 2, 2022. Standard Ports: 2462 Saint Thomas (Charlotte Amalie)
In Shallow Water Survey charts: Bathymetry data has been reduced to Lowest Astronomical Tide (LAT) using predictions from the Admiralty Tide Tables - South West Atlantic Ocean and South America, Volume 2, 2022. Standard Ports: 2460 Anegada, 2461 Tortola, 2462 Saint Thomas (Charlotte Amalie), 24624 Saint Thomas (Benner Bay), 2464 Culebra
In Deep Water Survey chart : No tidal reduction was applied to soundings deeper than 1000m



Survey date: May 2022

Scale
NATURAL SCALE 1 : 5,000 at 21°N
(At mid-latitude of chart)
TRUE SCALE 1 : 5080.59
0 100 200 300 400 500 m

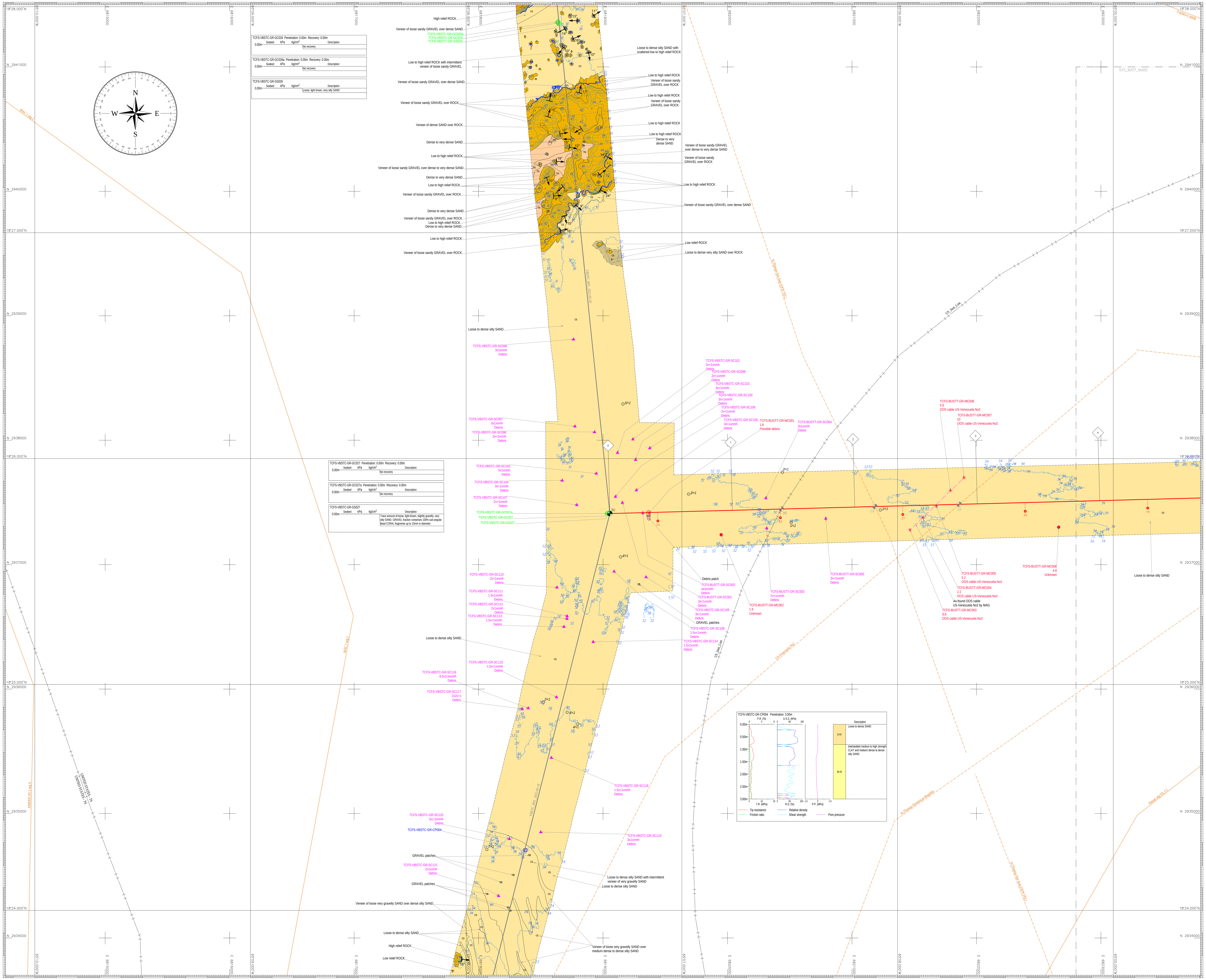
Customer: TC FS LW Subsea
Contractor: EGS

Project name
Trans Caribbean Fiber Submarine Cable System Marine Route Survey

Document title
SEGMENT BU ST. THOMAS TO ST. THOMAS
BRANCHING UNIT CHART
CHART NO. 001 OF 001
(KP 0.00 - KP 2.38)

Rev	Date	Prepared by	Checked by	Approved by	
0	May 2022	Jan Li	Jacky Lee	Chris Welsh	Preliminary

Route based upon: TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls
File name: TCFS_BUSTT_BU001



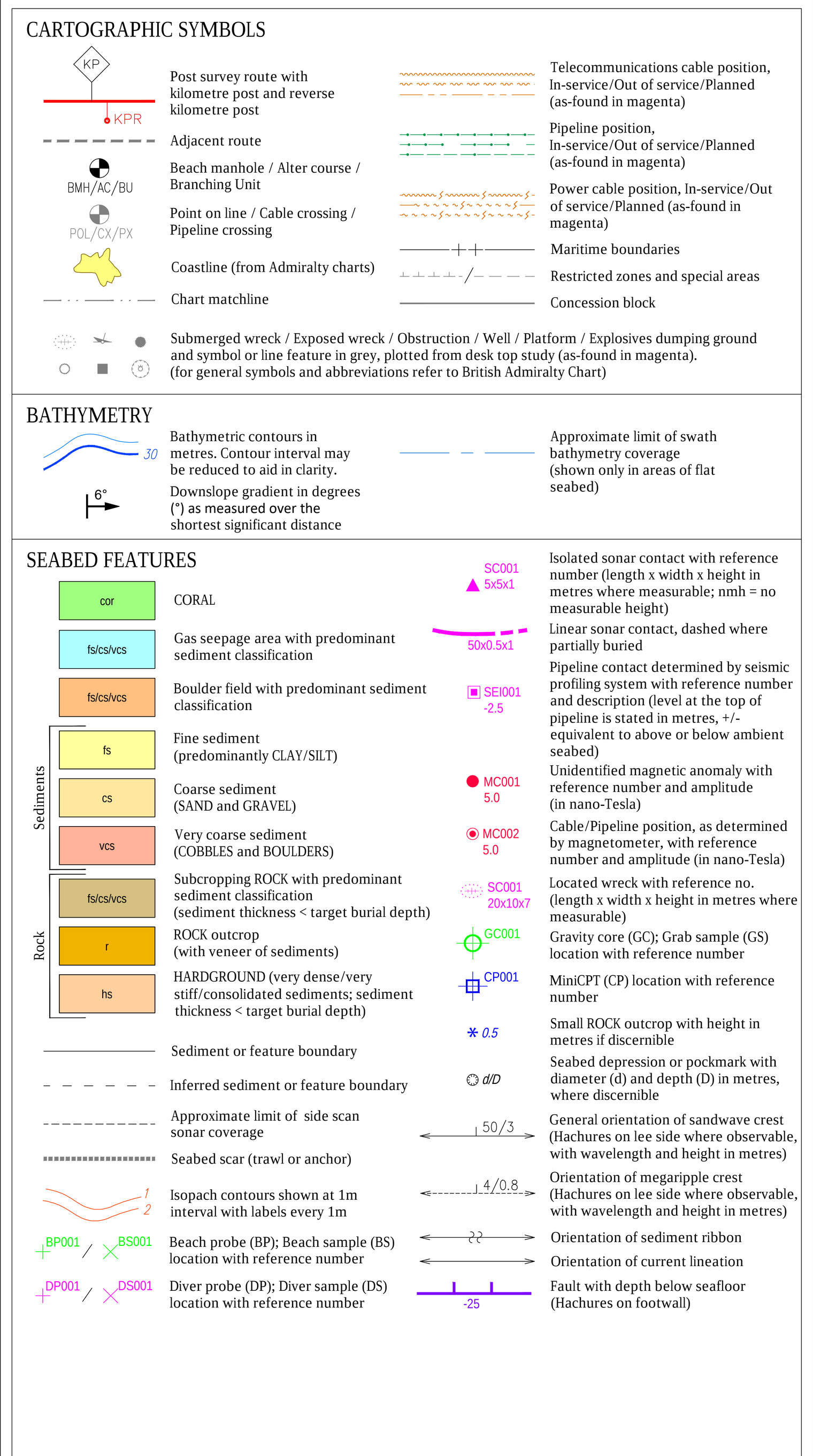


CHART COMMENT

Cable and Pipeline Crossings

- OOS St.Thomas-San Juan (telegraph)
- OOS US-Venezuela No2 (as-found)

Hazards and Obstructions

HARDGROUND and subcropping areas were mapped in the northern part of the chart.
Rocky areas were charted in the northern and southern part of the chart.
A debris patch was charted in the middle part of the chart.
GRAVEL patches were mapped in the south of center and the southern part of the chart.
Scattered depressions were mapped throughout the survey area.
Thirty-one (31) sonar contacts were identified throughout the chart.
Five (5) magnetic contacts related to OOS cables were charted in the eastern part of the chart. Other three (3) magnetic contacts were mapped in the middle, the east of the middle part and the eastern part of the chart which one of them was related to the debris patch and the other two were unknown.
The route runs in United States Territorial Sea and crosses US 3nm Line.

GENERAL NOTES

	Shallow and Deep Water	Inshore
Survey vessel	RV Geo Resolution	Survey Launch GR-2
Surface positioning system	Octopus F185+ GPS, Veripos LD6 DGPS, QinSy Navigation System	Applanix POS MV, Veripos LD900 DGNSS, Qinsy Navigation System
Underwater positioning system	Kongsberg HiPAP 501P USBL System	-
Bathymetry	Reson Seabat 7150-F MBES, Kongsberg Simrad EA400 SBES	Norbit iWBMS System
Morphology and stratigraphy	EdgeTech 4200 SSS, EdgeTech DSS-2000 combined towfish, GeoAcoustics 4x4 Array Pinger	EdgeTech 4200 SSS, GeoAcoustics 2x1 Array Pinger
Magnetometer survey	Geometrics G-882 Marine Magnetometer	Geometrics G-882 Marine Magnetometer

Target burial depth: 1m burial up to 500m water depth
Descriptive terms and definitions: The criteria used for interpretations and descriptions are presented in survey reports

GEODETIC PARAMETERS

Datum Parameters
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Ellipsoid : WGS84
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Projection : Mercator
False Northing : 1 000 000
False Easting : 6 000 000
Latitude of Origin : 0° (Equator)
Longitude of Origin : 73° W
Standard Parallel : 21° N
Scale Factor along Standard Parallel : 1

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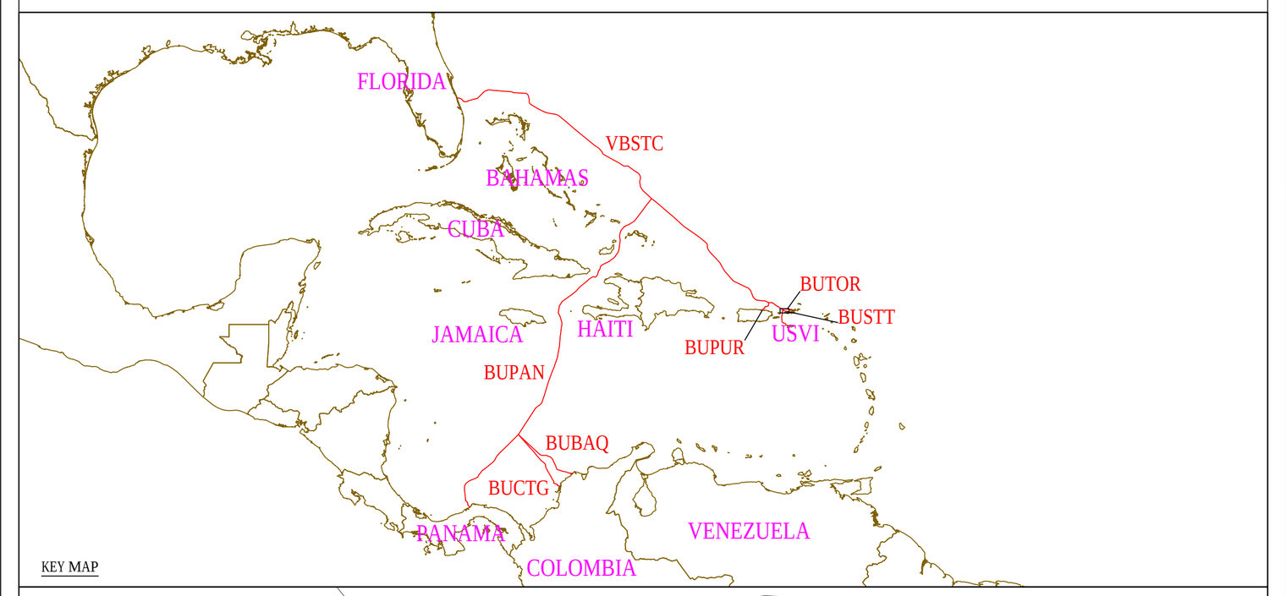
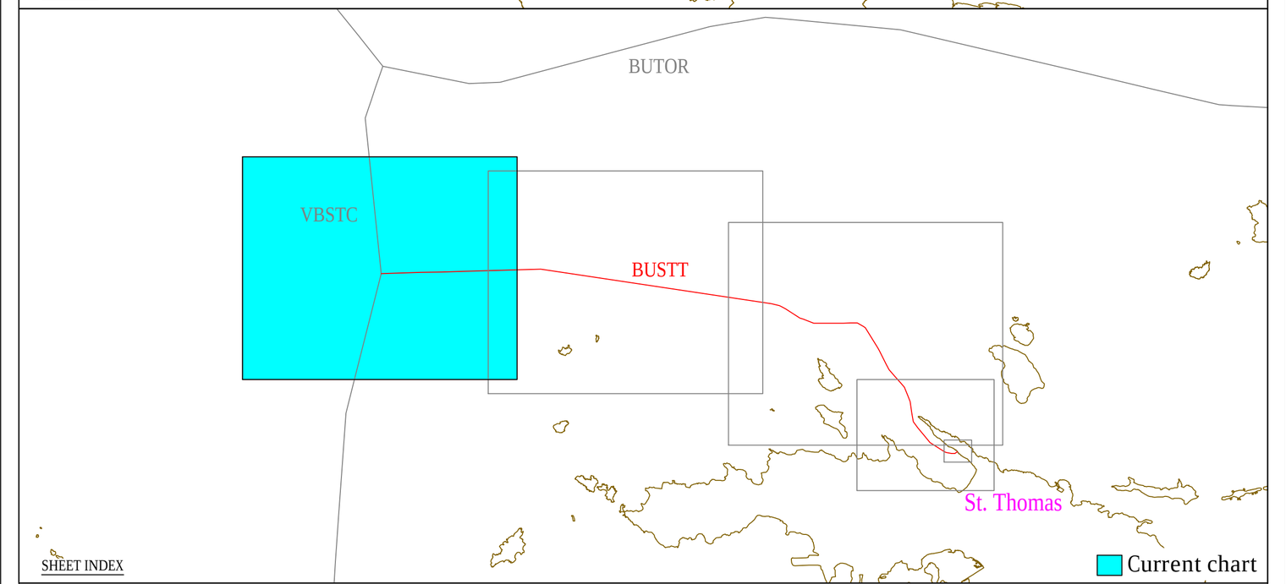
In Deep Water Survey chart : No tidal reduction was applied to soundings deeper than 1000m





Survey date: May 2022

Scale

NATURAL SCALE 1 : 10,000 at 21°N

(At mid-latitude of chart)
TRUE SCALE 1 : 10161.04

Customer: TC FS LW Subsea

Contractor: EGS EARTH SCIENCES & SURVEYING

EGS JOB NO.: SR007121 / R034721

Project name

Trans Caribbean Fiber Submarine Cable System Marine Route Survey

Document title

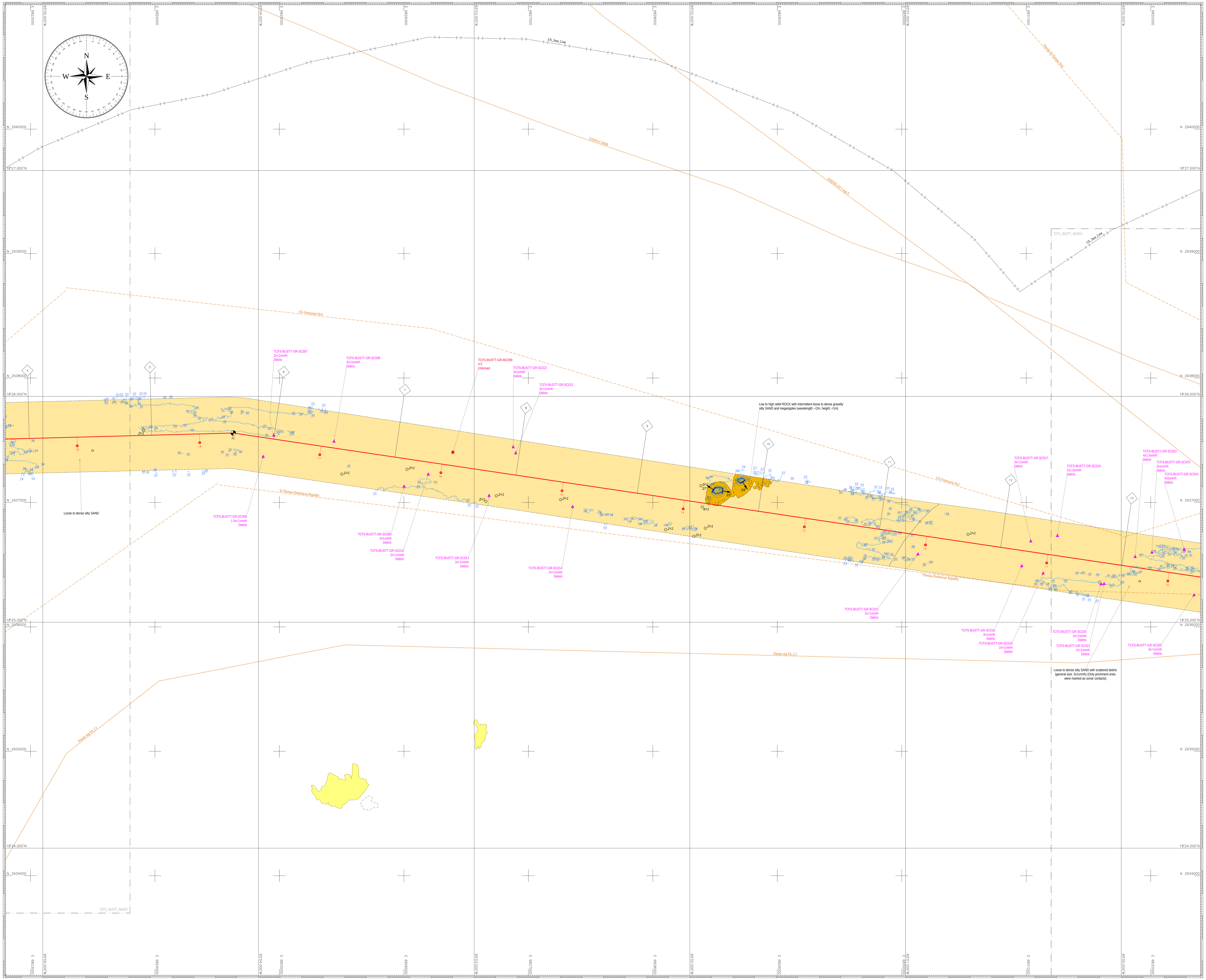
SEGMENT BU ST. THOMAS TO ST. THOMAS
NORTH UP CHART
CHART NO. 001 OF 005
(KP 0.00 - KP 4.82)

Rev	Date	Prepared by	Checked by	Approved by
0	May 2022	Jan Li	Jacky Lee	Chris Welsh

Preliminary

Route based upon: TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls

File name: TCFS_BUSTT_NU001



CARTOGRAPHIC SYMBOLS

- KP / KPR — Post survey route with kilometre post and reverse kilometre post
- Adjacent route
- BMH/AC/BU — Beach manhole / Alter course / Branching Unit
- POL/CX/PX — Point on line / Cable crossing / Pipeline crossing
- Coastline (from Admiralty charts)
- Chart matchline
- Telecommunications cable position, In-service/Out of service/Planned (as-found in magenta)
- Pipeline position, In-service/Out of service/Planned (as-found in magenta)
- Power cable position, In-service/Out of service/Planned (as-found in magenta)
- Maritime boundaries
- Restricted zones and special areas
- Concession block
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives dumping ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY

- 30 — Bathymetric contours in metres. Contour interval may be reduced to aid in clarity.
- 6° — Downslope gradient in degrees (°) as measured over the shortest significant distance
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)

SEABED FEATURES

- cor — CORAL
- fs/cs/vcs — Gas seepage area with predominant sediment classification
- fs/cs/vcs — Boulder field with predominant sediment classification
- Sediments:
  - fs — Fine sediment (predominantly CLAY/SILT)
  - cs — Coarse sediment (SAND and GRAVEL)
  - vcs — Very coarse sediment (COBBLES and BOULDERS)
- Rock:
  - fs/cs/vcs — Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth)
  - r — ROCK outcrop (with veneer of sediments)
  - hs — HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth)
- Sediment or feature boundary
- Inferred sediment or feature boundary
- Approximate limit of side scan sonar coverage
- Seabed scar (trawl or anchor)
- 1, 2 — Isopach contours shown at 1m interval with labels every 1m
- BP001 / BS001 — Beach probe (BP); Beach sample (BS) location with reference number
- DP001 / DS001 — Diver probe (DP); Diver sample (DS) location with reference number
- SC001 5x5x1 — Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height)
- 50x0.5x1 — Linear sonar contact, dashed where partially buried
- SEI001 -2.5 — Pipeline contact determined by seismic profiling system with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed)
- MC001 5.0 — Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla)
- MC002 5.0 — Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla)
- SC001 20x10x7 — Located wreck with reference no. (length x width x height in metres where measurable)
- GC001 — Gravity core (GC); Grab sample (GS) location with reference number
- CP001 — MiniCPT (CP) location with reference number
- 0.5 — Small ROCK outcrop with height in metres if discernible
- d/D — Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible
- 50/3 — General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres)
- 4/0.8 — Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres)
- Orientation of sediment ribbon
- Orientation of current lineation
- -25 — Fault with depth below seafloor (Hachures on footwall)

CHART COMMENT

Cable and Pipeline Crossings

The following cable runs within the survey corridor:

- OOS St.Thomas-Dominican Republic
- OOS US-Venezuela No2

Hazards and Obstructions

Rocky areas with very steep slope were charted in the east of the middle part of the chart.
Scattered depressions were mapped throughout the survey area.
Megaripples (wavelength: <2m, height: <1m) were charted in the east of the middle part of the chart.
Twenty (20) sonar contacts were identified throughout the chart.
Area with scattered debris (general size: 3m x 1m x nmh) was mapped in the eastern part of the chart.
One (1) unknown magnetic contact was mapped in the west of the middle part of the chart.
The route runs inside United States Territorial Sea.

GENERAL NOTES

	Shallow and Deep Water	Inshore
Survey vessel	RV Geo Resolution	Survey Launch GR-2
Surface positioning system	Octopus F185+ GPS, Veripos LD6 DGPS, QinSy Navigation System	Applanix POS MV, Veripos LD900 DGNSS, Qinsy Navigation System
Underwater positioning system	Kongsberg HiPAP 501P USBL System	-
Bathymetry	Reson Seabat 7150-F MBES, Kongsberg Simrad EA400 SBES	Norbit iWBMS System
Morphology and stratigraphy	EdgeTech 4200 SSS, EdgeTech DSS-2000 combined towfish, GeoAcoustics 4x4 Array Pinger	EdgeTech 4200 SSS, GeoAcoustics 2x1 Array Pinger
Magnetometer survey	Geometrics G-882 Marine Magnetometer	Geometrics G-882 Marine Magnetometer

Target burial depth: 1m burial up to 500m water depth
Descriptive terms and definitions: The criteria used for interpretations and descriptions are presented in survey reports

GEODETIC PARAMETERS

Datum Parameters

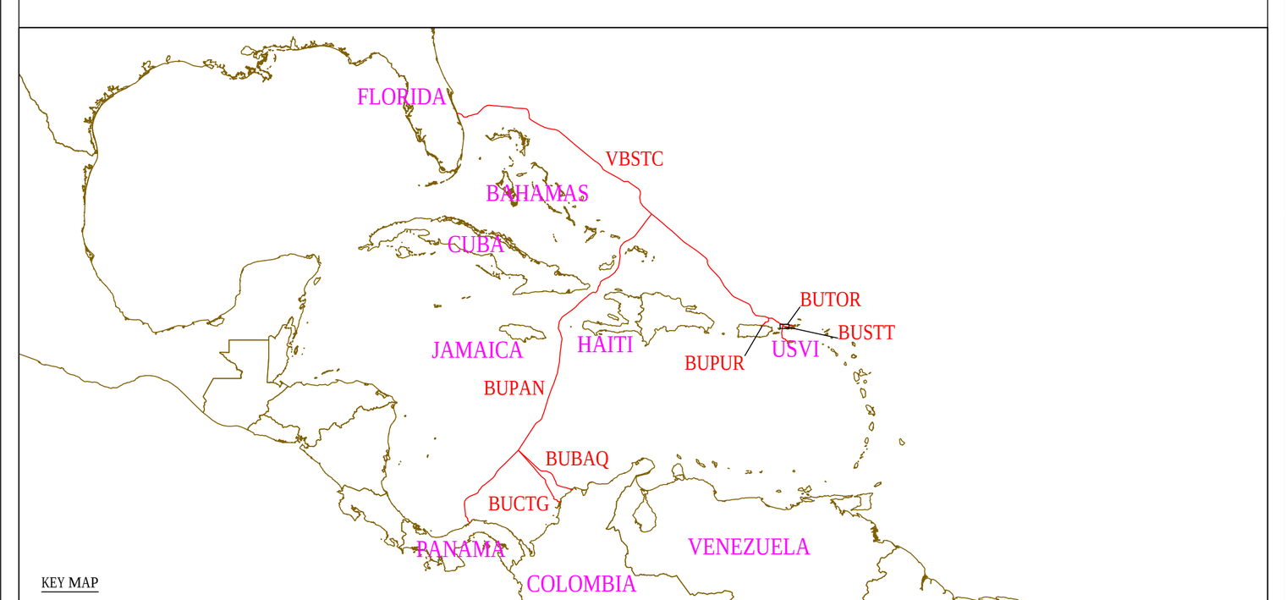
Datum : WGS84
Ellipsoid : WGS84
Semi-major Axis (a) (m) : 6 378 137.000
Inverse Flattening (1/f) : 298.257 223 563

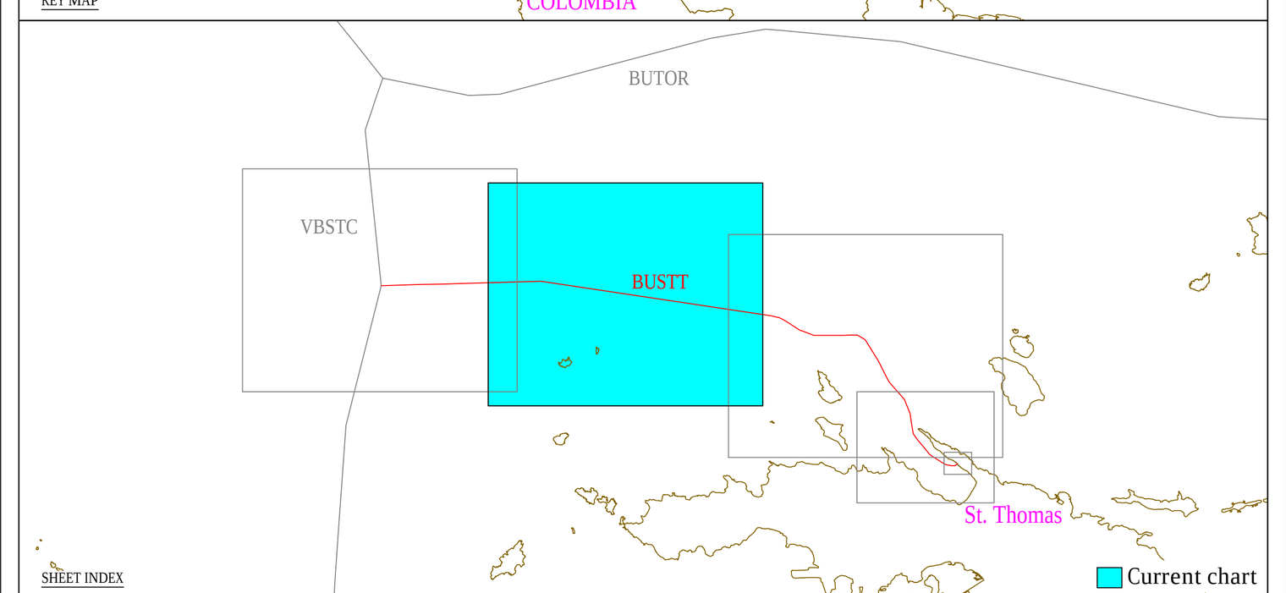
Map Projection Parameters

Projection : Mercator
False Northing : 1 000 000
False Easting : 6 000 000
Latitude of Origin : 0° (Equator)
Longitude of Origin : 73° W
Standard Parallel : 21° N
Scale Factor along Standard Parallel : 1

VERTICAL DATUM

In Landfall and Inshore Survey charts: Bathymetry data has been reduced to Lowest Astronomical Tide (LAT) using predictions from the Admiralty Tide Tables - South West Atlantic Ocean and South America, Volume 2, 2022. Standard Ports: 2462 Saint Thomas (Charlotte Amalie)
In Shallow Water Survey charts: Bathymetry data has been reduced to Lowest Astronomical Tide (LAT) using predictions from the Admiralty Tide Tables - South West Atlantic Ocean and South America, Volume 2, 2022. Standard Ports: 2460 Anegada, 2461 Tortola, 2462 Saint Thomas (Charlotte Amalie), 2462A Saint Thomas (Benner Bay), 2464 Culebra
In Deep Water Survey chart : No tidal reduction was applied to soundings deeper than 1000m





Survey date: May 2022

Scale

NATURAL SCALE 1 : 10,000 at 21°N

(At mid-latitude of chart)
TRUE SCALE 1 : 10161.31

0.0 0.2 0.4 0.6 0.8 1.0 km

Customer: TC FS LW Subsea

Contractor: EGS EARTH SCIENCES & SURVEYING

EGS JOB NO.: SR007121 / R034721

Project name

Trans Caribbean Fiber Submarine Cable System Marine Route Survey

Document title

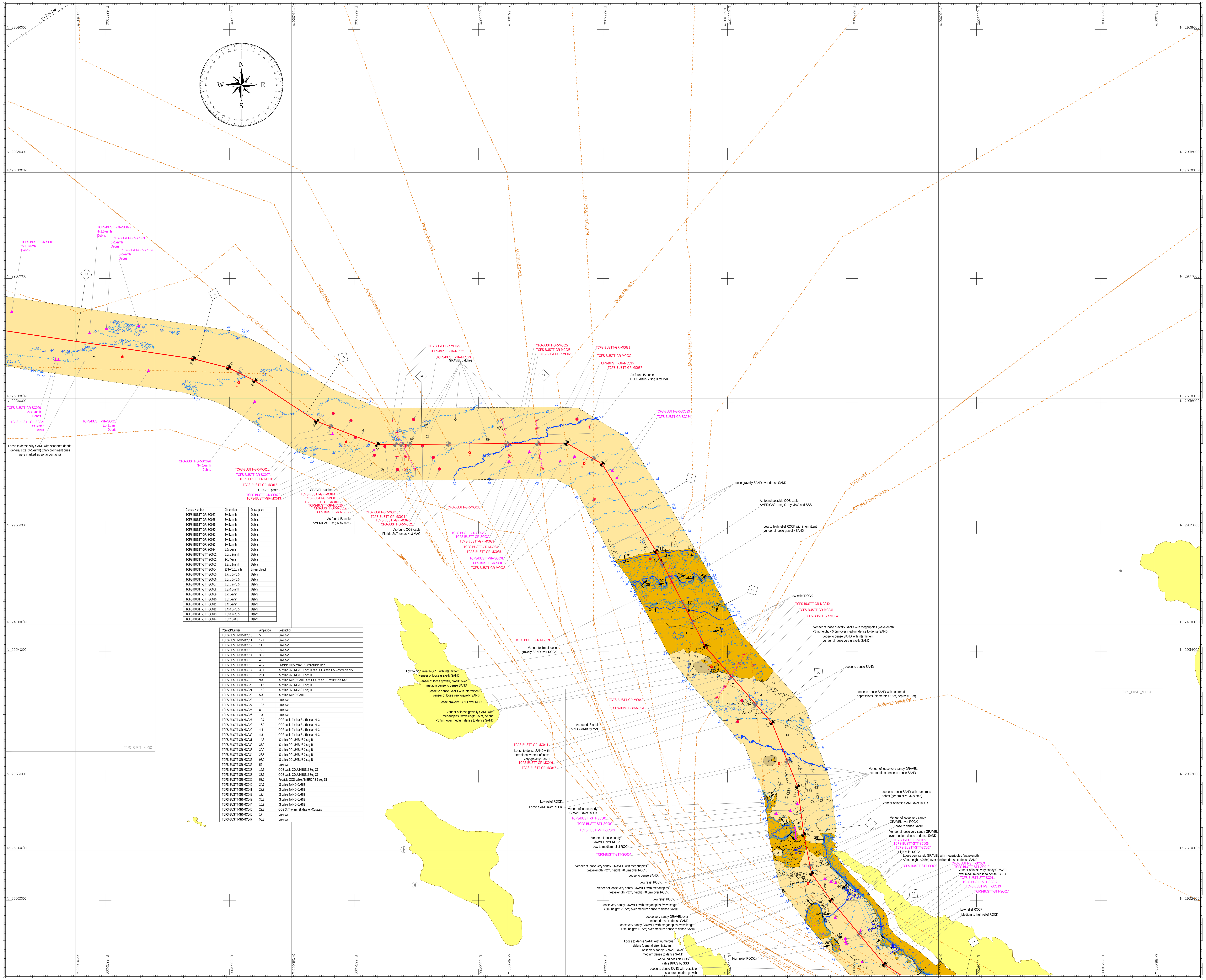
SEGMENT BU ST. THOMAS TO ST. THOMAS
NORTH UP CHART
CHART NO. 002 OF 005
(KP 3.81 - KP 13.65)

Rev	Date	Prepared by	Checked by	Approved by
0	May 2022	Jan Li	Jacky Lee	Chris Welsh

Preliminary

Route based upon: TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls

File name: TCFS_BUSTT_NU002



ContactNumber	Dimensions	Description
TCFS-BUSTT-GR-SC027	2x<1xnmh	Debris
TCFS-BUSTT-GR-SC028	2x<1xnmh	Debris
TCFS-BUSTT-GR-SC029	4x<1xnmh	Debris
TCFS-BUSTT-GR-SC030	2x<1xnmh	Debris
TCFS-BUSTT-GR-SC031	3x<1xnmh	Debris
TCFS-BUSTT-GR-SC032	3x<1xnmh	Debris
TCFS-BUSTT-GR-SC033	2x<1xnmh	Debris
TCFS-BUSTT-GR-SC034	1.5x1xnmh	Debris
TCFS-BUSTT-STT-SC001	1.6x1.2xnmh	Debris
TCFS-BUSTT-STT-SC002	3x1.7xnmh	Debris
TCFS-BUSTT-STT-SC003	2.3x1.1xnmh	Debris
TCFS-BUSTT-STT-SC004	228x<0.5xnmh	Linear object
TCFS-BUSTT-STT-SC005	2.7x1.5x<0.5	Debris
TCFS-BUSTT-STT-SC006	1.6x1.5x<0.5	Debris
TCFS-BUSTT-STT-SC007	1.5x1.2x<0.5	Debris
TCFS-BUSTT-STT-SC008	1.3x0.6xnmh	Debris
TCFS-BUSTT-STT-SC009	1.7x1xnmh	Debris
TCFS-BUSTT-STT-SC010	1.8x1xnmh	Debris
TCFS-BUSTT-STT-SC011	1.4x1xnmh	Debris
TCFS-BUSTT-STT-SC012	1.4x0.8x<0.5	Debris
TCFS-BUSTT-STT-SC013	1.5x0.7x<0.5	Debris
TCFS-BUSTT-STT-SC014	2.5x2.5x0.6	Debris

ContactNumber	Amplitude	Description
TCFS-BUSTT-GR-MC010	5	Unknown
TCFS-BUSTT-GR-MC011	17.1	Unknown
TCFS-BUSTT-GR-MC012	11.8	Unknown
TCFS-BUSTT-GR-MC013	72.9	Unknown
TCFS-BUSTT-GR-MC014	35.9	Unknown
TCFS-BUSTT-GR-MC015	45.6	Unknown
TCFS-BUSTT-GR-MC016	43.2	Possible OOS cable US-Venezuela No2
TCFS-BUSTT-GR-MC017	33.1	IS cable AMERICAS 1 seg N and OOS cable US-Venezuela No2
TCFS-BUSTT-GR-MC018	26.4	IS cable AMERICAS 1 seg N
TCFS-BUSTT-GR-MC019	9.8	IS cable TAINO-CARIB and OOS cable US-Venezuela No2
TCFS-BUSTT-GR-MC020	11.6	IS cable AMERICAS 1 seg N
TCFS-BUSTT-GR-MC021	15.3	IS cable AMERICAS 1 seg N
TCFS-BUSTT-GR-MC022	5.3	IS cable TAINO-CARIB
TCFS-BUSTT-GR-MC023	1.7	Unknown
TCFS-BUSTT-GR-MC024	12.6	Unknown
TCFS-BUSTT-GR-MC025	8.1	Unknown
TCFS-BUSTT-GR-MC026	1.3	Unknown
TCFS-BUSTT-GR-MC027	10.7	OOS cable Florida-St. Thomas No3
TCFS-BUSTT-GR-MC028	16.2	OOS cable Florida-St. Thomas No3
TCFS-BUSTT-GR-MC029	4.4	OOS cable Florida-St. Thomas No3
TCFS-BUSTT-GR-MC030	4.3	OOS cable Florida-St. Thomas No3
TCFS-BUSTT-GR-MC031	14.3	IS cable COLUMBUS 2 seg B
TCFS-BUSTT-GR-MC032	37.9	IS cable COLUMBUS 2 seg B
TCFS-BUSTT-GR-MC033	30.9	IS cable COLUMBUS 2 seg B
TCFS-BUSTT-GR-MC034	28.5	IS cable COLUMBUS 2 seg B
TCFS-BUSTT-GR-MC035	97.9	IS cable COLUMBUS 2 seg B
TCFS-BUSTT-GR-MC036	52	Unknown
TCFS-BUSTT-GR-MC037	16.5	OOS cable COLUMBUS 2 Seg C1
TCFS-BUSTT-GR-MC038	33.6	OOS cable COLUMBUS 2 Seg C1
TCFS-BUSTT-GR-MC039	53.2	Possible OOS cable AMERICAS 1 seg S1
TCFS-BUSTT-GR-MC040	24.7	IS cable TAINO-CARIB
TCFS-BUSTT-GR-MC041	28.3	IS cable TAINO-CARIB
TCFS-BUSTT-GR-MC042	13.4	IS cable TAINO-CARIB
TCFS-BUSTT-GR-MC043	30.9	IS cable TAINO-CARIB
TCFS-BUSTT-GR-MC044	10.3	IS cable TAINO-CARIB
TCFS-BUSTT-GR-MC045	22.8	OOS St.Thomas-St.Maarten-Curacao
TCFS-BUSTT-GR-MC046	17	Unknown
TCFS-BUSTT-GR-MC047	50.3	Unknown

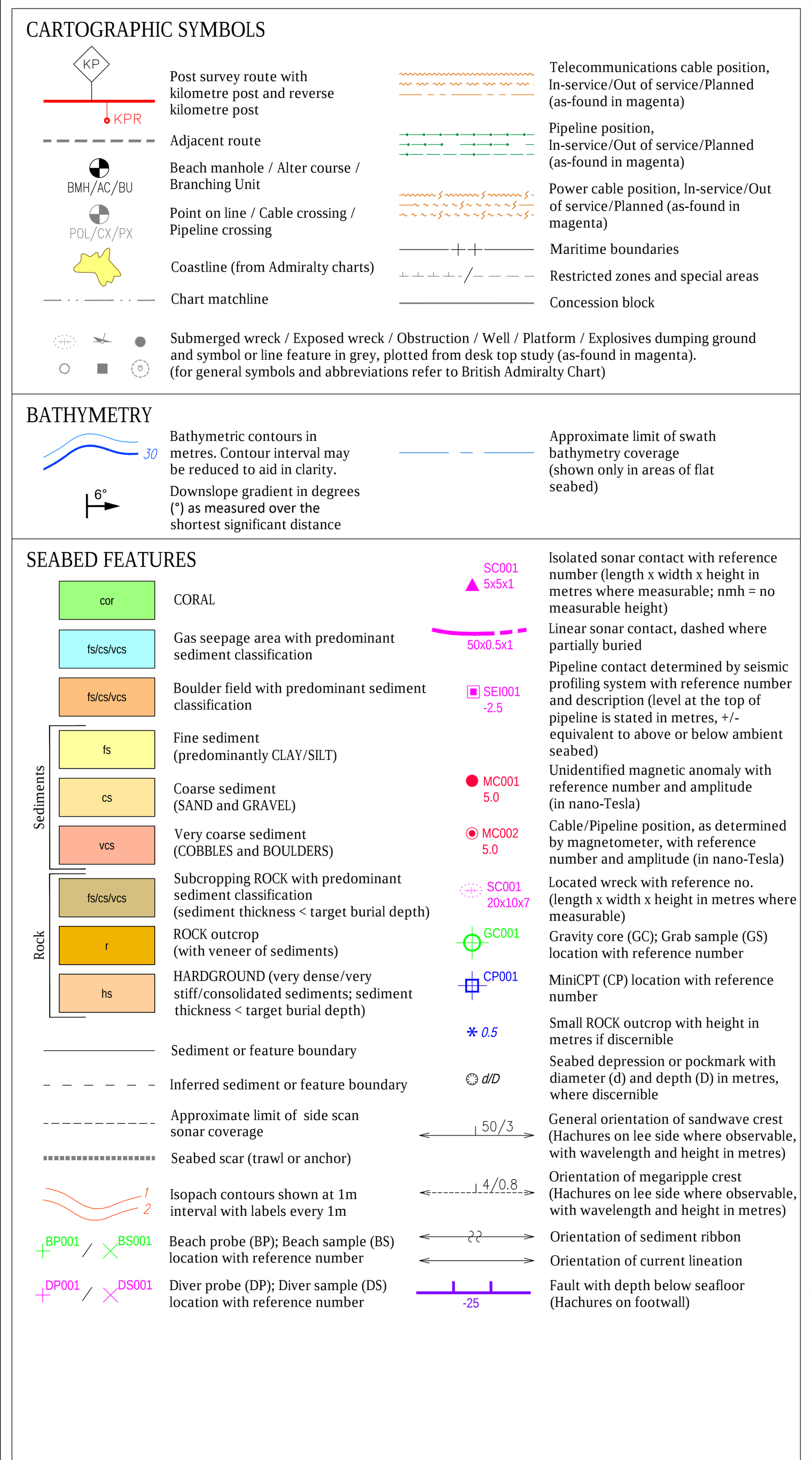


CHART COMMENT

Cable and Pipeline Crossings

- OOS St.Thomas-Dominican Republic
- OOS US-Venezuela No2
- IS AMERICAS 1 seg N (as-found)
- IS TAINO-CARIB (as-found)
- OOS Florida-St. Thomas No2
- OOS Florida-St. Thomas No3 (as-found)
- IS COLUMBUS 2 seg B (as-found)
- OOS Florida-St. Thomas No1
- OOS COLUMBUS 2 Seg C1
- OOS AMERICAS 1 seg S1
- OOS BRUS
- OOS St. Thomas-St. Maarten-Curacao
- OOS St. Thomas-Venezuela No1

Hazards and Obstructions

Rocky and subcropping areas with moderate to very steep slope were mapped in the south of center and the southeastern part of the chart.
Area with GRAVEL patches were mapped in the west of the middle part of the chart.
Megaripples (wavelength: <2m, height: <0.5m) were identified in the southeast of the middle part and the southeastern part of the chart.
Area with scattered depressions (diameter: <2.5m, depth: <0.5m) were mapped in the southeastern of middle part of the chart.
Thirty (30) sonar contacts were charted throughout the survey area where one of the contacts was identified as linear object.
Area with scattered debris (general size: 3m x 1m x nmh) was mapped in the northwestern part of the chart.
Areas with numerous debris (general size: 3m x 2m x nmh) were charted in the southeast of the middle part and the southeastern part of the chart.
Thirty-eight (38) magnetic contacts were charted throughout the chart where twenty-five (25) of the contacts were related to IS & OOS cables and thirteen (13) of the contacts were unknown.
The route runs inside United States Territorial Sea.

GENERAL NOTES

	Shallow and Deep Water	Inshore
Survey vessel	RV Geo Resolution	Survey Launch GR-2
Surface positioning system	Octopus F185+ GPS, Veripos LD6 DGPS, QinSy Navigation System	Applanix POS MV, Veripos LD900 DGNSS, Qinsy Navigation System
Underwater positioning system	Kongsberg HiPAP 501P USBL System	-
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Descriptive terms and definitions: The criteria used for interpretations and descriptions are presented in survey reports

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Map Projection Parameters
Projection : Mercator
False Northing : 1 000 000
False Easting : 6 000 000
Latitude of Origin : 0° (Equator)
Longitude of Origin : 73° W
Standard Parallel : 21° N
Scale Factor along Standard Parallel : 1

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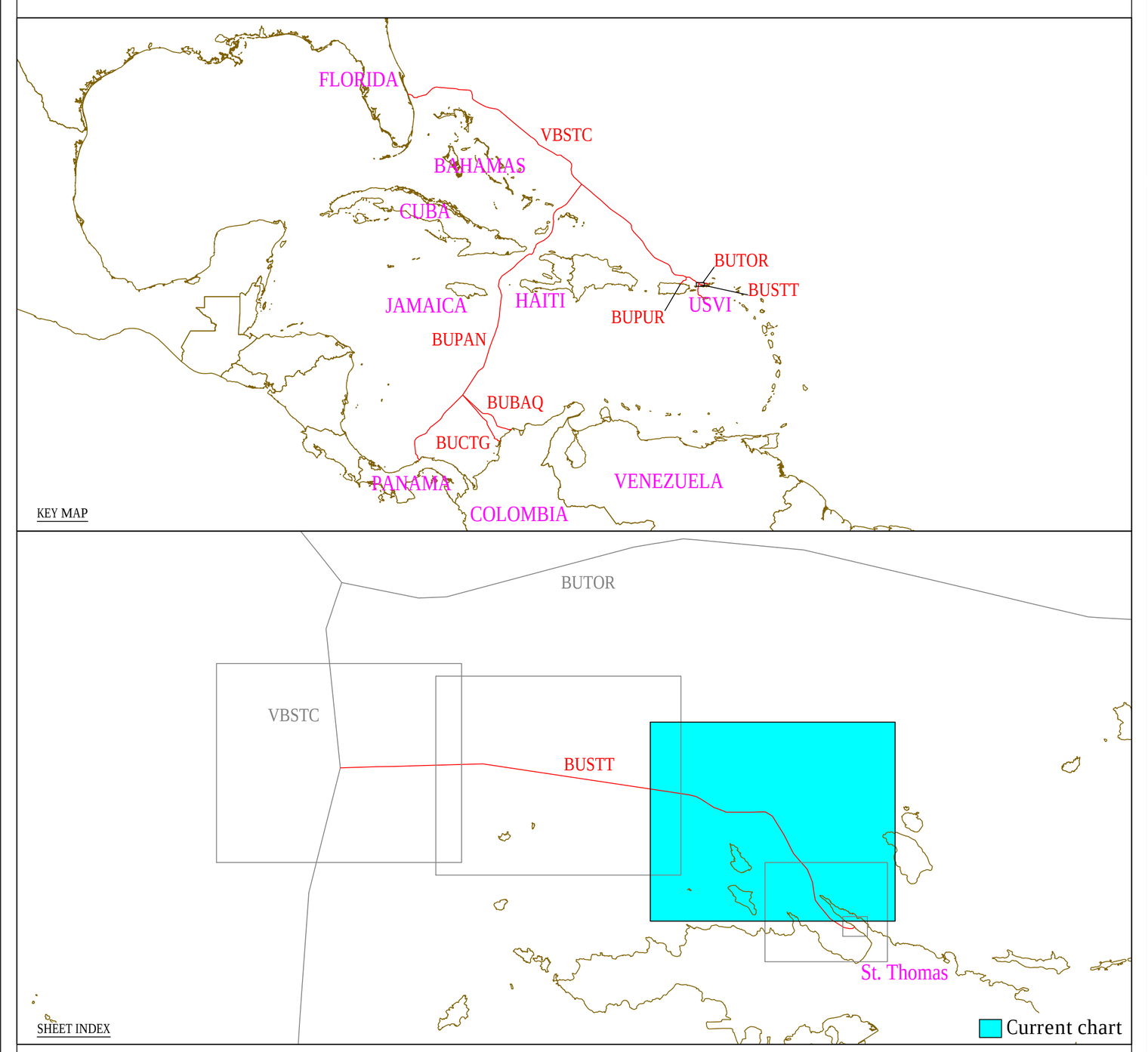


Survey date: May 2022

Scale
NATURAL SCALE 1 : 10,000 at 21°N
(At mid-latitude of chart)
TRUE SCALE 1 : 10162.28
0.0 0.2 0.4 0.6 0.8 1.0 km

Customer: TC FS LW Subsea
Contractor: EGS EARTH SCIENCES & SURVEYING
EGS JOB NO.: SR007121 / R034721

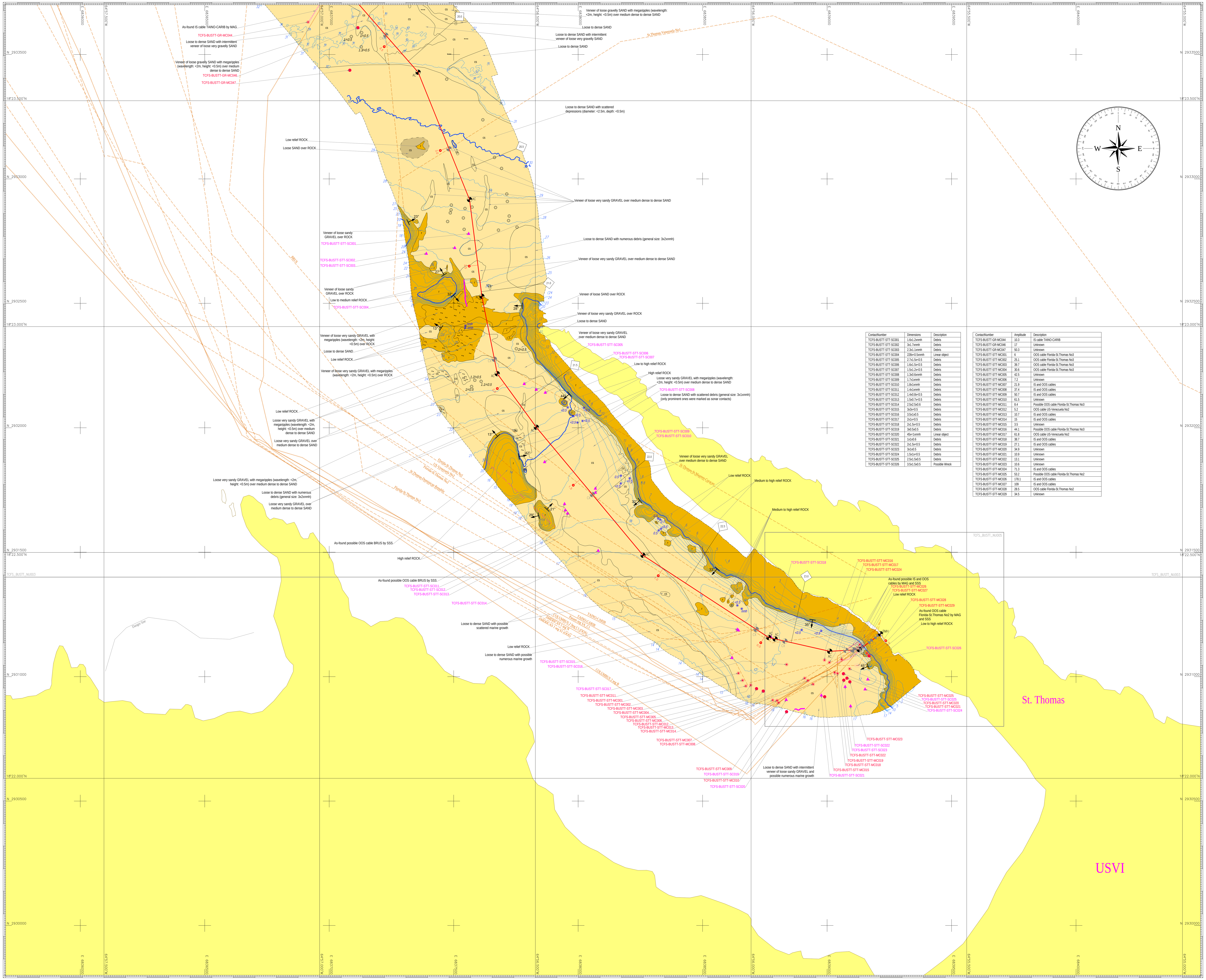
Project name
Trans Caribbean Fiber Submarine Cable System Marine Route Survey

Document title
SEGMENT BU ST. THOMAS TO ST. THOMAS
NORTH UP CHART
CHART NO. 003 OF 005
(KP 12.42 - KP 22.46)

Rev	Date	Prepared by	Checked by	Approved by
0	May 2022	Jan Li	Jacky Lee	Chris Welsh

Preliminary

Route based upon: TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls
File name: TCFS_BUSTT_NU003



ContactNumber	Dimensions	Description
TCFS-BUSTT-STT-SC001	1.6x1.2xnmh	Debris
TCFS-BUSTT-STT-SC002	3x1.7xnmh	Debris
TCFS-BUSTT-STT-SC003	2.3x1.1xnmh	Debris
TCFS-BUSTT-STT-SC004	228x<0.5xnmh	Linear object
TCFS-BUSTT-STT-SC005	2.7x1.5x<0.5	Debris
TCFS-BUSTT-STT-SC006	1.6x1.5x<0.5	Debris
TCFS-BUSTT-STT-SC007	1.5x1.2x<0.5	Debris
TCFS-BUSTT-STT-SC008	1.3x0.6xnmh	Debris
TCFS-BUSTT-STT-SC009	1.7x1xnmh	Debris
TCFS-BUSTT-STT-SC010	1.8x1xnmh	Debris
TCFS-BUSTT-STT-SC011	1.4x1xnmh	Debris
TCFS-BUSTT-STT-SC012	1.4x0.8x<0.5	Debris
TCFS-BUSTT-STT-SC013	1.5x0.7x<0.5	Debris
TCFS-BUSTT-STT-SC014	2.5x2.5x0.6	Debris
TCFS-BUSTT-STT-SC015	3x3x<0.5	Debris
TCFS-BUSTT-STT-SC016	3.5x1x0.5	Debris
TCFS-BUSTT-STT-SC017	2x1x<0.5	Debris
TCFS-BUSTT-STT-SC018	2x1.5x<0.5	Debris
TCFS-BUSTT-STT-SC019	3x0.5x0.5	Debris
TCFS-BUSTT-STT-SC020	45x<1xnmh	Linear object
TCFS-BUSTT-STT-SC021	1x1x0.6	Debris
TCFS-BUSTT-STT-SC022	2x1.5x<0.5	Debris
TCFS-BUSTT-STT-SC023	3x1x0.5	Debris
TCFS-BUSTT-STT-SC024	1.5x1x<0.5	Debris
TCFS-BUSTT-STT-SC025	2.5x1.5x0.5	Debris
TCFS-BUSTT-STT-SC026	3.5x1.5x0.5	Possible Wreck

ContactNumber	Amplitude	Description
TCFS-BUSTT-GR-MC044	10.3	IS cable TAINO-CARIB
TCFS-BUSTT-GR-MC046	17	Unknown
TCFS-BUSTT-GR-MC047	50.3	Unknown
TCFS-BUSTT-STT-MC001	6	OOS cable Florida-St.Thomas No3
TCFS-BUSTT-STT-MC002	25.1	OOS cable Florida-St.Thomas No3
TCFS-BUSTT-STT-MC003	39.7	OOS cable Florida-St.Thomas No3
TCFS-BUSTT-STT-MC004	30.6	OOS cable Florida-St.Thomas No3
TCFS-BUSTT-STT-MC005	42.5	Unknown
TCFS-BUSTT-STT-MC006	7.2	Unknown
TCFS-BUSTT-STT-MC007	21.9	IS and OOS cables
TCFS-BUSTT-STT-MC008	37.4	IS and OOS cables
TCFS-BUSTT-STT-MC009	50.7	IS and OOS cables
TCFS-BUSTT-STT-MC010	61.5	Unknown
TCFS-BUSTT-STT-MC011	8.4	Possible OOS cable Florida-St.Thomas No3
TCFS-BUSTT-STT-MC012	5.2	OOS cable US-Venezuela No2
TCFS-BUSTT-STT-MC013	10.7	IS and OOS cables
TCFS-BUSTT-STT-MC014	15	IS and OOS cables
TCFS-BUSTT-STT-MC015	3.5	Unknown
TCFS-BUSTT-STT-MC016	44.1	Possible OOS cable Florida-St.Thomas No3
TCFS-BUSTT-STT-MC017	61.8	OOS cable US-Venezuela No2
TCFS-BUSTT-STT-MC018	38.7	IS and OOS cables
TCFS-BUSTT-STT-MC019	27.1	IS and OOS cables
TCFS-BUSTT-STT-MC020	34.9	Unknown
TCFS-BUSTT-STT-MC021	10.9	Unknown
TCFS-BUSTT-STT-MC022	13.1	Unknown
TCFS-BUSTT-STT-MC023	10.6	Unknown
TCFS-BUSTT-STT-MC024	71.3	IS and OOS cables
TCFS-BUSTT-STT-MC025	53.2	Possible OOS cable Florida-St.Thomas No2
TCFS-BUSTT-STT-MC026	178.1	IS and OOS cables
TCFS-BUSTT-STT-MC027	109	IS and OOS cables
TCFS-BUSTT-STT-MC028	28.5	OOS cable Florida-St.Thomas No2
TCFS-BUSTT-STT-MC029	34.5	Unknown

CARTOGRAPHIC SYMBOLS

- KP / KPR — Post survey route with kilometre post and reverse kilometre post
- Adjacent route
- BMH/AC/BU — Beach manhole / Alter course / Branching Unit
- POL/CX/PX — Point on line / Cable crossing / Pipeline crossing
- Coastline (from Admiralty charts)
- Chart matchline
- Telecommunications cable position, In-service/Out of service/Planned (as-found in magenta)
- Pipeline position, In-service/Out of service/Planned (as-found in magenta)
- Power cable position, In-service/Out of service/Planned (as-found in magenta)
- Maritime boundaries
- Restricted zones and special areas
- Concession block
- Submerged wreck / Exposed wreck / Obstruction / Well / Platform / Explosives dumping ground and symbol or line feature in grey, plotted from desk top study (as-found in magenta). (for general symbols and abbreviations refer to British Admiralty Chart)

BATHYMETRY

- 30 — Bathymetric contours in metres. Contour interval may be reduced to aid in clarity.
- 6° — Downslope gradient in degrees (°) as measured over the shortest significant distance
- Approximate limit of swath bathymetry coverage (shown only in areas of flat seabed)

SEABED FEATURES

- cor — CORAL
- fs/cs/vcs — Gas seepage area with predominant sediment classification
- fs/cs/vcs — Boulder field with predominant sediment classification
- Sediments:
  - fs — Fine sediment (predominantly CLAY/SILT)
  - cs — Coarse sediment (SAND and GRAVEL)
  - vcs — Very coarse sediment (COBBLES and BOULDERS)
- Rock:
  - fs/cs/vcs — Subcropping ROCK with predominant sediment classification (sediment thickness < target burial depth)
  - r — ROCK outcrop (with veneer of sediments)
  - hs — HARDGROUND (very dense/very stiff/consolidated sediments; sediment thickness < target burial depth)
- Sediment or feature boundary
- Inferred sediment or feature boundary
- Approximate limit of side scan sonar coverage
- Seabed scar (trawl or anchor)
- 1 / 2 — Isopach contours shown at 1m interval with labels every 1m
- BP001 / BS001 — Beach probe (BP); Beach sample (BS) location with reference number
- DP001 / DS001 — Diver probe (DP); Diver sample (DS) location with reference number
- SC001 5x5x1 — Isolated sonar contact with reference number (length x width x height in metres where measurable; nmh = no measurable height)
- 50x0.5x1 — Linear sonar contact, dashed where partially buried
- SEI001 -2.5 — Pipeline contact determined by seismic profiling system with reference number and description (level at the top of pipeline is stated in metres, +/- equivalent to above or below ambient seabed)
- MC001 5.0 — Unidentified magnetic anomaly with reference number and amplitude (in nano-Tesla)
- MC002 5.0 — Cable/Pipeline position, as determined by magnetometer, with reference number and amplitude (in nano-Tesla)
- SC001 20x10x7 — Located wreck with reference no. (length x width x height in metres where measurable)
- GC001 — Gravity core (GC); Grab sample (GS) location with reference number
- CP001 — MiniCPT (CP) location with reference number
- 0.5 — Small ROCK outcrop with height in metres if discernible
- d/D — Seabed depression or pockmark with diameter (d) and depth (D) in metres, where discernible
- 50/3 — General orientation of sandwave crest (Hachures on lee side where observable, with wavelength and height in metres)
- 4/0.8 — Orientation of megaripple crest (Hachures on lee side where observable, with wavelength and height in metres)
- Orientation of sediment ribbon
- Orientation of current lineation
- -25 — Fault with depth below seafloor (Hachures on footwall)

CHART COMMENT

Cable and Pipeline Crossings

- IS TAINO-CARIB (as-found)
- OOS St.Thomas-St. Maarten-Curacao
- OOS St.Thomas-Venezuela No1
- OOS Florida-St. Thomas No2 (as-found)
- OOS Florida-St. Thomas No1
- OOS BRUS (as-found)
- OOS AMERICAS 1 seg S1
- IS AMERICAS 1 seg N
- OOS Florida-St. Thomas No3
- IS Panam seg SA_C1
- OOS COLUMBUS 2 Seg C1
- OOS US-Venezuela No2
- IS COLUMBUS 2 seg B
- IS AMERICAS 1 seg N
- OOS AMERICAS 1 seg S1

The following cable runs within the survey corridor:

- OOS St. homas-Dominican Republic

Hazards and Obstructions

Rocky and subcropping areas with moderate to very steep slopes were mapped in the north of the middle part, the middle and the southeastern part of the chart.
Megaripples (wavelength: <2m, height: <0.5m) were identified in the northern part, the west of the middle part of the chart.
Area with scattered depressions (diameter: <2.5m, depth: <0.5m) were mapped in the northwestern of the chart.
Twenty-six (26) sonar contacts were charted throughout the survey area where two (2) of the contacts were identified as linear object and one (1) of the contacts as a possible wreck.
Area with scattered debris was mapped in the middle part of the chart.
Area with numerous debris was identified in the northern of the middle and the middle part of the chart.
Thirty-two (32) magnetic contacts were charted where twenty-one (21) of the contacts are related to IS & OOS cables and eleven (11) of the contacts are unknown.
The route runs inside United States Territorial Sea.

GENERAL NOTES

	Shallow and Deep Water	Inshore
Survey vessel	RV Geo Resolution	Survey Launch GR-2
Surface positioning system	Octopus F185+ GPS, Veripos LD6 DGPS, QinSy Navigation System	Applanix POS MV, Veripos LD900 DGNSS, Qinsy Navigation System
Underwater positioning system	Kongsberg HiPAP 501P USBL System	-
Bathymetry	Reson Seabat 7150-F MBES, Kongsberg Simrad EA400 SBES	Norbit iWBMS System
Morphology and stratigraphy	EdgeTech 4200 SSS, EdgeTech DSS-2000 combined towfish, GeoAcoustics 4x4 Array Pinger	EdgeTech 4200 SSS, GeoAcoustics 2x1 Array Pinger
Magnetometer survey	Geometrics G-882 Marine Magnetometer	Geometrics G-882 Marine Magnetometer

Target burial depth: 1m burial up to 500m water depth
Descriptive terms and definitions: The criteria used for interpretations and descriptions are presented in survey reports

GEODETIC PARAMETERS

Datum Parameters

Datum : WGS84
Ellipsoid : WGS84
Semi-major Axis (a) (m) : 6 378 137.000
Inverse Flattening (1/f) : 298.257 223 563

Map Projection Parameters

Projection : Mercator
False Northing : 1 000 000
False Easting : 6 000 000
Latitude of Origin : 0° (Equator)
Longitude of Origin : 73° W
Standard Parallel : 21° N
Scale Factor along Standard Parallel : 1

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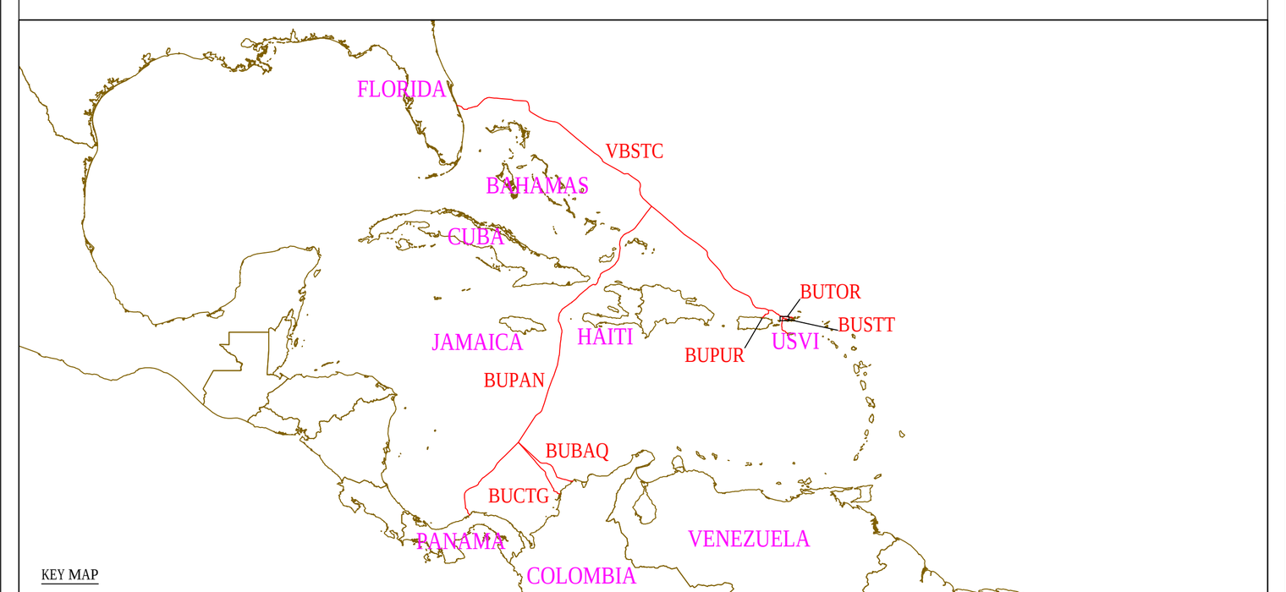
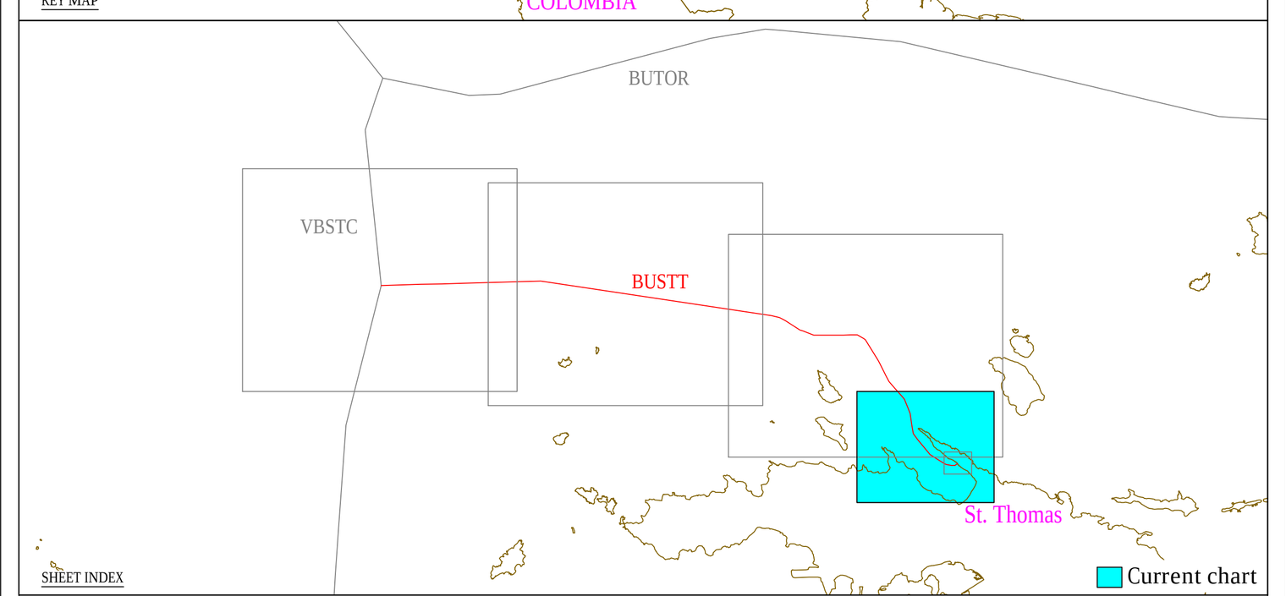




Survey date: May 2022

Scale

NATURAL SCALE 1 : 5,000 at 21°N

(At mid-latitude of chart)
TRUE SCALE 1 : 5082.09

0 100 200 300 400 500 m

Customer: LW Subsea

Contractor: EGS EARTH SCIENCES & SURVEYING

EGS JOB NO.: SR007121 / R034721

Project name

Trans Caribbean Fiber Submarine Cable System Marine Route Survey

Document title

SEGMENT BU ST. THOMAS TO ST. THOMAS
NORTH UP CHART
CHART NO. 004 OF 005
(KP 19.69 - KP 23.39)

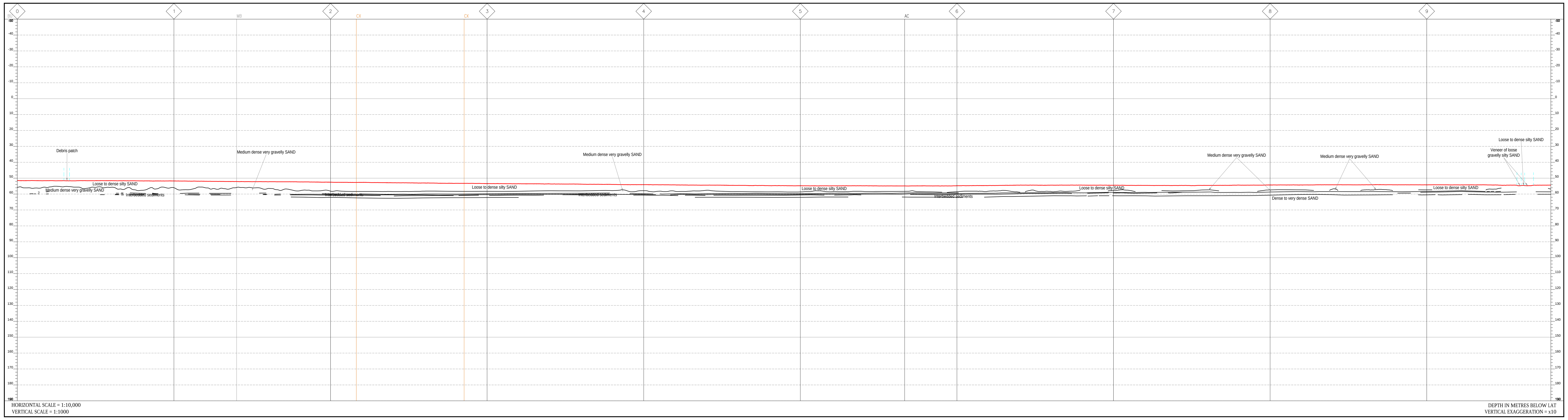
Rev	Date	Prepared by	Checked by	Approved by
0	May 2022	Jan Li	Jacky Lee	Chris Welsh

Preliminary

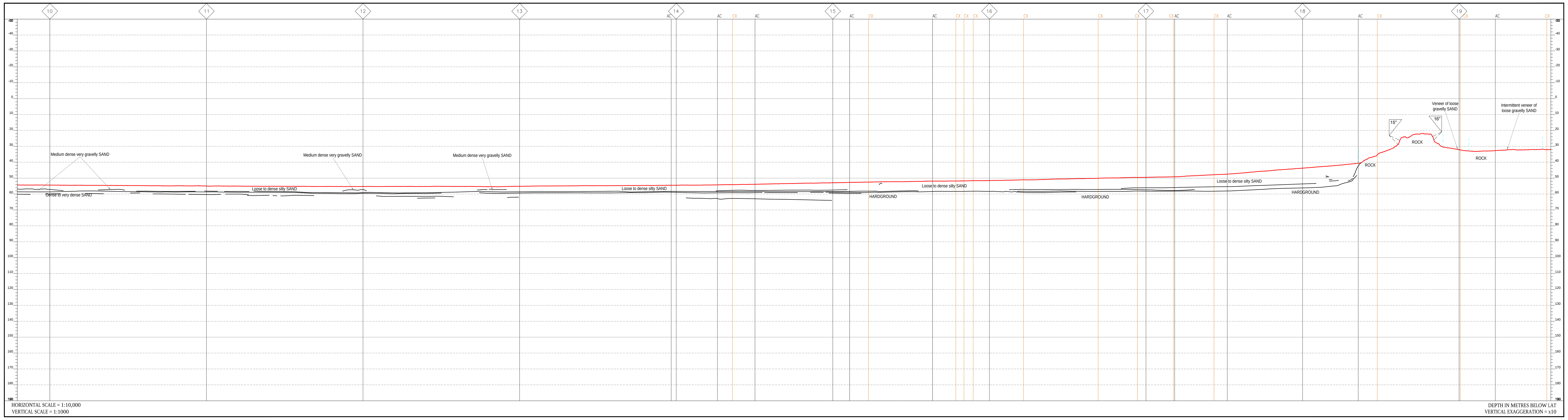
Route based upon: TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls

File name: TCFS_BUSTT_NU004

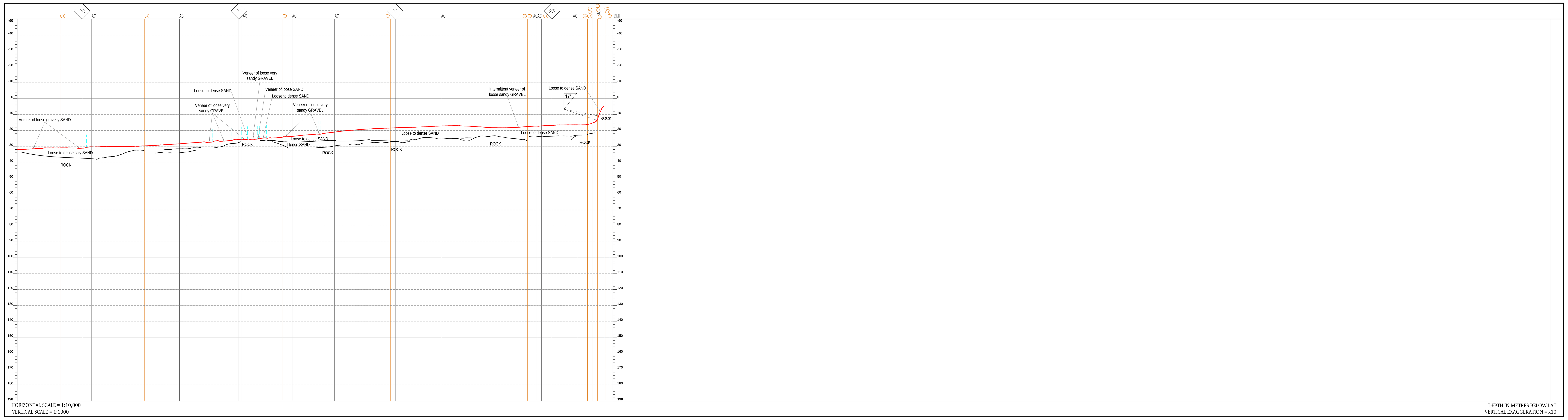
SEABED PROFILE AND GEOLOGICAL INFORMATION PANEL



SEABED PROFILE AND GEOLOGICAL INFORMATION PANEL



SEABED PROFILE AND GEOLOGICAL INFORMATION PANEL



SHALLOW GEOLOGY PROFILE

- Seabed profile
- Major reflectors
- 10° Seafloor slope angle values in degrees
- CP001 MiniCPT (CP) location with reference number
- GC001 Seabed sample location with reference number
- Seabed features boundary
- Cable / Pipeline crossing

GENERAL NOTES

	Shallow and Deep Water	Inshore
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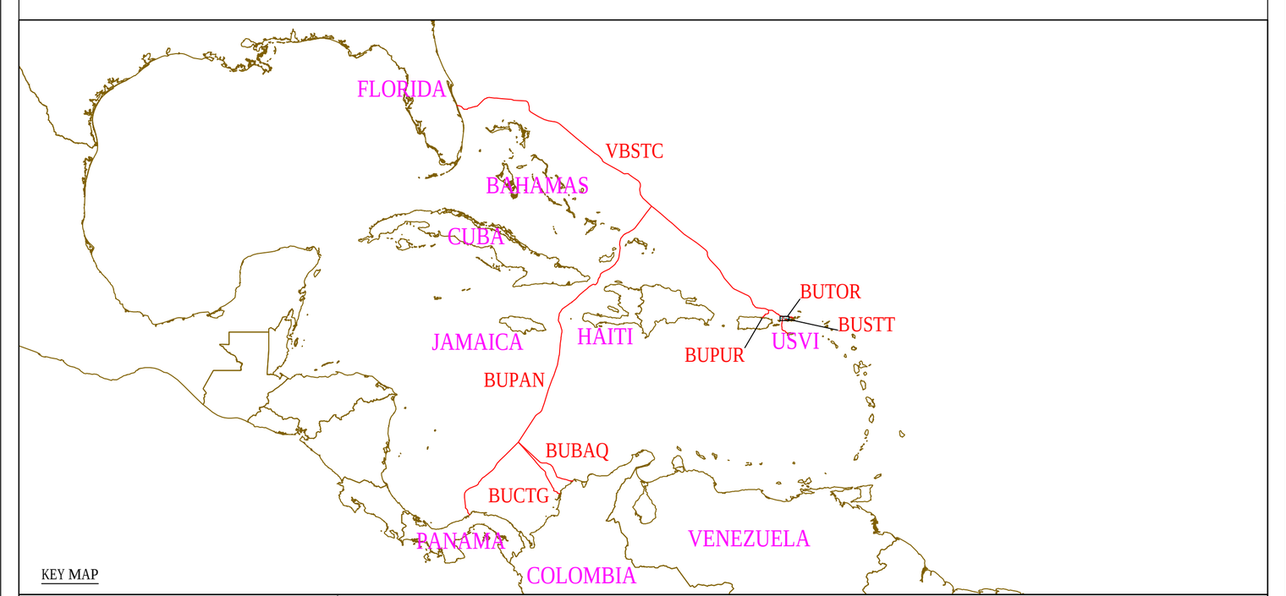
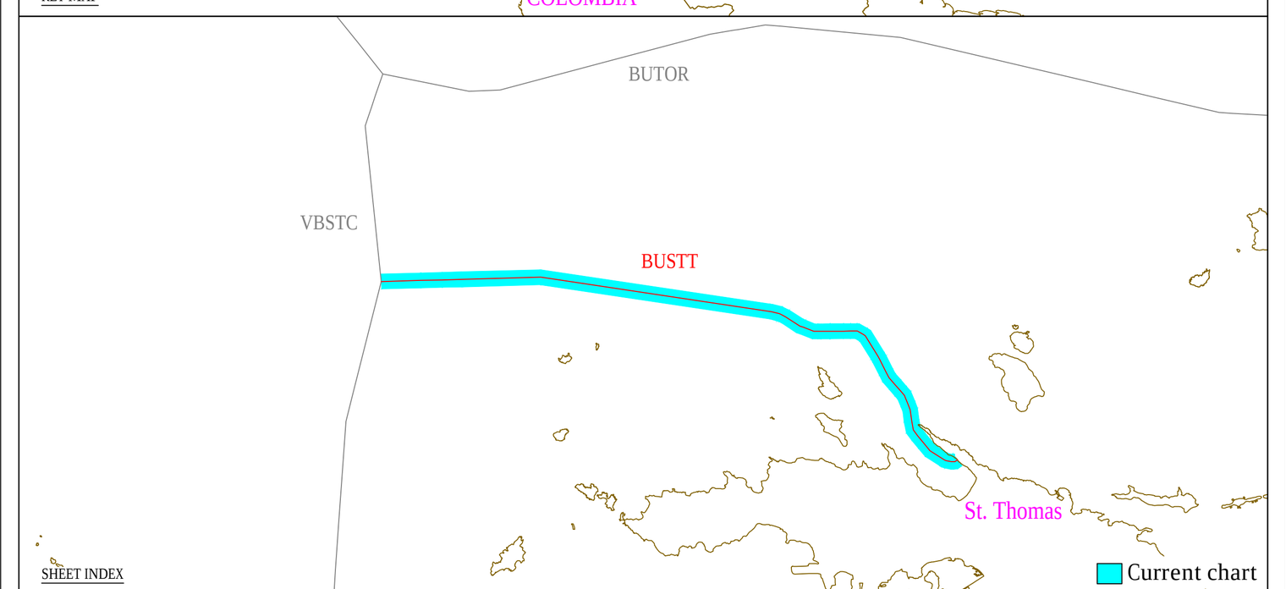




Survey date: May 2022

Scale: NATURAL SCALE 1 : 10,000 at 21° N (0.0 – 0.2 – 0.4 – 0.6 – 0.8 – 1.0 km)

Customer: TCFS LW Subsea

Contractor: EGS EARTH SCIENCES & SURVEYING

EGS JOB NO.: SR007121 / R034721

Project name: **Trans Caribbean Fiber Submarine Cable System Marine Route Survey**

Document title: SEGMENT BU ST. THOMAS TO ST. THOMAS
STRIP CHART
CHART NO. 001 OF 001
(KP 0.00 - KP 23.39)

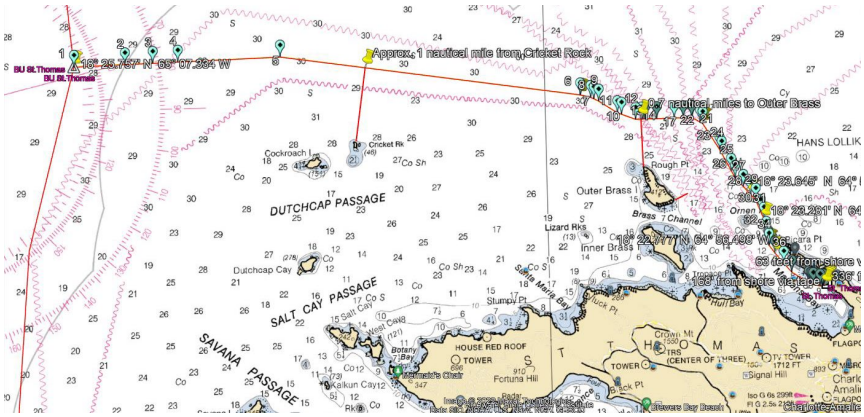
Rev	Date	Prepared by	Checked by	Approved by
0	May 2022	Jan Li	Jacky Lee	Chris Welsh

Preliminary

Route based upon: TCFS_BU-St.Thomas_2022-04-06_CX_withBurial.xls

File name: TCFS_BUSTT_SC001

BENTHIC SURVEY REPORT



BENTHIC SURVEY REPORT

AT&T OF THE VIRGIN ISLANDS INC

No. 1, 2, 3, 4, 5 & 6 Estate Peterborg, Northside St. Thomas, USVI

MAGEN'S BAY, ST. THOMAS USVI TRANS-CARIBBEAN FIBER SYSTEM CABLE LANDING PROJECT

Submitted by:

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Any Way You Look At It We Are The BEST
7-SEAS-L LTD

Tysam Tech, LLC

2022/11/18 -11/20 – STT Observations and Notes

The proposed submarine cable lay in St. Thomas enters the 3 nautical mile (3.5 statute miles) USVI territorial waters boundary at GPS point #2. It comes from a north/south cable intersection 0.75 nautical miles to the west of there at GPS point #1. The cable runs east passing approximately one nautical mile north of Cricket Rock onward to a point approximately 0.7 nautical miles north of Outer Brass then continues east to a point roughly one nautical mile northeast of Outer Brass where it runs generally south and southeast into Magen's Bay. The route is mapped by 55 GPS points starting at the intersection with the north/south cable (GPS point 1) and ending on land with GPS Point 55. (Figure 1 below).

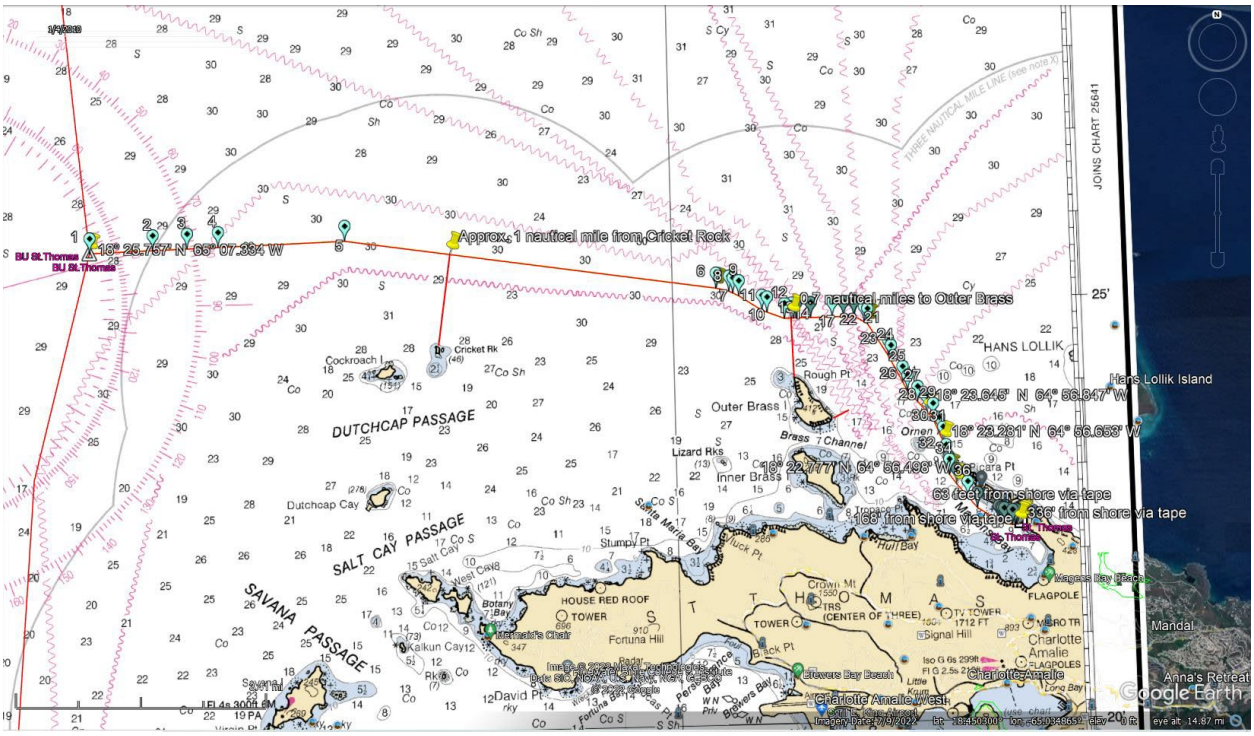


Figure 1: NOAA chart overlay on Google Earth Image showing proposed cable route and the numerous existing cables identified by oscillating red lines.

The proposed route was videotaped using a drop camera, ROV and/or diver held cameras. After inspecting and videotaping the 6.8 nautical miles from GPS 23 to GPS 5 and finding no significant habitats and a uniform silt/sand bottom, the section between GPS 1 to a point approximately 500 feet west of GPS 5 was randomly sampled with a drop camera at various sections on and near the proposed route to look for any possible significant benthic habitat. The benthic community was a uniform fine sand/silt for the entire route from GPS 1 to GPS 23 (approximately 10 nautical miles) and a uniform depth that varied only from a maximum of 178' near GPS 4 to 130' at GPS 23.

Of particular concern for the proposed cable route was the possibility of encountering deep water Mesophotic Reefs. These little studied reefs are found elsewhere in St. Thomas (see T. B. Smith, et. al.

"*Benthic structure and cryptic mortality in a Caribbean mesophotic coral reef bank system, the Hind Bank Marine Conservation District, U.S. Virgin Islands*" in Coral Reefs (2010) 29:289–308 DOI 10.1007/s00338-009-0575-8 and David K.Weinstein, Tyler B. Smith, James S. Klaus in "*Mesophotic bioerosion: Variability and structural impact on U.S. Virgin Island deep reefs*" in Geomorphology 222 (2014) 14–24). Therefore, particular attention was paid to areas near land that might have connected or associated hard-bottom habitats that could support these deep reefs. None were found (see figure 3).

Video and still photos were collected from a mid-point on the 70 foot deep reef discovered between GPS 24 and GPS 25 (Figure 2). Two 25 meter long transects, one running north and the other south, were laid from this center point via SCUBA with Nikon W300 and GoPro Hero 4 cameras. In the ROV video footage from the same area an existing cable is plainly visible with no observed disturbance of benthic habitats.

Figure 2: Location of reef between GPS Points 24 and 25 that is east of Outer Brass Island

From GPS point #55 on shore, a survey was made with a measuring tape laid along the bottom (and in view in the videos) out 100+ meters from shore to GPS 50. As with other existing cables found elsewhere, the existing cables are plainly visible here, some on the reef and some well off the bottom. No evidence of habitat degradation was observed. The reef documented at approximately 200' to 300' from shore is a mixed bottom with various habitats and benthic life, including hard corals of various species.

To document the 14.5 mile proposed route, 5 ¾ hours of video footage was captured using a professional Outland UWC-325/P Color Camera which featured very low light sensitivity (.001 lux) using

a 3.6mm f1.4 lens measuring 1.62" x 5" with a depth rating of 2000 m and 750 lines horizontal resolution. 83 minutes of video footage was captured using a Deep Trekker Revolution ROV.

Figure 3: Sites surveyed south of the proposed cable route that are closer to land.

Figure 4: Proposed Cable Route as it passes closest to Picara Point (see Figure 2 also)

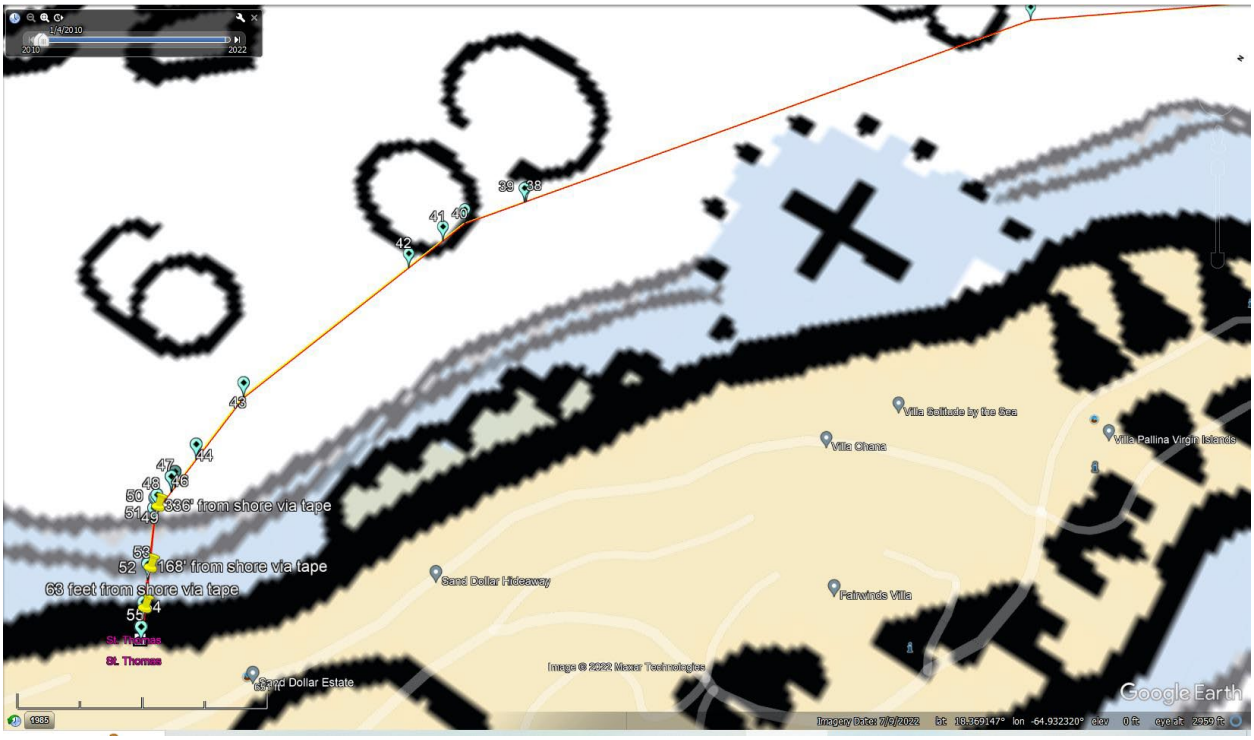
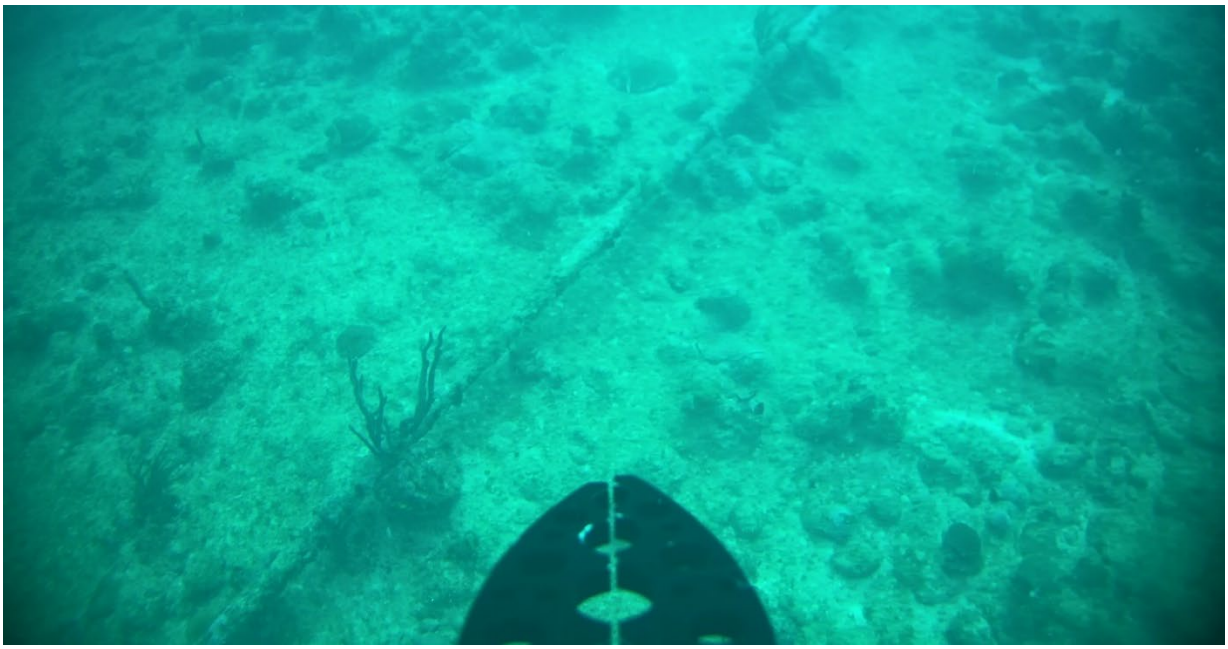


Figure 5: NOAA Chart showing Magen's Bay Shoreline with proposed cable landing and cable route along GPS points



Frame grab of video from ROV at area between GPS 24 and GPS 25 showing existing cable

The most common benthic feature other than sand were a few gorgonian skeletons and approximately 20 were observed. Typical gorgonian skeleton in 170’ deep water (frame grab from video camera).

2023/11/06 – STT Observations and Notes

Substantial bleaching was observed on almost all hard coral species although some color was visible. It cannot be confirmed visually if it is late bleaching or early recovery. Bleaching was occurring in soft corals as well. The last time bleaching was this pervasive was in 2005 (see graphs on page 3). At the NPS coral monitoring sites around VI National Park in St. John, bleaching combined with the coral disease white plague caused over a 60% decline in coral cover (Ref: Miller, J., et al. "Coral disease following massive bleaching in 2005 causes 60% decline in coral cover on reefs in the US Virgin Islands." Coral Reefs 28 (2009) 925-937). The coral disease white plague has not been a large problem lately, but Stony Coral Tissue Loss Disease (SCTLD) has been extremely virulent and prevalent throughout Florida and the Caribbean causing extensive coral mortality. It is impossible to predict the impact of this SCTLD-environment now combined with bleaching, but it is likely there will be a decline in coral cover from these on-going events. This loss would be unrelated to the cable laying at this time. A new baseline benthic survey should be done during or immediately after the cable laying so that the post-bleaching live coral coverage can be documented as a baseline.

GPS 24- GPS 25 site

Starting at 18.402279 N, -64.953460 W

Benthic cover estimated as follows:

Hard Coral:	4%
Octocorals:	2%
Macroalgae:	10%
Crustose coralline algae:	1%
Sand:	2%
Sponges:	1%
Turf algae:	80%
TOTAL:	**100%**

Shortly after documenting the immediate area in the middle this hardbottom area, the divers located and followed an existing cable and documented the numerous hard and soft corals and sponges growing directly “ON” the cable. It is our judgement that the corals are scattered enough that the new cable could be laid in the scattered sand channels or through this benthic community without causing damage to existing corals or habitat. This would be best accomplished if

the cable laying was guided by divers during the placement and laying of the cable. A new baseline benthic survey should be made during or immediately after the cable lay so that the post-bleaching live coral coverage can be documented as a baseline.

Cable Landing Site in Magen's Bay

The inspection began at the point where existing cables begin their sharp turn to the north at GPS 50. Benthos is 100% silty mud. Most cables observed (3-4) were suspended above the benthos at this point.

Proceeding towards shore, shallower and upslope, the cables came in contact with a hardbottom community, primarily turf algae, and rose rapidly up to 20' depth.

At that 20' depth, the "shoulder of the slope" was between 20' - 12' where numerous large patch reefs were observed among a scattered coral and rock community. The three (3) Orbicella listed species (*O. annularis, O. franksi, O. faveolata*) were found here. *Orbicella annularis* colonies were abundant and large. The divers swam approximately north and south, parallel to the shoulder of the hardbottom, observing 7-9 existing cables laying among and often over the vibrant coral and fish community. There was evidence of storm damage with some coral colonies toppled, and shore debris (plastic beach chair). Other land-based pollution (bottles, cans, unidentifiable plastic) was also observed.

The overall impression is that the existing cables were laid without regard to the reef community, much of which was composed of coral species listed on the US Endangered Species List (genus Orbicella). Future cables would need to be guided through this reef community to avoid contact with existing corals.

In 10 – 12' depth, the hard bottom changed into a sand a seagrass community. The area is dominated by the invasive seagrass (*Halodule stipulacea*). (Ref: Willette, Demian A., Julien Chalifour, AO Dolfi Debrot, M. Sabine Engel, Jeff Miller, Hazel A. Oxenford, Frederick T. Short, Sascha CC Steiner, and Fabien Védie. "Continued expansion of the trans-Atlantic invasive marine angiosperm Halophila stipulacea in the Eastern Caribbean." *Aquatic botany* 112 (2014): 98-102.) The brown macroalgae (Dictyota spp.) was mixed among the invasive seagrass. This algae genus was not observed in 2022 in this area. Occasionally, native turtle grass

(Thalassia testudinum) was observed. A Green sea turtle (also on the ESA species list – *Chelonia mydas*) was also observed during this dive. Laying a new cable through this community would cause minimal disruption if placed by divers.

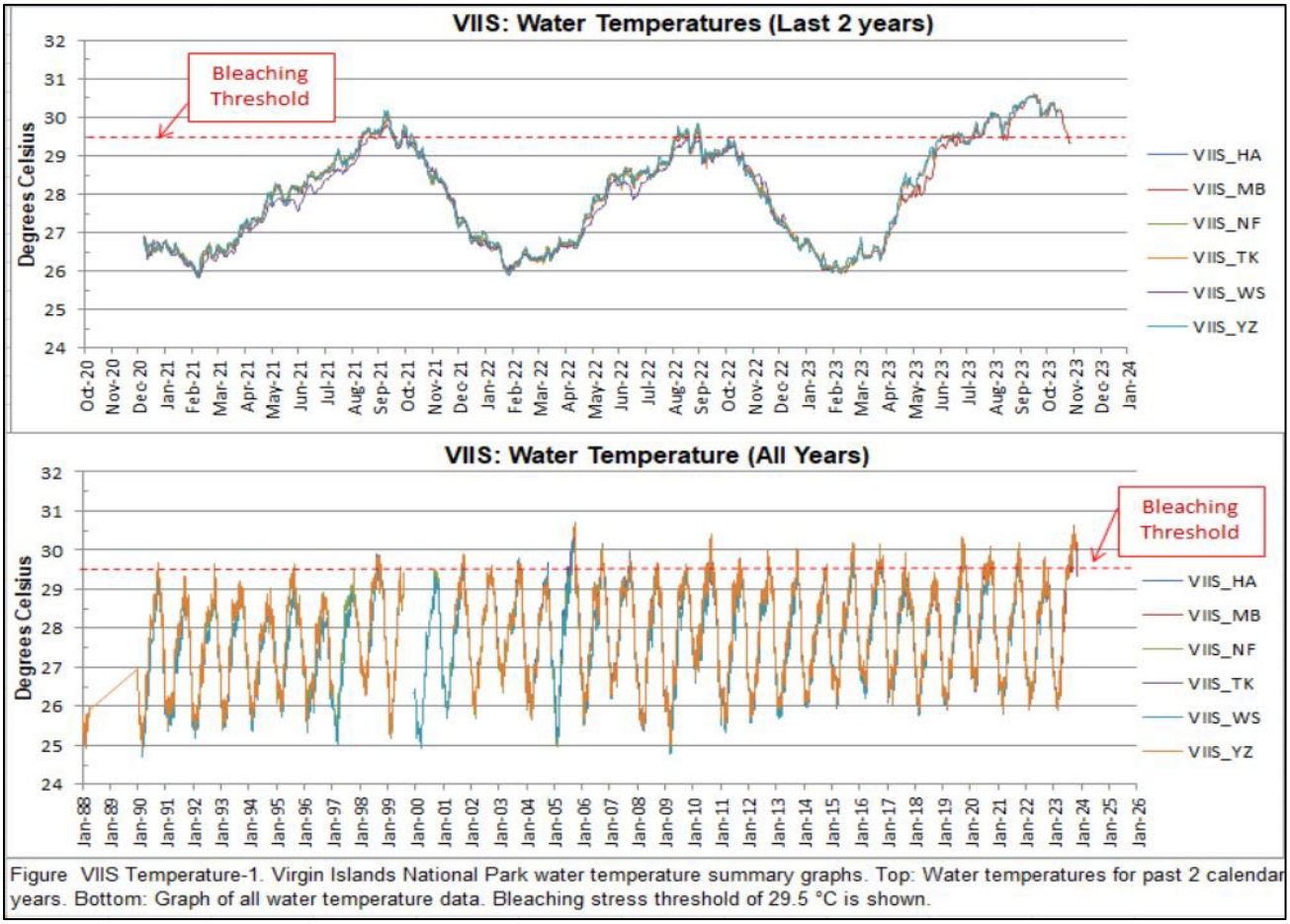


Figure VIIS Temperature-1. Virgin Islands National Park water temperature summary graphs. Top: Water temperatures for past 2 calendar years. Bottom: Graph of all water temperature data. Bleaching stress threshold of 29.5 °C is shown.

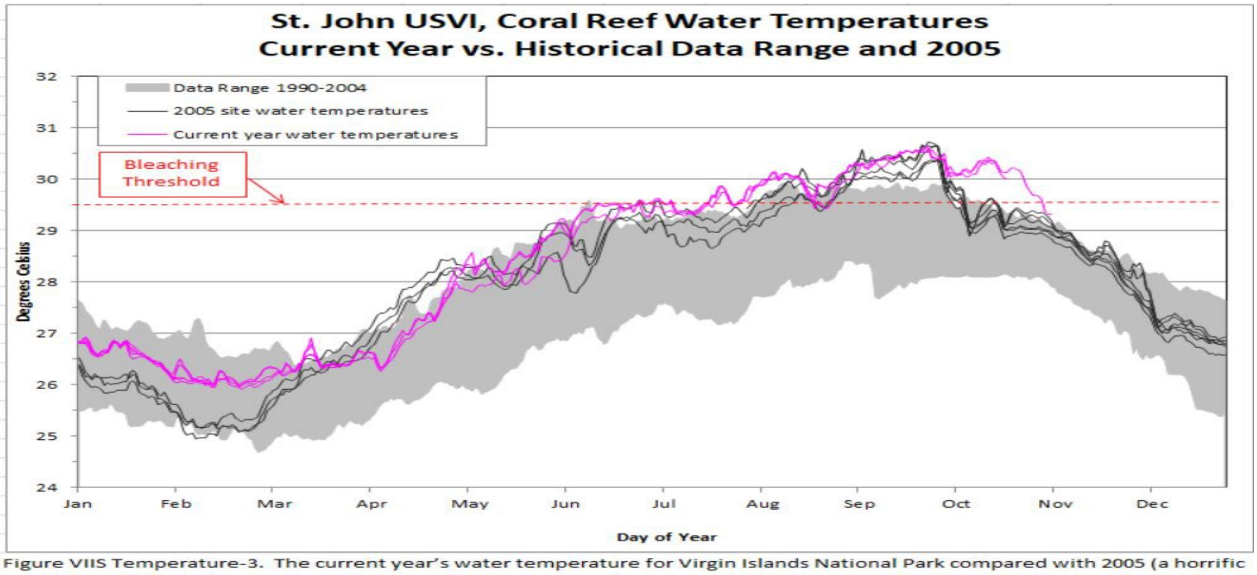


Figure VIIS Temperature-3. The current year's water temperature for Virgin Islands National Park compared with 2005 (a horrific bleaching year) and the 1990-2004 range of daily average temperatures for all sites.

Species lists for Coral, Fish, Inverts, Seagrass (and others) at Cable Crossing shoreline to first major cable turn, Magen's Bay, St. Thomas

November 2023 Survey

VISUAL OBSERVATION

CORAL

Code	Genus	species	common name	category
DLAB	Diploria	labyrinthiformis	Grooved brain coral	Coral
FFRA	Favia	fragum	Golfball coral	Coral
MALC	Millepora	alcicornis	Fire coral	Coral
MCAV	Montastraea	cavernosa	Great star coral	Coral
MDEC	Madracis	decactis	Ten-ray star coral	Coral
OANN	Orbicella	nnularis	Common star coral	Coral
OFAV	Orbicella	faveolata	Mountainous star coral	Coral
OFRA	Orbicella	franksi	Boulder star coral	Coral
PAST	Porites	astreoides	Mustard hill coral	Coral
PPOR	Porites	porites	Finger coral	Coral
PSTR	Pseudodiploria	strigosa	Symmetrical brain coral	Coral
SINT	Stephanocoenia	intersepta	Blushing star coral	Coral
SSID	Siderastrea	siderea	Massive starlet coral	Coral
UAGA	Undaria	agaricites	Lettuce coral	Coral

Yellow indicates species observed in the 2022 video analysis.

VISUAL OBSERVATION

SEAGRASS **MACROALGAE**

Code	Genus	species	common name	category
HSTI	Halophila	stipulacea	invasive seagrass	Seagrass
TTES	Thalassia	testudinum	turtle grass	Seagrass
DICT	Dicyota		common macroalgae	Macroalgae
Green	Chelonia	mydas	Green Sea turtle	Turtle

Yellow indicates species observed in the 2022 video analysis.

VISUAL OBSERVATION

INVERTS

Code	Genus	species	common name	category
SCUC			VARIOUS SEA CUCUMBERS	Inverts
SPO			VARIOUS SPONGES	Inverts
WORM			TUBE WORMS	Inverts

Yellow indicates species observed in the 2022 video analysis.

VISUAL
OBSERVATION
FISH

Code	Genus	species	common name	category
ABSA	Abudefduf	saxatilis	sergeant major	Fish
ACBA	Acanthurus	bahianus	ocean surgeonfish	Fish
ACCH	Acanthurus	chirurgus	doctorfish	Fish
ACCO	Acanthurus	coeruleus	blue tang	Fish
CARU	Caranx	ruber	bar jack	Fish
CHCA	Chaetodon	capistratus	foureye butterflyfish	Fish
EPCR	Epinephelus	cruentatus	graysby	Fish
EPGU	Epinephelus	guttatus	red hind	Fish
EPMO	Epinephelus	morio	red grouper	Fish
HABI	Halichoeres	bivittatus	slippery dick	Fish
HAFL	Haemulon	flavolineatum	french grunt	Fish
HAGA	Halichoeres	garnoti	yellowhead wrasse	Fish
HAMA	Halichoeres	maculipinna	clown wrasse	Fish
HAPL	Haemulon	plumieri	white grunt	Fish
HORU	Holocentrus	rufus	squirrelfish	Fish
HYAB	Hypoplectrus	aberrans	yellowbelly hamlet	Fish
HYPU	Hypoplectrus	puella	barred hamlet	Fish
HYUN	Hypoplectrus	unicolor	hamlet	Fish
LATR	Lactophrys	triqueter	smooth trunkfish	Fish
LUSY	Lutjanus	synagris	lane snapper	Fish
OCCH	Ocyurus	chrysurus	yellowtail snapper	Fish
PSMA	Pseudupeneus	maculatus	spotted goatfish	Fish
SCIS	Scarus	iseri	striped parrotfish	Fish
SPAU	Sparisoma	aurofrenatum	redband parrotfish	Fish
SPVI	Sparisoma	viride	stoplight parrotfish	Fish
STDI	Stegastes	diencaeus	longfin damselfish	Fish
STLE	Stegastes	leucostictus	beaugregory	Fish
STPA	Stegastes	partitus	bicolor damselfish	Fish
STPL	Stegastes	planifrons	threespot damselfish	Fish
THBI	Thalassoma	bifasciatum	bluehead wrasse	Fish

Species lists for Coral, Fish, Inverts, Seagrass (and others) at GPS 24-25 Center, Outer Brass, St. Thomas

November 2023 Survey

VISUAL OBSERVATION

CORAL

Code	Genus	species	common name	category
CORJU	Coral juvenile		Juvenile coral	Coral
DLAB	Diploria	labyrinthiformis	Grooved brain coral	Coral
GO	Gorgonians		Various octocorals	Coral
HCUC	Helioseris	cucullata	Sunray lettuce coral	Coral
MALC	Millepora	alcicornis	Fire coral	Coral
MCAV	Montastraea	cavernosa	Great star coral	Coral
MDEC	Madracis	decactis	Ten-ray star coral	Coral
OFRA	Orbicella	franksi	Boulder star coral	Coral
PFUR	Porites	furcata	Branched finger coral	Coral
PAST	Porites	astreoides	mustard hill coral	Coral
PPOR	Porites	porites	Finger coral	Coral
PSTR	Pseudodiploria	strigosa	Symmetrical brain coral	Coral
SINT	Stephanocoenia	intersepta	Blushing star coral	Coral
SSID	Siderastrea	siderea	Massive starlet coral	Coral
UAGA	Undaria	agaricites	Lettuce coral	Coral

Yellow indicates species observed in the 2022 video analysis.

VISUAL OBSERVATION

INVERTS

Code	Genus	species	common name	category
XMUT	Xestospongia	muta	barrel sponge	Invert
SPO			various sponges	Invert
WORMS			various worms	Invert
ZOOX	Palythoa	caribaeorum	white encrusting zooxanthid	Invert

Yellow indicates species observed in the 2022 video analysis.

VISUAL OBSERVATION

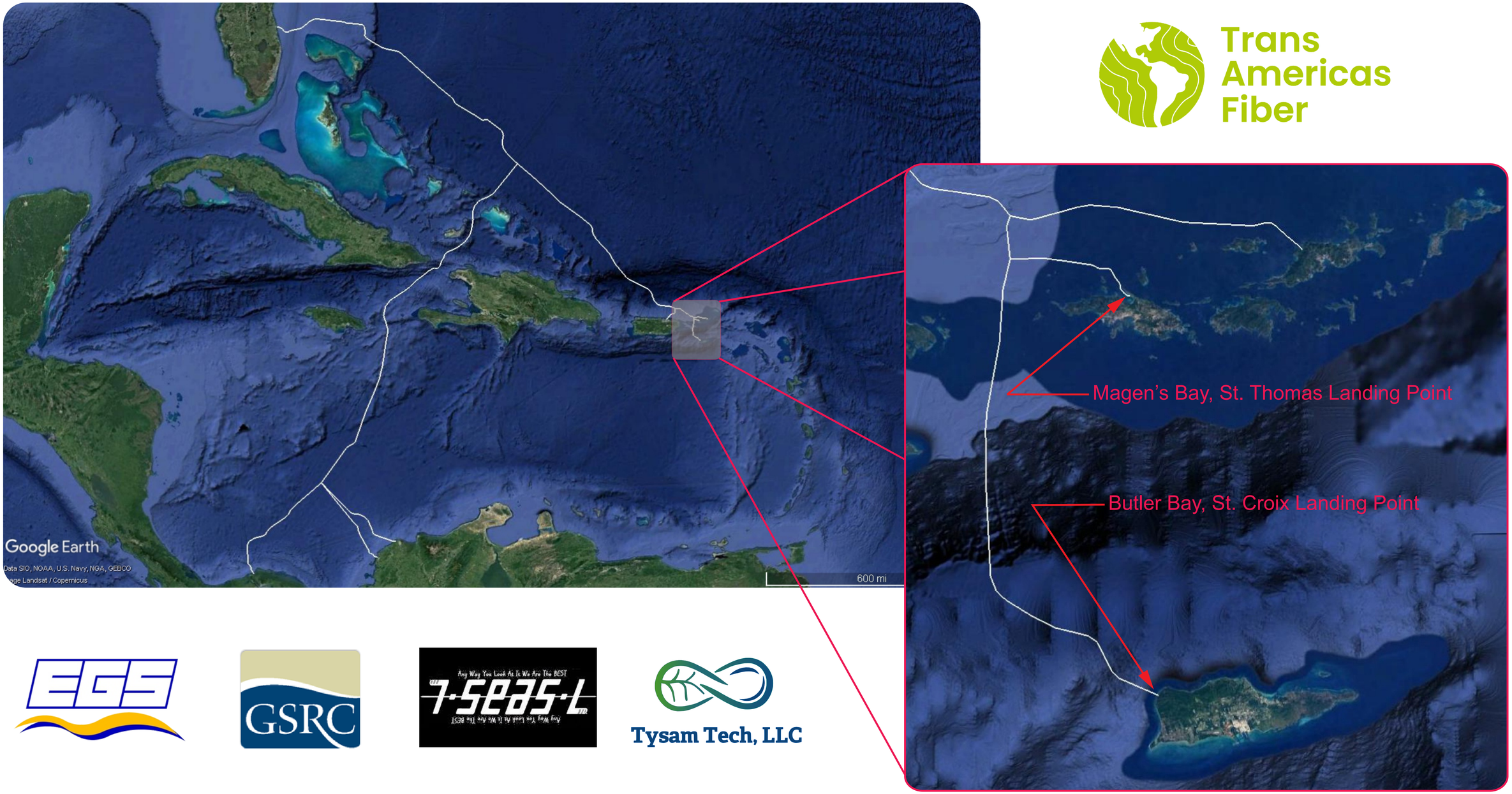
FISH

Code	Genus	species	common name	category
ACBA	Acanthurus	bahianus	ocean surgeonfish	Fish
ACCH	Acanthurus	chirurgus	doctorfish	Fish
CARO	Canthigaster	rostrata	sharpnose puffer	Fish
CHCA	Chaetodon	capistratus	foureye butterflyfish	Fish
CHCY	Chromis	cyanea	blue chromis	Fish
CHSE	Chaetodon	sedentarius	reef butterflyfish	Fish
CLPA	Clepticus	parrai	creole wrasse	Fish
DEMA	Decapterus	macarellus	mackerel scad	Fish
EPCR	Epinephelus	cruentatus	graysby	Fish
EPFU	Epinephelus	fulvus	coney	Fish
EPGU	Epinephelus	guttatus	red hind	Fish
HAFL	Haemulon	flavolineatum	french grunt	Fish
HAGA	Halichoeres	garnoti	yellowhead wrasse	Fish
HAMA	Halichoeres	maculipinna	clown wrasse	Fish
HAPL	Haemulon	plumieri	white grunt	Fish
HORU	Holocentrus	rufus	squirrelfish	Fish
HOTR	Holacanthus	tricolor	rock beauty	Fish
OCCH	Ocyurus	chrysurus	yellowtail snapper	Fish
SCIS	Scarus	iseri	striped parrotfish	Fish
SCTA	Scarus	taeniopterus	princess parrotfish	Fish
SETA	Serranus	tabacarius	tobaccofish	Fish
SPAU	Sparisoma	aurofrenatum	redband parrotfish	Fish
SPVI	Sparisoma	viride	stoplight parrotfish	Fish
STPA	Stegastes	partitus	bicolor damselfish	Fish
THBI	Thalassoma	bifasciatum	bluehead wrasse	Fish

Yellow indicates species observed in video analysis.

ROUTE AND APPROACH MAPS

TRANS-CARIBBEAN FIBER SYSTEM (TCFS)
USVI CABLE LANDING PROJECT



Trans Americas Fiber

EGS

GSRC

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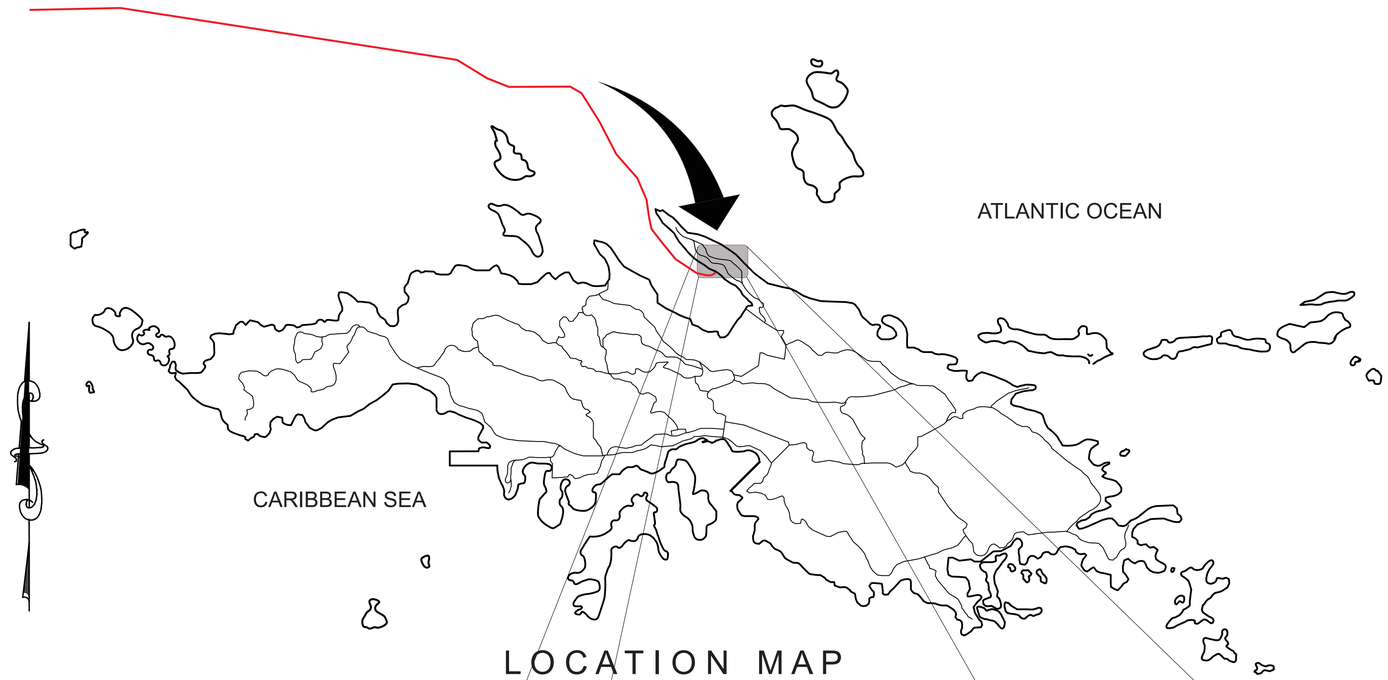
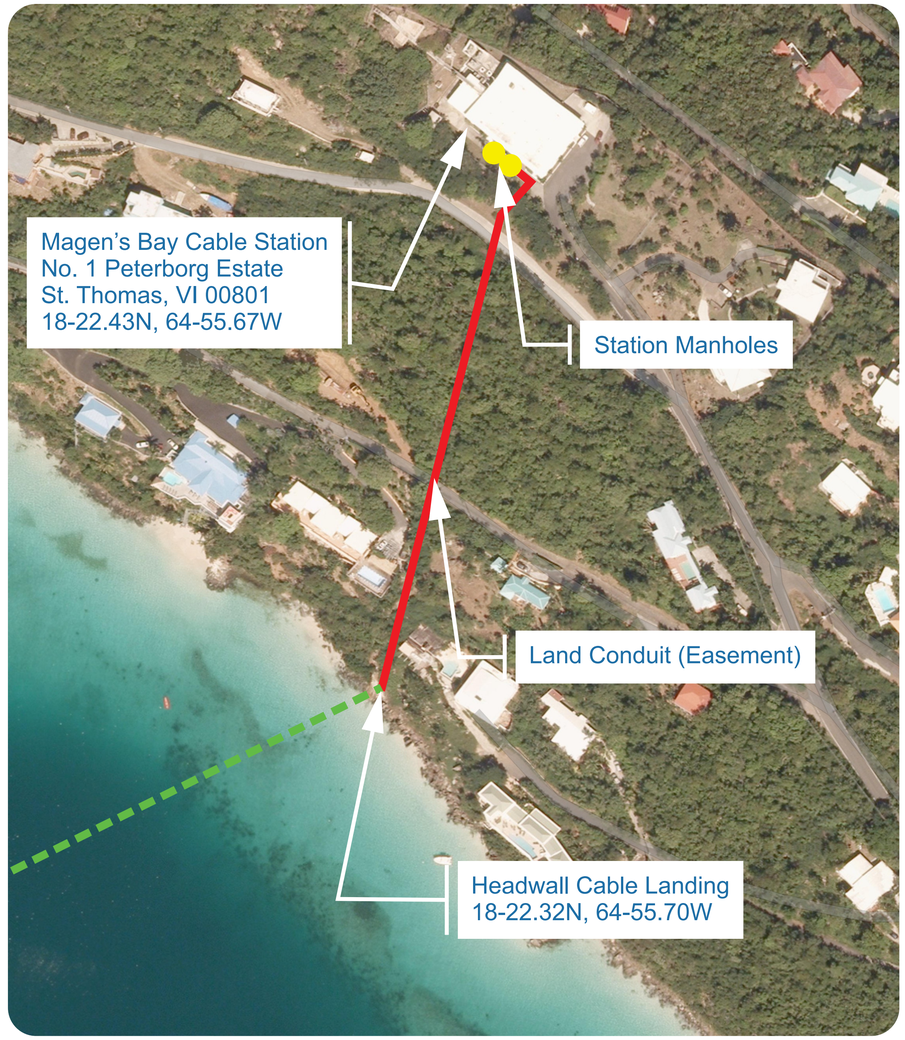
Tysam Tech, LLC

TRANS-CARIBBEAN FIBER SYSTEM (TCFS)
LANDING PROJECT

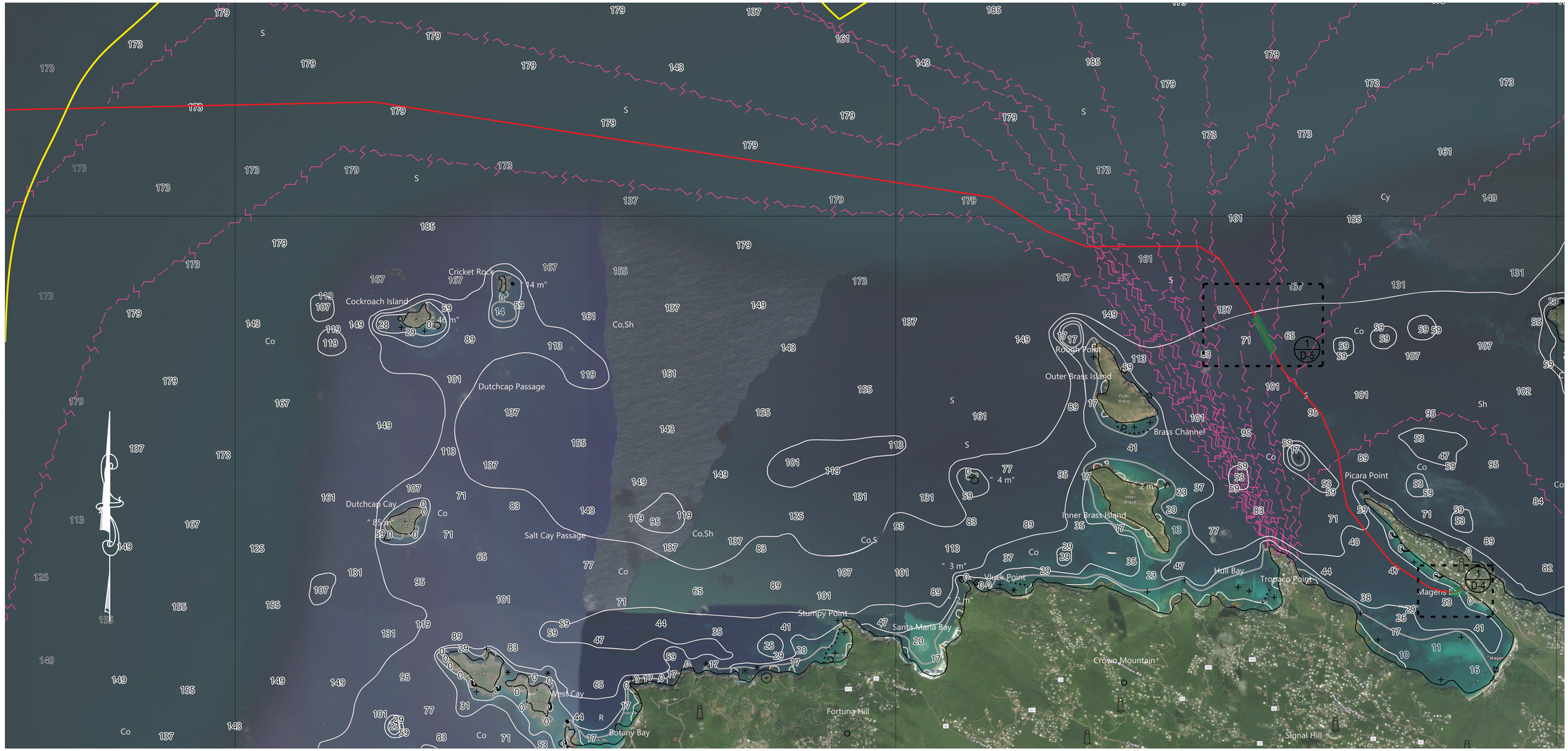
MAGEN'S BAY, ST. THOMAS, USVI LANDING LOCATION



LOCATION MAP GOOGLE EARTH MAPS



PROJECT MAP GOOGLE EARTH MAPS



Nautical Miles
0 0.4 0.8 1.2 1.6

Meters
0 850 1,700 2,550 3,400

PROPOSED TCFS CABLE ROUTE

EXISTING CABLES

USVI TERRITORIAL WATERS LIMIT

CORAL REEF LOCATION

	BY	DATE
DESIGNED	B. KEULARTS	12/18/2023
DRAWN	B. KEULARTS	12/18/2023
CHECKED		
REVISED		

PROJECT NO.

20210923-03

SCALE: AS NOTED

STAMP

NOTES

Bathymetry Overlay
WGS 1984 World Mercator (Calculated)
SCALE 1:35000 at Lat. 18°25.29'
GCS WGS 1984

Satellite Base Image
Esri Community Maps Contributors
US Virgin Islands GIS Division, Esri, HERE, Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NPS, US Census Bureau

PROJECT:

USVI TELECOMMUNICATIONS CABLE LANDING PROJECT

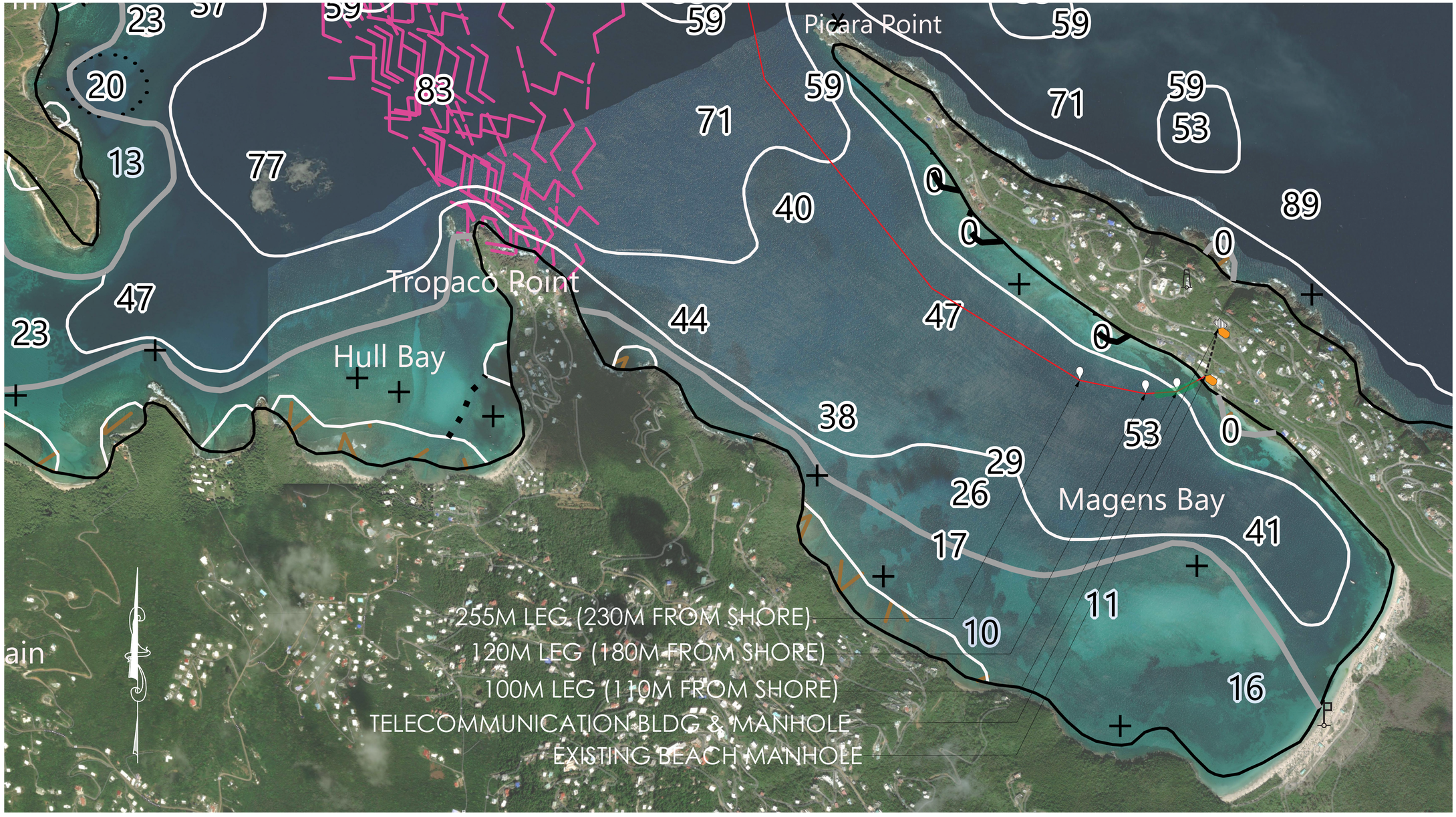
MAGEN'S BAY ST. THOMAS CABLE ROUTE

Tysam Tech, LLC

9139 CASTLE COAKLEY
BAY 7, SUITE 1
CHRISTIANSTED, VI 00820

SHEET

D-2



	BY	DATE
DESIGNED	B. KEULARTS	12/18/2023
DRAWN	B. KEULARTS	12/18/2023
CHECKED		
REVISED		

PROJECT NO.

20210923-03

SCALE: AS NOTED

STAMP

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SCALE 1:35000 at Lat. 18°25.29'
GCS WGS 1984

Satellite Base Image
Esri Community Maps Contributors
US Virgin Islands GIS Division, Esri, HERE, Garmin, Foursquare, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, NPS, US Census Bureau

PROJECT:

USVI TELECOMMUNICATIONS CABLE LANDING PROJECT

MAGEN'S BAY ST. THOMAS CABLE ROUTE

Nautical Miles

0 0.2 0.4 0.6 0.8

Meters

0 425 850 1,275 1,700

- *KEY MARKER POINTS FOR NEW CABLE ROUTE*
- *EXISTING CABLES*
- *PROPOSED SHORE-SIDE MANHOLE LOCATION*
- *EXISTING SHORE-SIDE CONDUIT*
- *PROPOSED TCFS CABLE ROUTE*
- *CORAL REEF LOCATION*

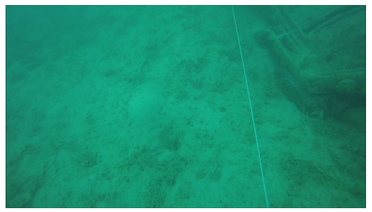
Tysam Tech, LLC

9139 CASTLE COAKLEY
BAY 7, SUITE 1
CHRISTIANSTED, VI 00820

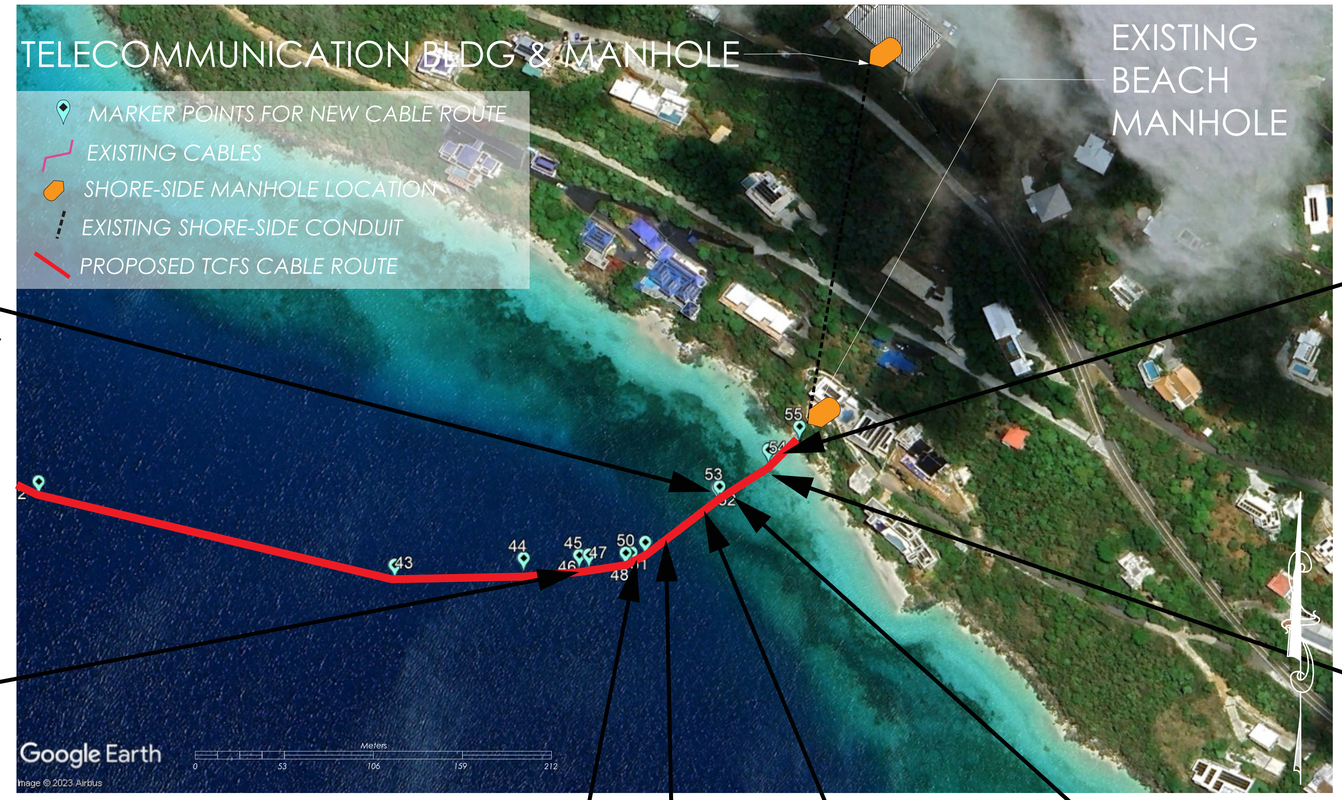
SHEET

D-3

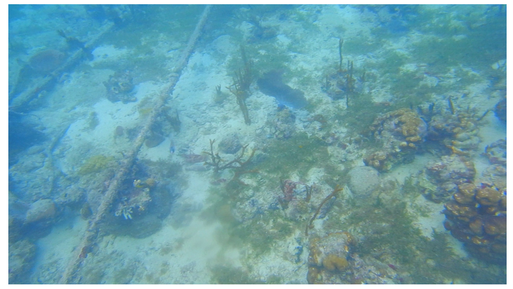
MODERATE SEAGRASS DENSITY, MINIMAL CORAL DENSITY



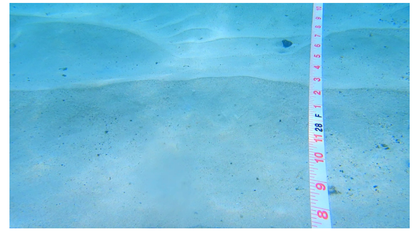
MOSTLY SANDY BOTTOM, SOME ALGAE & DEBRIS



MINIMAL ALGAE, MOSTLY SANDY BOTTOM



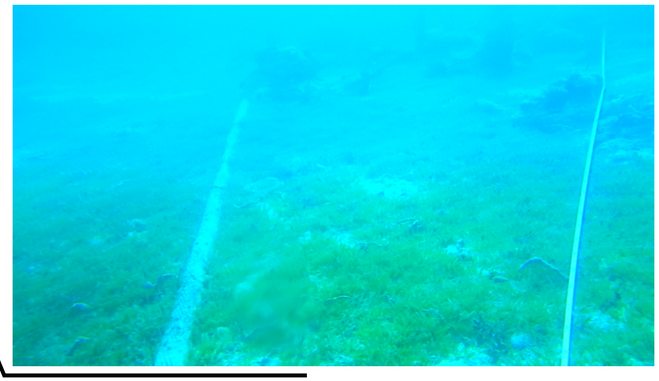
EXISTING CABLES, CORAL WITH SOME HARDBOTTOM



SANDY BOTTOM

MODERATE SEAGRASS DENSITY

MODERATE SEAGRASS DENSITY, MINIMAL CORAL DENSITY



MODERATE SEAGRASS DENSITY, SOME CORAL

	BY	DATE
DESIGNED	B. KEULARTS	12/18/2023
DRAWN	B. KEULARTS	12/18/2023
CHECKED		
REVISED		

PROJECT NO.

20210923-03

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SCALE 1:35000 at Lat. 18°25.29'
GCS WGS 1984

Satellite Base Image
Esri Community Maps Contributors
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PROJECT:

USVI TELECOMMUNICATIONS CABLE LANDING PROJECT

MAGEN'S BAY ST. THOMAS CABLE ROUTE

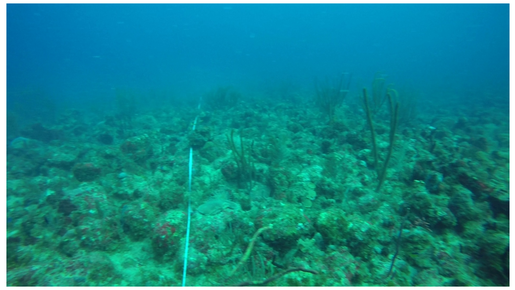
SURVEY AREA FROM GPS POINTS 46 - 55

Tysam Tech, LLC

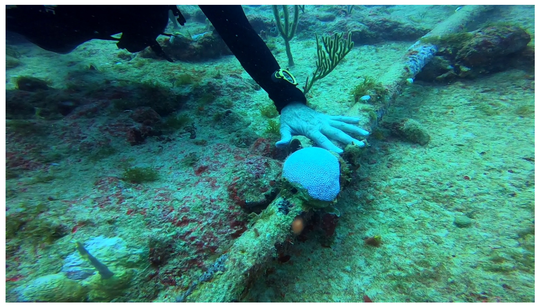
9139 CASTLE COAKLEY
BAY 7, SUITE 1
CHRISTIANSTED, VI 00820

SHEET

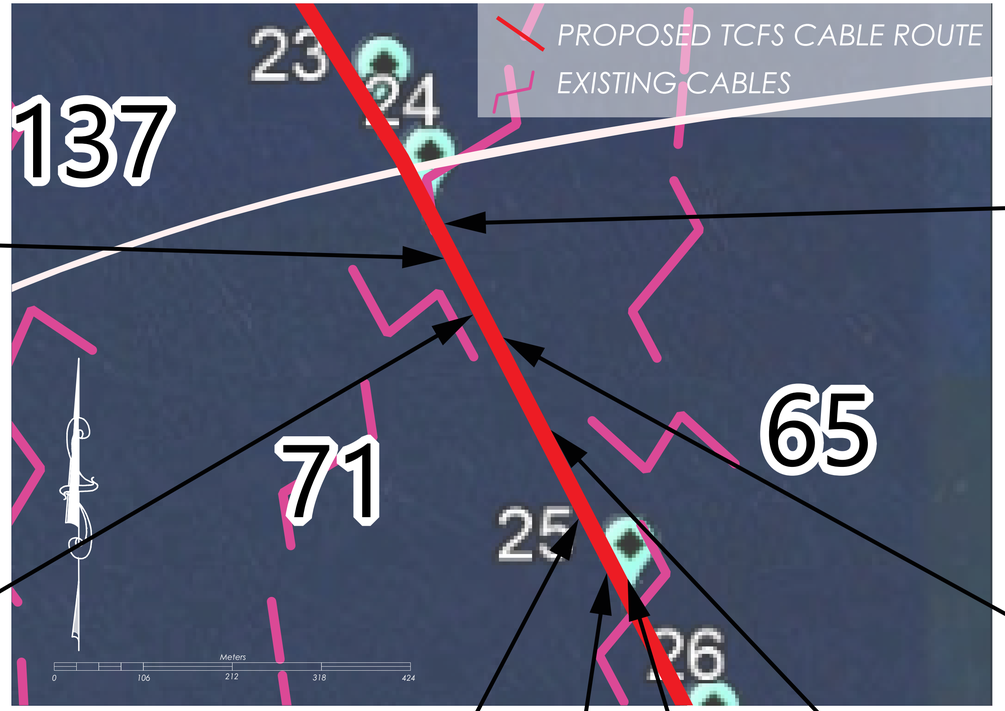
D-4



CORAL AND HARDBOTTOM

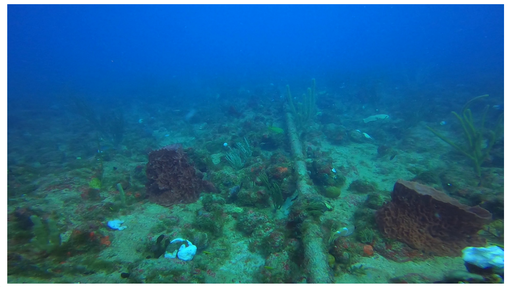


EXISTING CABLE, CORAL AND HARDBOTTOM

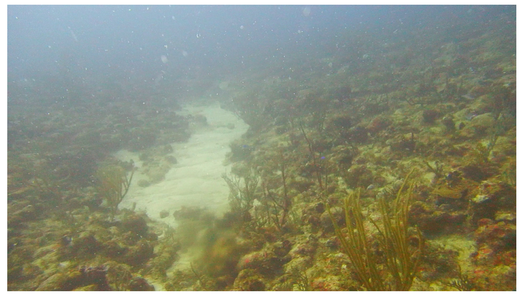


CORAL AND HARDBOTTOM

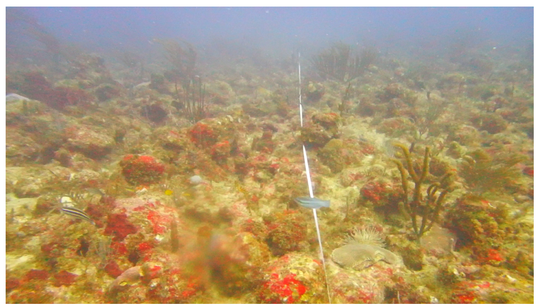
CORAL AND HARDBOTTOM, EXISTING CABLE



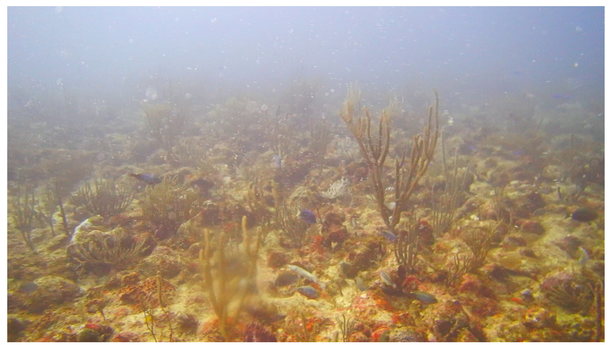
CORAL AND HARDBOTTOM, EXISTING CABLE



CORAL AND HARDBOTTOM



CORAL AND HARDBOTTOM



CORAL AND HARDBOTTOM

	BY	DATE
DESIGNED	B. KEULARTS	12/18/2023
DRAWN	B. KEULARTS	12/18/2023
CHECKED		
REVISED		

PROJECT NO.

20210923-03

SCALE: AS NOTED

STAMP

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Bathymetry Overlay
WGS 1984 World Mercator (Calculated)
SCALE 1:35000 at Lat. 18°25.29'
GCS WGS 1984

Satellite Base Image
Esri Community Maps Contributors
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PROJECT:

USVI TELECOMMUNICATIONS CABLE LANDING PROJECT

MAGEN'S BAY ST. THOMAS CABLE ROUTE

SURVEY AREA FROM GPS POINTS 24 - 25

Tysam Tech, LLC

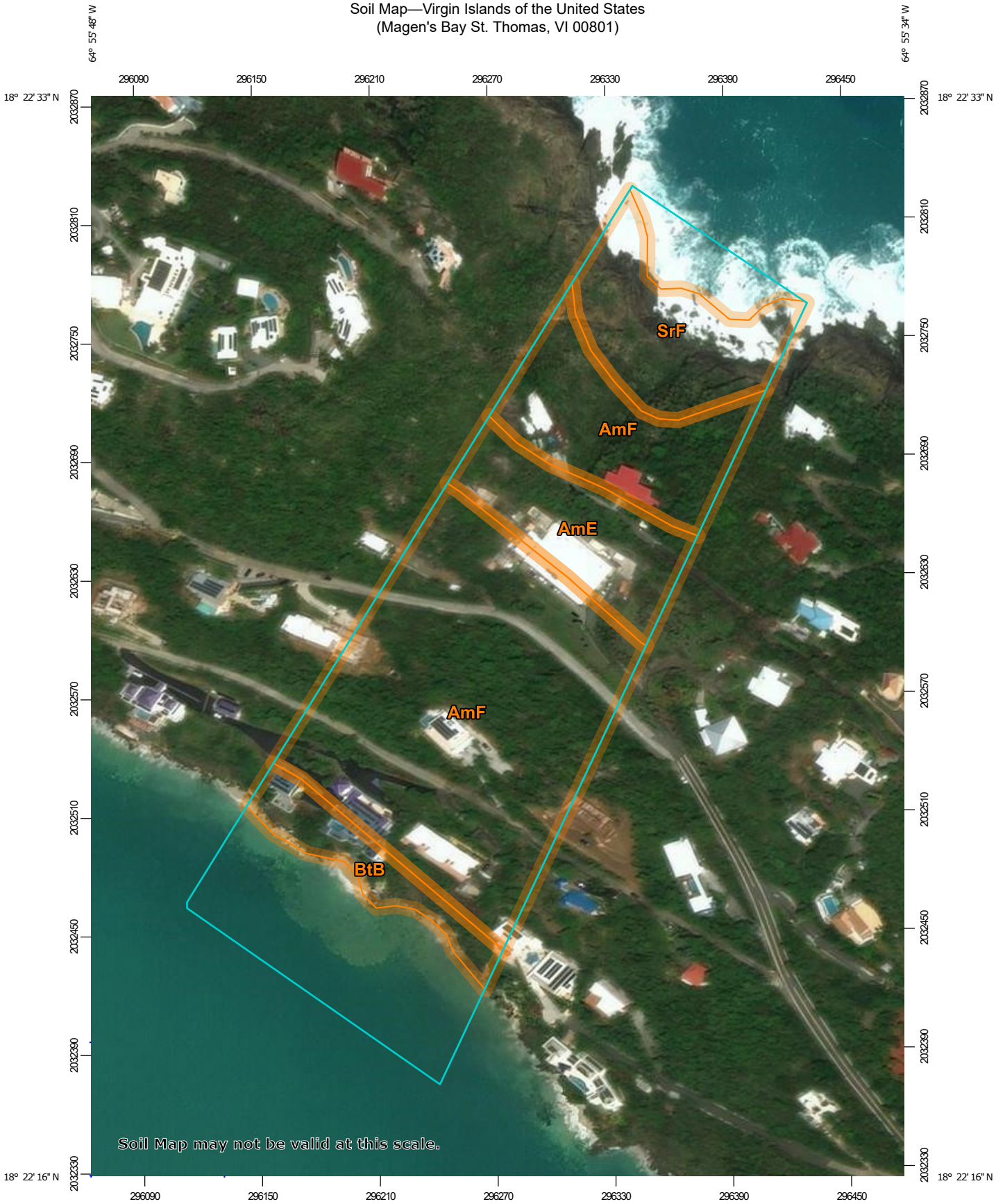
9139 CASTLE COAKLEY
BAY 7, SUITE 1
CHRISTIANSTED, VI 00820

SHEET

D-5

REQUIRED MAPS (ZONING, PARCEL, FIRM, ETC.)

Soil Map—Virgin Islands of the United States
(Magen's Bay St. Thomas, VI 00801)



Map Scale: 1:2,670 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 35 70 140 210

Feet
0 100 200 400 600

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 20N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Virgin Islands of the United States
Survey Area Data: Version 4, Sep 12, 2022

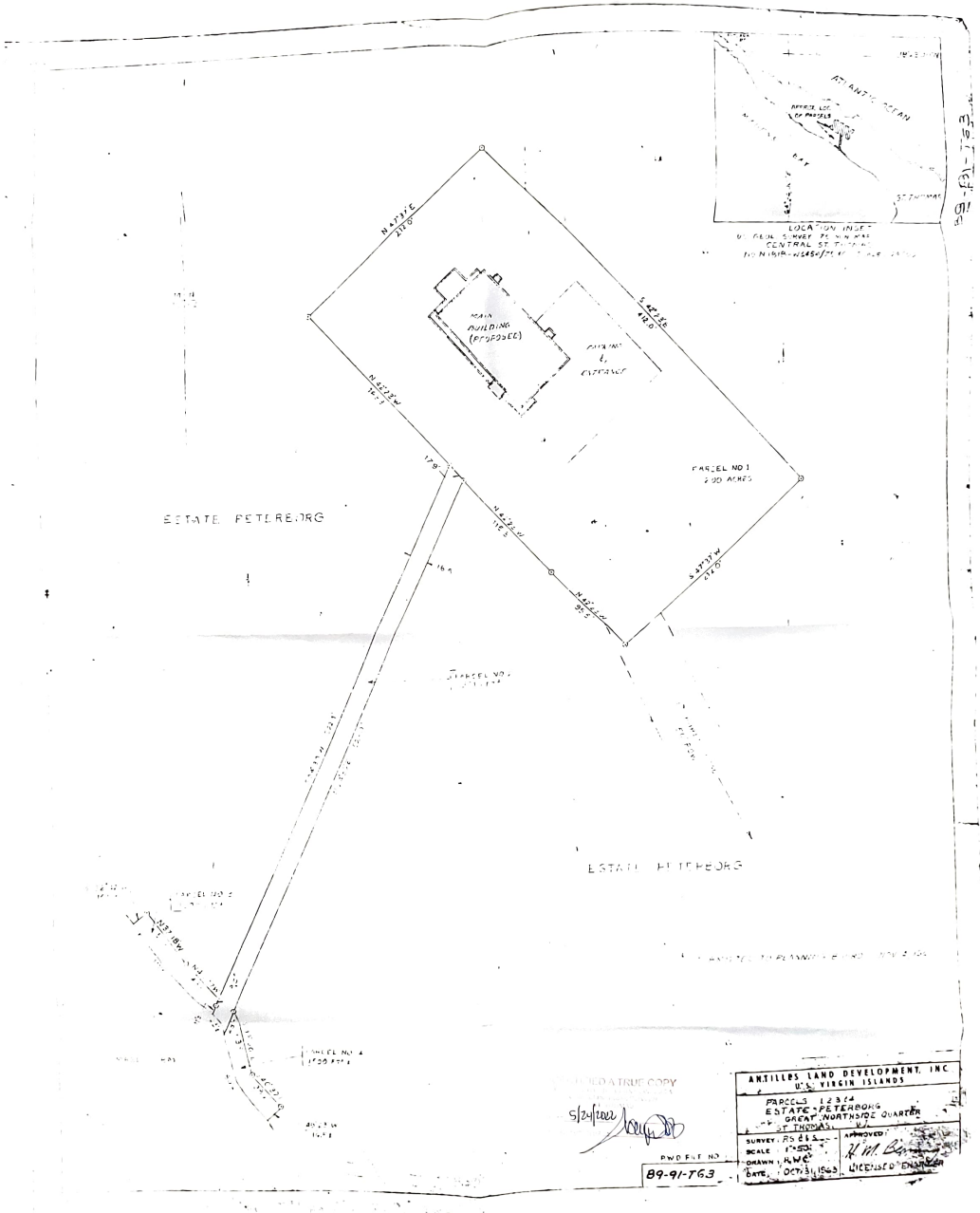
Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

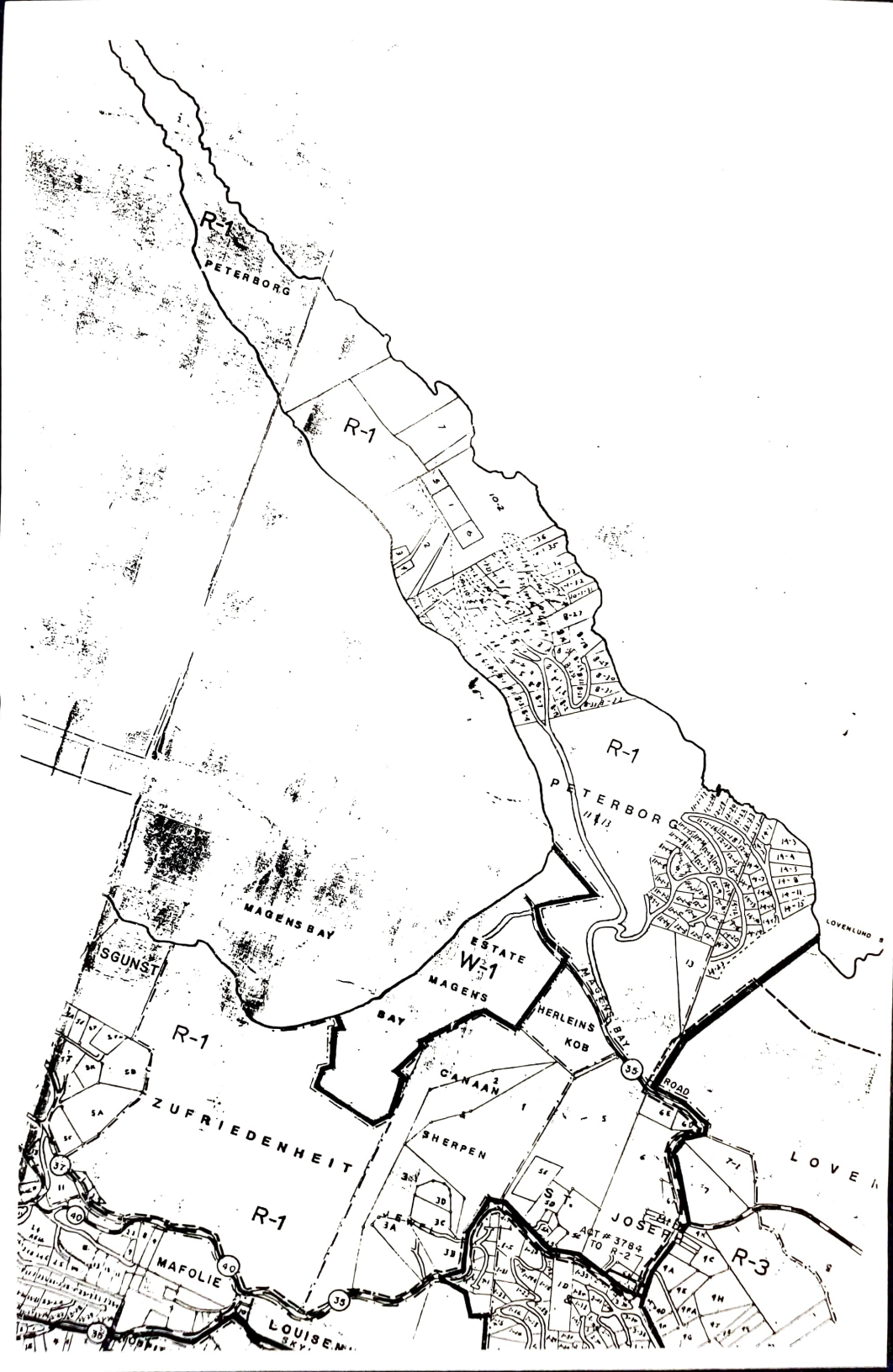
Date(s) aerial images were photographed: Jan 14, 2014—May 27, 2020

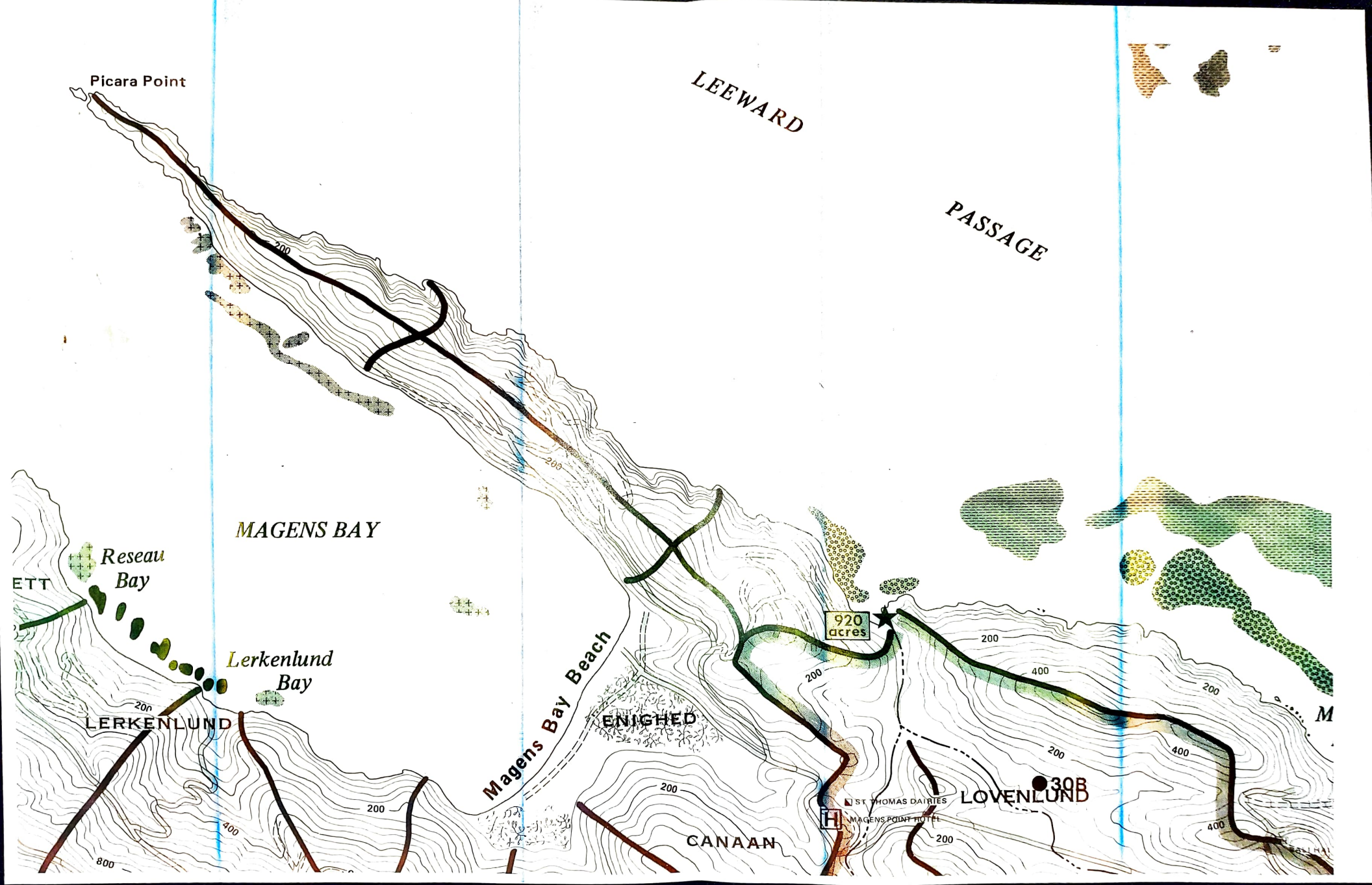
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

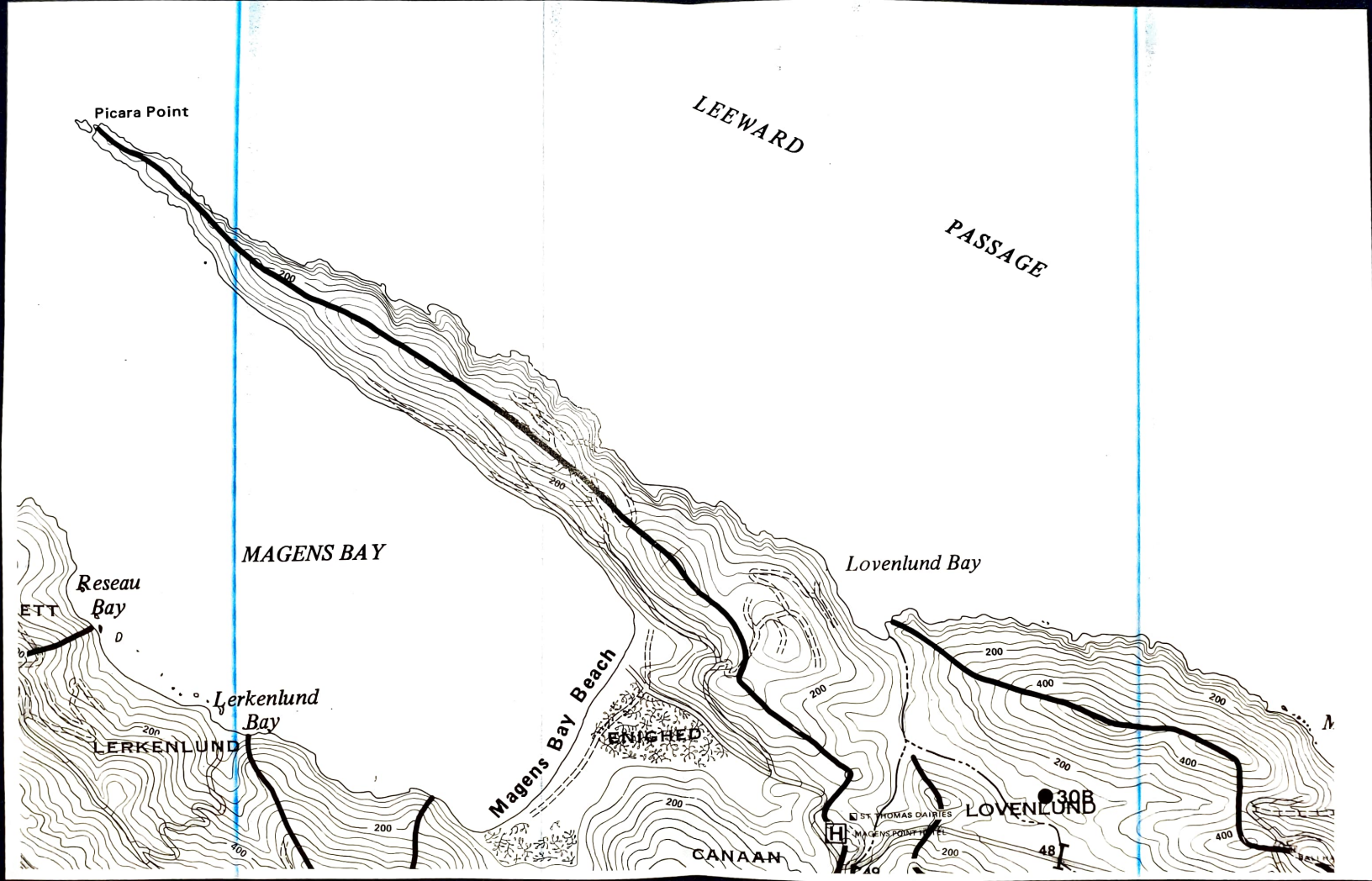
Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
AmE	Annaberg-Maho Bay complex, 20 to 40 percent slopes, extremely stony	1.4	10.2%
AmF	Annaberg-Maho Bay complex, 40 to 60 percent slopes, extremely stony	7.5	52.8%
BtB	Beaches, stony	0.8	5.6%
SrF	Southgate-Rock outcrop complex, 40 to 60 percent slopes	1.6	11.4%
Totals for Area of Interest		**14.2**	**100.0%**


LOCATION INSET
MAIN BUILDING (PROPOSED)
PARKING & ENTRANCE
PARCEL NO 1
2.00 ACRES
ESTATE PETERBORG
ESTATE PETERBORG
PARCEL NO 2
1.39 ACRES
PARCEL NO 3
1.39 ACRES
ANTILLES LAND DEVELOPMENT, INC.
U.S. VIRGIN ISLANDS
PARCELS 1 & 2 & 4
ESTATE PETERBORG
GREAT NORTHSIDE QUARTER
ST THOMAS, V.I.
SURVEY: AS BUILT
SCALE: 1"=50'
DRAWN: HWC
DATE: OCT 31, 1989
APPROVED:
LICENSED ENGINEER
PWD FILE NO
89-91-763
5/24/2022


R-1
PETERBORG
R-1
R-1
PETERBORG
MAGENSBAY
SGUNST
R-1
ZUFRIEDENHEIT
R-1
MAFOLIE
LOUISE
ESTATE
W-1
MAGENS
BAY
HERLEINS
KOB
MAGENS BAY
CANAAN
SHERPEN
JOSEF
ACT # 3784
TO
R-2
R-3
LOVENLUND
ROAD
LOVE
35
37
40
36


Picara Point
LEEWARD
PASSAGE
MAGENS BAY
Reseau Bay
Lerkenlund Bay
LERKENLUND
Magens Bay Beach
ENIGHED
CANAAN
920 acres
ST THOMAS DAIRIES
MAGENS POINT HOTEL
LOVENLUND
200
400
800


Picara Point
LEEWARD
PASSAGE
MAGENS BAY
Lovenlund Bay
Reseau
Bay
ETT
Lerkenlund
Bay
LERKENLUND
Magens Bay Beach
ENIGHED
CANAAN
LOVENLUND
ST. THOMAS DAIRIES
MAGENS POINT HOTEL
200
400

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The **community map repository** should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of local tidal datum defined by the National Ocean Service (NOS) and determined by the Army Corps of Engineers (1995). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations tables in the Flood Insurance Study report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations tables should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Puerto Rico / U.S. Virgin Islands State Plane FIPSZONE 5200. The **horizontal datum** was NAD 83, GRS80 spheroid. Differences in datum, spheroid, projection or State Plane zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood Elevations on this map are referenced to local tidal datum defined by the National Ocean Service (NOS) and determined by the Army Corps of Engineers (1995). These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum**. For information regarding the calculation of local tidal datum, contact the Army Corps of Engineers, Jacksonville district, http://www.saj.usace.army.mil/. The Jacksonville District can be contacted at the following address:

U.S. Army Corps of Engineers,
Jacksonville District
701 San Marco Boulevard
Jacksonville, FL 32207-8175
Phone: 904-232-2234
or 1-800-291-9405

Elevation, description, and/or location information for **bench marks** shown on this map are located in the accompanying Flood Insurance Study Report.

Base map information shown on this FIRM was derived from multiple sources. For the three major U.S. Virgin Islands (St. Croix, St. John, and St. Thomas), digital orthophotography was provided by the U.S. Army Corps of Engineers, Jacksonville District. These data were produced for use at a scale of 1:2,400 from photography dated February 6, 1994. For the small islands offshore of the three main islands, digital imagery was provided by the National Oceanic and Atmospheric Administration's Coastal Services Center. These data were produced at a scale of 1:48,000 from aerial photography dated 1999.

Based on updated topographic information, this map reflects more detailed and up-to-date **stream channel configurations and floodplain delineations** than those shown on the previous FIRM for this jurisdiction. As a result, the Flood Profiles and Floodway Data tables in the Flood Insurance Study Report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map. Also, the road to floodplain relationships for unrevised streams may differ from what is shown on previous maps.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map showing the layout of map panels for this jurisdiction.

Contact the **FEMA Map Service Center** at 1-800-358-9616 for information on available products associated with this FIRM. Available products may include previously issued Letters of Map Change, a Flood Insurance Study report, and/or digital versions of this map. The FEMA Map Service Center may also be reached by Fax at 1-800-358-9620 and its website at http://www.msc.fema.gov.

If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA MAP** (1-877-336-2627) or visit the FEMA website at http://www.fema.gov.

COASTAL BARRIER LEGEND

11-16-1990 Coastal Barrier

FLOOD INSURANCE NOT AVAILABLE FOR NEW CONSTRUCTION OR SUBSTANTIALLY IMPROVED STRUCTURES ON OR AFTER NOVEMBER 16, 1990, IN DESIGNATED COASTAL BARRIERS.

11-16-1991 Otherwise Protected Area

FLOOD INSURANCE NOT AVAILABLE FOR STRUCTURES – NEWLY BUILT OR SUBSTANTIALLY IMPROVED ON OR AFTER NOVEMBER 16, 1991 – NOT USED IN A MANNER CONSISTENT WITH THE PURPOSE OF THE OTHERWISE PROTECTED AREAS.

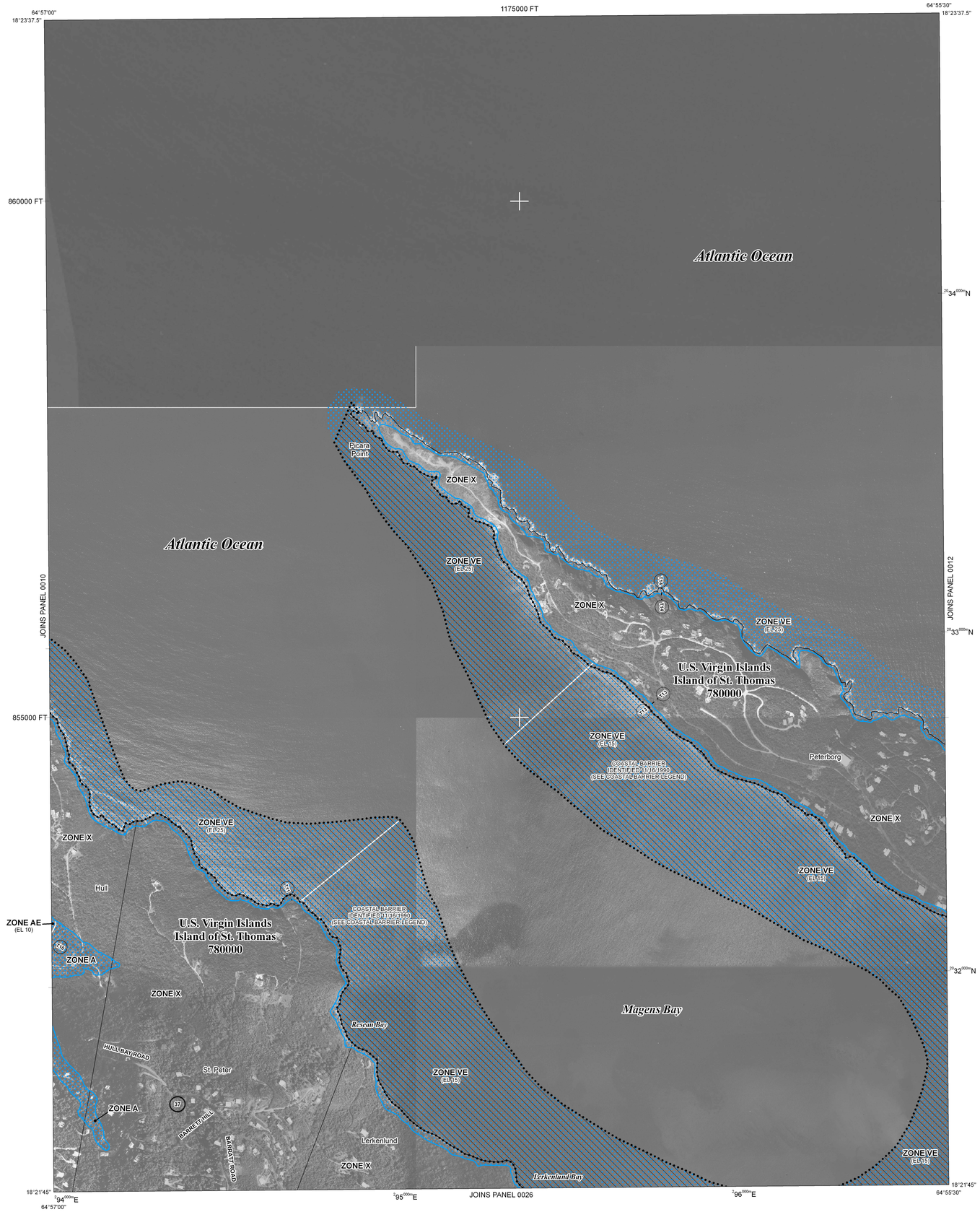
11-15-1993 Coastal Barrier

FLOOD INSURANCE NOT AVAILABLE FOR NEW CONSTRUCTION OR SUBSTANTIALLY IMPROVED STRUCTURES ON OR AFTER NOVEMBER 15, 1993, IN DESIGNATED COASTAL BARRIERS.

02-24-1997 Coastal Barrier

FLOOD INSURANCE NOT AVAILABLE FOR NEW CONSTRUCTION OR SUBSTANTIALLY INPROVED STRUCTURES ON OR AFTER FEBRUARY 24, 1997, IN DESIGNATED COASTAL BARRIERS.

Comments or concerns regarding the Coastal Barrier Resources System or Otherwise Protected Areas should be directed to the Coastal Barrier Coordinator at the U.S. Fish and Wildlife Service; (404) 679-7106.



LEGEND

SPECIAL FLOOD HAZARD AREAS SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

	1% annual chance floodplain boundary
	0.2% annual chance floodplain boundary
	Floodway boundary
	Zone D boundary
	CBRS and OPA boundary
	Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.
513	Base Flood Elevation line and value; elevation in feet*
(EL 987)	Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the Local Tidal Datum

A — A	Cross section line
23 — 23	Transect line
87°07'45", 32°22'30"	Geographic coordinates referenced to the North American Datum of 1983 (NAD 83), Western Hemisphere
2476000mN	1000-meter Universal Transverse Mercator grid values, zone 20N
600000 FT	5000-foot grid ticks: Puerto Rico Virgin Islands State Plane coordinate system, zone (FIPSZONE 5200), Lambert Conformal Conic projection
DX5510 ×	Bench mark (see explanation in Notes to Users section of this FIRM panel)
●M1.5	River Mile

MAP REPOSITORY
Office of the Tax Assessor and the Cadastral Section
1131 King Street
Christiansted, Virgin Islands 00820

INITIAL NFIP MAP DATE
February 25, 1977

FLOOD HAZARD BOUNDARY MAP REVISIONS
None

FLOOD INSURANCE RATE MAP EFFECTIVE
October 15, 1980

FLOOD INSURANCE RATE MAP REVISIONS
April 16, 2007 – to change base flood elevations, to change special flood hazard areas, to update map format, and to incorporate previously issued letters of map revisions.

See the NOTICE TO FLOOD INSURANCE STUDY USERS page of the Flood Insurance report for map revision dates prior to April 16, 2007

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 METERS

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0011G

FIRM

FLOOD INSURANCE RATE MAP

U.S. VIRGIN ISLANDS

PANEL 11 OF 94

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
U.S. VIRGIN ISLANDS	780000	0011	G

- NOTE -

THIS MAP INCLUDES COASTAL BARRIER RESOURCES SYSTEM BOUNDARIES ESTABLISHED UNDER THE COASTAL BARRIER RESOURCES ACT OF 1982 AND/OR SUBSEQUENT LEGISLATION.

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
7800000011G

MAP REVISED
APRIL 16, 2007

Federal Emergency Management Agency

QUALIFICATIONS AND BACKGROUND

Tysam Tech, LLC

Benjamin Keularts

Project Engineer II

EDUCATION & TRAINING

- B.S. Chemical Engineering, Leigh University
- Summer Chemical Engineering Technical Electives Program **University of Dortumund** ***Dortumund, Germany***

CERTIFICATIONS

- NPDES Permit Writer's Training Certified
- NPDES Stormwater Permit Writer and Inspector Certified
- BEACH Sampler's Training Certified
- WOPPER/HAZMAT Training Certified - Expired
- Divemaster Certified
- EPA Certified Scientific Diver

SKILLS

- **Computer:** ArcView GIS, R Programming, Bently CivilStorm, Storm Water Management Model (SWMM), WinTR-55 Hydrology, CorelCAD, Microsoft Office
- **Laboratory:** General laboratory skills, familiarity with all common laboratory apparatus and more complicated tool functions (i.e. reading pH, titration, centrifuging, etc.), familiarity with calibration and other QA/QC methods for common industry testing.

Summary

With an education and degree in Chemical Engineering, Benjamin has 15 years of experience in the environmental engineering field covering major environmental disciplines and branches, such as Air, Water, Solid Waste and Coastal Zone management and has expertise in both technical and regulatory (federal and local) aspects of environmental engineering. Having worked in both public and private sector, as both field reconnaissance engineer, technical reviewer, project leads, program manager, and support staff, provides a very flexible skill-set as typically required in the Virgin Islands territory.

Relevant Experience

Tysam Tech, LLC ***St. Croix, USVI***
Environmental Engineer II ***December 2019-Present***

Provides project and environmental site review as well as permit development and Environmental Assessment Review (EAR) development. Knowledge of both federal and local environmental regulation under CWA and CAA, used to advise clients and construct management plans for projects as well as day to day industrial and commercial operations. Storm water BMP design and hydrology & hydraulics report development, to address Low Impact Development (LID) requirements. Inspection of active sites, including construction, industrial and commercial to ensure operations are in line with environmental regulations. Project tasks performed include historic record review, site map creation and background environmental condition report development.

Major Projects:

- Limetree Bay Facility Emergency Response Plan Development
- Limetree Bay Facility Flare Exceedance monitoring, data review and reporting analysis
- Limetree Bay Facility Heaters and Process Boilers Energy Assessment analysis
- Diageo USVI Permit development for four (4) air pollution emitting units brought online in 2020
- Coastal Zone Management of $20M upgrades to the Virgin Island's racetracks (2), including Emergency CZM and Rezoning Process, H&H Study Review & Site Inspections
- Coastal Zone Management of $10M upgrades to the Virgin Island's Roads & Bridges through VIP/DPW VI ST ER STX(003): Storm Damage Repair to Roadways, Culverts, Embankments, Bridges, and Other Roadway Features on St. Croix, USVI
- Development of Concrete Batch Plant: EAR development and package submittal for flood, air storm water and building permits and site inspections.
- Updates to USVI refinery and terminal Integrated Contingency Plan: revisions and updates to regulations relating to RCRA, CERCLA, AST, HAZMAT, SPCC.

Virgin Islands Dept. of Planning & Natural Resources **St. Croix, USVI**
Environmental Program Manager ***October 2015-December 2019***

Worked as Environmental Program Manager for all Water Pollution Control and Clean Water Act Programs, managing day to day program activities, grant management and renewal, work plan commitment reporting and development, SOP and policy development, Environmental Assessment Report review and project permit issuance, water quality sampling, as well as data collection and management. Supportive roles include permit writing, Storm Water TPDES inspections and reporting, field water sampling, regulation and code review and promulgation.

Major Projects:

- Veteran's Drive (Route 30) Major Road Improvements Project, St. Thomas, USVI: EAR, CWA401/404 assessment Review, H&H study and Storm Water design review, site compliance inspections.
- Turpentine Run (Route 32) Bridge Approaches Project St. Thomas, USVI: EAR, CWA 401/404 assessment Review, H&H study and Storm Water design review, site compliance inspections.
- Henry E. Rohlsen Airport Apron Rehab Project, St. Croix, USVI: H&H study and Storm Water design review, and site compliance and installation inspections.
- Water and Power Authority Major 24" Water Line Upgrade Project, St. Croix USVI: H&H study and Storm Water design review, site compliance and installation inspections.
- Louise E. Brown Phase 1-3 VIHA Housing Projects, S t. Croix USVI: H&H study and Storm Water design review, site compliance and installation inspections.

Virgin Islands Dept. of Planning & Natural Resources **St. Croix, USVI**
Environmental Engineer ***October 2005-October 2015***

Worked as Environmental Engineer with Water Pollution Control Program focusing on writing TPDES Permits, developing TPDES regulations, TPDES Permit evaluation and sampling inspections, developing TPDES Permit Writing SOPs, building GIS data related to the TPDES Program, survey and hydrology report assessment and inspection, Environmental Assessment Report review and development, EPA/DEP diving projects or investigations, and providing general engineering advice to other programs and divisions.

Tysam Tech, LLC

Trinity Austrie

Director of Environmental Services

EDUCATION & TRAINING

- B.S. Environmental Engineering, University of Florida
- B.S. Applied Mathematics A.S Physics University of the Virgin Islands

CERTIFICATIONS

- Certified Engineer-In-Training
- Certified in Management of Change
- Certified Process Hazard Analysis Team Leader
- Certified ISO 9001:2015 Lead Auditor
- Diageo USVI 2017 Sensory Panel Accreditation
- 40 Hour HAZWOPER Certified
- IMDG/CFR-49 Transportation of Hazmat Compliance Safety and Security Certified
- Candidate, Certified Energy Manager
- Candidate, Professional Engineering License

AWARDS

- ***Diageo NA Special Project Champion*** (Tysam Tech Award for efficient execution of special projects).
- ***2016 Excellence in Safety Award*** (Team Award for Successful Behavioral Safety Program)
- ***2015 Brilliant Execution Award*** (Team Award for contributing to the Environmental, Health, and Safety Team on l regulatory/corporate records audit with no major findings)

Summary

Challenge-seeker quantifiably launching and strengthening Environmental Programs. Focused on providing the Caribbean with environmental services that address the unique needs of island-based businesses and industrial facilities. Over 10 years of experience with solving complex environmental issues in the US Virgin Islands ranging from waste disposal to pollution discharge compliance.

Relevant Experience

Tysam Tech, LLC — **St. Croix, USVI**
Director of Environmental Services — **November 2017-Present**
Directing all environmental projects for the Environmental Firm. Assisting businesses and government agencies with Environmental Applications, Environmental Permitting (Coastal Zone Management, Air Permit, NPDES/TPDES) and Water Resource Management (H&H Studies, and Water Use Optimization Plans), Waste Disposal, Environmental Compliance, Phase 1 and Phase II ESAs, and Energy Use Optimization.

Primary Duties:
- Manage project timelines and deliverables
- Liaise between local agencies such as DPNR and client
- Ensure all projects are commissioned in accordance with local regulations

Major Clients:
Retained to provide Environmental Program Management for the following industries in the Territory: Diageo USVI, Cruzan Rum, Limetree Bay Refinery and Terminal Facility, St. Croix Renaissance Group Industrial Park, Asphalt Plants (2), Concrete Batch Plant, VI Housing Authority, VI Housing and Finance Authority

Diageo USVI, Captain Morgan Plant — **St. Croix, USVI**
Risk Manager — **August 2017-March 2019**
Risk Team Lead & Environmental Compliance Specialist — **September 2012-April 2014**
Compliance Consultant via Pinnacle Services LLC — **January 2011-September 2012**
- Pioneered and sustained the Environmental Management Program in support of the opening of the new Captain Morgan North America plant; included Coastal Zone Management, Air Permit Development, TPDES (NPDES) Development and alignment with the USVI Multi Sector General Permit and necessary Environmental Assessments.
- Created strategies and managed projects resulting in a 30% improvement in water use efficiency, a decrease in water consumption, and a 28% energy efficiency improvement. Managed the site towards attaining the best water efficiency numbers in the region.
- Created Best in Class Contractor EHS Training Program per Diageo North America Region standards.
- Supervised 12 personnel in the EHSS divisions.

University of the Virgin Islands — **St. Croix, USVI**
Adjunct Professor of EHS Course & Process Equipment Course — **December 2012-Present**

Hovensa — **St. Croix, USVI**
Industrial Hygiene Assistant (Intern) — **Summer 2008**

Department of Energy — **Richland, Washington**
Nuclear Research Technician (Co-Op) — **Summer 2007**

Tysam Tech, LLC

Jewel C. Cumberbatch Cornwall

Project Engineer I

EDUCATION & TRAINING

- Masters in Public Administration, University of the Virgin Islands (2020)
- B.S. Environmental Engineering, University of Florida (2016)
- B.S. Applied Mathematics, University of the Virgin Islands (2016)
- A.S. Physics, University of the Virgin Islands (2016)

CERTIFICATIONS

- Method 9 Certified Observer (2022)

KEY SKILLS

- Microsoft Office Suite
- Hazardous Waste Storage and Management
- Laboratory Management

AWARDS

- 1st Place Poster Presentation Winner for REU Tampa Interdisciplinary Environmental Research Symposium in Tampa, FL, (2015)
- 2nd Place Poster Presentation Winner at SAEOPP McNair/SSS Scholars Research Conference in Atlanta, GA, (2014)
- 2nd Place Poster Presentation Winner at UVI's Spring Science Symposium, St. Croix, USVI, (2012)

Summary

Trained in Environmental Engineering and Public Administration to focus on engineering sustainable communities by improving the environment and the quality of life for others through land, water, air, waste and energy systems R&D and technologies.

Relevant Experience

Tysam Tech, **St. Croix, USVI**
Environmental Engineer I **2022-Present**
Providing Tysam Tech Clients with Project Management, Compliance Assistance and Consulting, Project Design support, and other tasks to ensure compliance and/or progress in development project.

Primary Duties:

- Assist in providing project and environmental site review as well as permit development and Environmental Assessment Review (EAR) development.
- Review and understand federal and local environmental regulation under CWA and CAA, used to advise clients and construct management plans for projects as well as day to day industrial and commercial operations.
- Assist in inspection of active sites, including construction, industrial and commercial to ensure operations are in line with environmental regulations.
- Assist in project tasks to include historic record review, site map creation and background environmental condition report development.

University of South Florida
Civil and Environmental Engineering Department **Tampa, FL**
Environmental Consultant ***2021-Present***

- Work in collaboration with research group on NSF funded project called the Blue Green Action Platform (BlueGAP) which aims to create an interactive platform that links upstream and downstream communities with each other, and to resources and tools that improve how they manage nutrient pollution and ultimately improve public health and livelihoods.
- Develop a human-centered design prototype focusing on 3 diverse watersheds, Salt River Bay, Tampa Bay, and Mississippi River.
- Meet with various stakeholders along the watershed to understand how things are managed, what are needs etc. when it comes to nutrients.
- Participate in a structured program curriculum to focus on watersheds and histories of land tenure and land use, nitrogen pollution and health impacts, data collection and monitoring, using and visualizing data, current and better farming practices, improving soil health and reducing nitrogen runoff, and economic, social, and ecological benefits to improved nitrogen management practices.

American Society of Civil Engineers **St. Croix, VI**
Infrastructure Initiatives Fellow ***2021-2022***

- Research and assess publicly available data to draft various ASCE state report card chapters
- Coordinate research and writing support for ASCE members
- Develop a thorough working knowledge of ASCE infrastructure report card tone, content, and measurable outcomes.
- Technically review and provide feedback on ASCE state report card chapters

University of the Virgin Islands, College of Science & Mathematics **St. Croix, VI**
Part Time Faculty Professor – Introduction to Chemistry Lab ***2017-2021***

- Teach students to be proficient in the following chemistry techniques in laboratory.

ACTIVITES

- St. Croix Hiking Association (2018 – Present)
- St. Croix Environmental Association, Board of Directors Secretary (2018 – 2019) & Treasurer (2017-2018)
- Rotary Club of St. Croix Treasurer (2020-Present) President, (2019-2020) & Vice President, (2018-2019)
- Member of National Society of Black Engineers (NSBE), University of Florida, (2014 – 2016)
- American Association of Blacks in Energy (AABE) University of Florida Chapter Treasurer (2014 – 2015)
- Member of National Society of Black Engineers (NSBE), University of the Virgin Islands (2013)
- Member of Mathematical Association of America, University of the Virgin Islands (2013)
- Member of Materials Science Research Society, University of the Virgin Islands (2012 – 2013)
- Emerging Caribbean Scientists HBCU-UP Scholar, University of the Virgin Islands, (2011 – 2013)
- Member of Nature's Environmental Role Models, St. Croix Central High School, 2009 – 2010

- Investigate the uses and the limits of the various types of (I) laboratory balances and (II) volumetric glassware.
- Learn how to use hydrometer to obtain specific density.
- Learn gravimetric methods in analyses.
- Learn volumetric methods in analyses.
- Learn different analyses used to test water quality in drinking water.
- Observe the relationship between pressure and volume using Boyle's Law.
- Learn how rates are affected by concentration.
- Write permits for Title V, minor source, and synthetic minor facilities.

University of the Virgin Islands
College of Science & Mathematics / Campus Operations **St. Croix, VI**
Laboratory Manager / Compliance Specialist ***2016-2021***

- Manages the day-to-day activities of the CSM labs including maintaining science labs by organizing, cleaning and preparing laboratory experiments.
- Ensures safe laboratory conditions including safe and secure handling and storage of supplies and equipment, recommends, implements and maintains safety standards to comply with federal and local hazardous materials, health and safety, hazardous waste regulations and other applicable regulations.
- Initiates purchase requisitions and prepares cost estimates and justifications for purchases.
- Manages storage of and maintains an inventory of chemicals and equipment to include installation, calibration, preventative maintenance and repairs.
- Assists students in the use of lab equipment and facilities.
- Manages storage and disposal of waste streams (hazardous waste, medical waste, used oil, fluorescent lamps, and e-devices).
- Monitors Safe Drinking Water Act testing and analysis reports and manages local VIWMA and DPNR permits.

University of South Florida, Department of Anthropology **Tampa, FL**
Research Assistant ***2016***

- Participated in an Ethnographic Overview and Assessment of Virgin Islands National Park Hassel Island for the National Park Service Virgin Islands National Park and Virgin Islands
- Coral Reef National Monument under a Cooperative Agreement with the South Florida/Caribbean Cooperative Ecosystem Studies Unit (CESU) and the University of South Florida under the direction of Dr. Antoinette T. Jackson.
- Collected ethnographic and ethnohistorical/archival data pertaining to the park and surrounding communities with a specific emphasis on Hassel Island and associated people and communities on St Thomas and St. John Islands.

University of Florida, College of Engineering **Gainesville, FL**
Engineers Without Borders Bolivia International ***2014-2016***
Team Member & Design Team Leader

- Improved the quality of life in the community of Aripalca, Bolivia by providing clean reliable water supply for crop irrigation to improve and sustain their agricultural practices.
- Organized with a team of 20 engineering students and mentors to design, fundraise and implement a gabion wall to protect a failing section of an irrigation system in Aripalca, Bolivia.
- Managed project budget of $14,000, in-country logistics, project partner communication and fundraising efforts.
- Successfully implemented project with community support over 11 construction days in country during May 2015.

University of Florida, College of Engineering **Gainesville, FL**
Research Assistant ***2014-2016***

- Assisted Dr. David Mazyck and doctoral student Regina Rodriguez to focus on formulating and characterizing specific surface functional groups of physically and chemically treated activated carbons to investigate these modifications in terms of their effects on mercury removal in wastewater.
- Conducted experiments on activated carbon for surface area, pore volume, elemental composition, ash content, pH, yield, and pore size distribution characterization.
- Presented work at the 20th Annual SAEOPP McNair/SSS Scholars Research Conference in Atlanta, GA and University of Maryland, Baltimore County (UMBC) McNair Research Conference in Baltimore, MA.
- This research was supported by the Ronald E. McNair Post Baccalaureate Program.

University of South Florida,
Civil and Environmental Engineering Department **Tampa, FL**
Research Assistant ***2015***

- Participated in the Summer Research Experience for Undergraduates (REU) Tampa Interdisciplinary Environmental Research (TIER) Program.
- Assisted Dr. Qiong Zhang and doctoral student Eunyoung Lee to understand the anaerobic co-digestion kinetics of microalgae and waste activated sludge (WAS) for energy conversions and recovery that can be used for combined heat and power purposes.
- Conducted kinetic experiments of algae-WAS co-digestion to test chemical oxygen demand (COD), volatile solids (VS), total solids (TS), volatile suspended solids (VSS), total suspended solids (TSS), pH, alkalinity, total ammonia nitrogen (TAN) concentrations, volatile fatty acids (VFA) removal, and biogas/methane yield.
- Presented work at USF Research Symposium in Tampa, FL, the National Science Foundation (NSF) Research Symposium in Arlington, VA and the National Society of Black Engineers 42nd National Conference in Boston, MA.
- This research was funded by the National Science Foundation (NSF) (Grant number 1156905)

University of the Virgin Islands, College of Science and Mathematics **St. Thomas, VI**
Brookhaven National Laboratory, **Upton, NY**
Research Assistant ***2012-2013***

- Participated in the Visiting Faculty Program (VFP) at the Center for Functional Nanomaterials.
- Assisted Dr. Kevin Yager and Dr. Wayne Archibald to identify optimal growth and transfer conditions that minimized the number of atomic scale defects and grain boundaries in graphene sheets to better understand how it can be used in nano-scale electronic devices.
- Synthesized monolayer, bilayer, and multilayer graphene grown by chemical vapor deposition on copper substrates.
- Presented work at BNL Research Symposium and UVI's Spring, Summer, and Fall Science Symposiums in St. Thomas and St. Croix, USVI.
- Participated at the Materials Science Research (MRS) Conference in Boston, MA.
- This research was supported and funded by the Department of Energy (DOE), NSF (Grant Number 1238839) and UVI Emerging Caribbean Scientists (ECS) Program.

University of the Virgin Islands, College of Science and Mathematics **St. Croix, VI**
Research Assistant ***2011-2012***

- Participated in the Emerging Caribbean Scientist Summer Undergraduate Research Experience (SURE).

- Assisted Dr. Bernard F. Castillo to better understand terrestrial/aquatic carbon and nutrient influxes to implement land management practices and produce methods to protect marine ecosystems.
- Quantified particulate organic material and erosion rates from natural and anthropogenic sources in small subtropical watersheds in the east end of St. Croix.
- Presented work at UVI Summer and Fall Research Symposiums in St. Thomas and St. Croix, USVI and Emerging Researchers National (ERN) Conference in STEM in Atlanta, GA.
- Acknowledged in article publication “Quantification and modeling of foot trail surface erosion in a dry sub-tropical setting” by Carlos E. Ramos-Scharrón, Kynoch Reale-Munroe, and Scott C. Atkinson.
- This research was funded by the United States Geological Survey (USGS) through the Water Resources Research Institute (WRRI) at UVI (Project Number 2010VI170B) and NSF (Grant Number HRD-0506096)

Henry E. Tonnemacher, Environmental Biologist (1974), continuously licensed to do business by the Government of the Virgin Islands (via yearly renewals) since 1983; Marine consulting and contracting specializing in Benthic Surveys, Environmental Assessments and Monitoring, Scientific Research, Coral Reef Reconstruction & Restoration; USCG licensed 100 ton Master (Captain) with sailing addendum continuously since 1978; Certified as a: NAUI SCUBA diver in 1969, PADI Research Diving Instructor in 1977, NAUI Cave Diver in 1983, TDI NITROX Diver in 2003 and TDI Prism Topaz Closed Circuit Rebreather (CCR) Diver in 2017, contact Henry via **Cell # 340-725-5499** or email to go7seas@gmail.com

One project selected from each year and completed for various clients 1987–2021, listed below as:

YEAR – Project Title, brief project description – project location (client)

2021 – Coral Relocation Consultant and Diving Vessel Captain, removal, relocation and monitoring of over 250 coral colonies from the National Park Service Christiansted Bulkhead to permanent reef locations or staging areas – Christiansted Harbor, St. Croix, USVI (Tetra Tech, Inc., 5 year contract 2020-2025)

2020 – Permit Approval Plans for the US Army Corp of Engineers (USACE), the USVI Coastal Zone Management (CZM) & the USVI Dept. of Planning and Natural Resources (DPNR) including a new Project Coral Relocation Plan, update the 2018 aquatic habitat surveys (see 2018 below) at seven Aids to Navigation (ATON), for US Coast Guard (USCG) Project No. 4070992 to demolish & replace channel lights 7, 9, 10, 11, 13 & Daybeacon 16 in Christiansted Harbor and Coakley Bay Light 1, submit reports and plans to Environmental Science Associates (ESA) – St. Croix, USVI (ESA for Appledore Marine Engineering, LLC contracted by the USCG)

2019 – Recovery and Maintenance of the National Park Service (NPS) Acoustic Receiver Equipment, Captain the NPS R/V "Osprey" for live boat diving operations with NPS SCUBA divers to assist with the recovery, maintenance and replacement of the equipment which recorded the location of the many acoustically tagged marine animals such as sharks, fish, lobster, conch, etc. (**see also 2008**), Buck Island Reef National Monument out to the tip of Lang Bank, St. Croix (NPS)

2018 – New Biological Surveys Surrounding Seven US Coast Guard (USCG) Aids to Navigation (ATONs), Consultant and Vessel Captain to update the **2012 Seven Seas Ltd. Submerged Marine Resource Proposals Report for USCG PROJECT NO. 4070992** prior to the proposed demolition & replacement of seven USCG channel markers – Christiansted Harbor & Coakley Bay, St. Croix, USVI (Tetra Tech Inc.)

2017-19 – Captain of the 63' Catamaran "Jolly Mon", the USCG Licensed Master (captain) of this 49 passenger sailing vessel (originally named "Tsje Tsja" designed and built in St. Maarten), full/half day charters and sunset sails from Frederiksted, St. Croix with activities that included snorkeling, paddle boarding, etc., safely secured/undamaged during hurricanes Irma and Maria - St. Croix, USVI and Puerto Rico (Lyric Sails)

2016 – Habitat Surveys of the South Shore Industrial Complex – Designed, collected and submitted surveys of the seafloor coral, seagrass and sediments including the current environmental conditions to characterize over 4,600 acres of submerged land - HOVENSA Oil Refinery Harbor and the former Alcoa Aluminum Plant Harbor (Industrial Economics Inc. for the Environmental Response Trust for Hovensa and the USVI DPNR)

2015 – Pilot Port Sampling Project, Document the size, weight, species, number and method of fish and lobster catches of fishers at various landings over a three month period – St. Thomas & St. Croix, USVI (MER Consultants, DPNR, Atlantic Coastal Cooperative Statistics Program and the NOVA Southeast Fisheries Science Center)

2014 – **Commercial Diving and Vessel Captaining Projects**, Serving as the vessel captain, diving supervisor and/or commercial diver (complying with OSHA and USCG Commercial Diving Regulations) doing underwater inspections for certifications by Lloyds of London, ABS, DNV, USCG etc. and/or repairs of oil tankers, interisland ferries, barges and other various large vessels, also doing scientific research, coral reef surveys etc. – Numerous Caribbean Islands (Cruzan Maritime Services, LLC and The National Park Service)

2013 – **Water Quality Monitoring**, One full year of extensive field water quality data collection using a YSI multi-probe sonde and other equipment to determine the best location of an intake for a marine laboratory seawater system at the proposed Salt River Bay Marine Research and Education Center (MREC) - St. Croix, USVI (CoastWorks for University of North Carolina, Wilmington and DOI & the US NPS)

2012 – **Aquatic Habitat Surveys of the South Shore Industrial Complex**, Collect sediment samples and perform biological surveys to support the environmental damage claims made by the Government of the Virgin Islands against HOVENSA and Lockheed Martin, et al. –, St. Croix, USVI (Law Offices of John K. Dema, P.C.)

2011 – Commercial Fish Trap Catch Surveys, Newly built fish traps were baited, set and collected at 638 locations by various commercial fishers to produce a large data base of fish catches to help set annual catch limits for various commercial fish species – St. Croix, USVI (NOAA, National Marine Fishery Service, SE & Fisheries Science Center)

2010 – Aquatic Habitat Surveys and Installation of the St. Croix East End Marine Park (EEMP) Boundary Marker Buoys, locate and document benthic habitats to eliminate environmental impacts, assemble and install at the designated sites the USCG approved buoys and anchoring systems - St. Croix, USVI (The Nature Conservancy and the Virgin Islands Department of Planning and Natural Resources)

2009 - **Reef Reconstruction & Restoration**, oil tanker and vessel groundings caused extensive coral reef damage at two locations, served as environmental consultant, commercial diver and vessel captain - Buccaneer Reef and Long Point Reef, St. Croix, USVI (Vessel Owners & Insurers via Jimenez, Graffam & Lausell, Attorneys at Law, and Polaris Applied Sciences)

2008 – Shark Acoustic Tagging, Surgically implanting electronic transmitters in sharks to record their location and movements in and around the monument, served as vessel captain, implant assistant and consultant - Buck Island Reef National Monument, St. Croix (National Park Service)

2007 - **Aquatic Habitat Surveys & Mitigation Proposals**, environmental biologist, diver and vessel captain to produce a complete species list and benthic map of habitats adjacent to 400 meters of shoreline for the proposed Amalago Bay Marina and Resort development - Estate William & Punch, Frederiksted, St., Croix, V.I. (Island Resources Foundation for McComb Engineering & the Mashantucket Pequot Tribal Nation)

2006 – Five Years of Sampling the Sahara Dust Air Masses from Air and Seawater to Document their Microbes and Contaminants, Collecting seawater samples in vials and collect dust samples by vacuuming air through fine filters for laboratory analysis – East End, St. Croix, V.I. (Texas A&M University and the U.S. Geological Survey (USGS)

2005 - Elkhorn Coral Study of Bleaching, Disease and Population Densities, long term photographic and data collection, vessel captain and scientific diver - Buck Island Reef National Monument, St. Croix (Dept. of the Interior / National Park Service)

2004 - **Marine Habitat Surveys**, Benthic surveys off shore of two proposed beachfront resort and community developments to produce baseline habitat maps of all flora and fauna to species level - Frenchman's Bay and Nazareth Bay, St. Thomas (Dr. Dennis Hubbard, Oberlin College, for McComb Engineering)

2003 - **Water Quality Monitoring for the Wetlands and Riparian Areas Inventory**, Extensive data collection using Hydrolab multi-probe sondes and water bottle sample collections for laboratory analysis - St. Thomas, St. John and St. Croix, USVI (Island Resources Foundation for the V.I. Dept. of Planning and Natural Resources)

2002 – Marine Benthic Habitat Surveys at an Industrial Ocean Outfall (6th year), baseline surveys to species level of all marine life for possible impacts of effluent from manufacturing facilities - Freeport, Grand Bahama (V.I. Marine Advisors for Ramboll/Environ)

2001 - **Environmental Monitoring During New Dock Construction**, environmental biologist and vessel captain to record water quality data using a Hydrolab multi-probe sonde, collect water samples for laboratory analysis - HOVIC Oil Refinery, St. Croix, V.I. (Hess Oil Virgin Islands Corporation)

2000 - Marine Benthic Habitat Surveys for a Proposed Subsea Fiber-optic Cable Network, vessel captain, environmental biologist & scientific diver for baseline benthic surveys to determine possible environmental impacts of submarine cable installation - U.S. Virgin Islands (V.I. Marine Advisors for Innovative Communications Corp.)

1999 – **Coral Reef Surveys of Easter Island (Isla de Pascua)**, follow-up visual, video and photographic surveys documenting the coral reefs and their inhabitants to determine potential impacts of increased Island tourism - Isla de Pascua, Chile (The Science Museum of Long Island, The Explorer's Club, the U. S. National Park Service)

1998 - **Marine Life Surveys of Borneo's Offshore Islands**, photographing the coral reefs and their associated fish and other species to promote SCUBA diving tourism around the islands of Sipadan, Mabul, Kapalai and other islands - Sabah, Malaysia (Malaysia Tourism Promotion Board)

1997 – **Marine Benthic Habitat Surveys and Monitoring of an AT&T Submarine Cable Lay**, scientific diver and vessel captain to document the environmental damage caused by the spilled bentonite drilling mud during a directed subterranean drilling project, – Frederiksted, St. Croix (VI Marine Advisors, USVI Government)

1996 - Underwater Coring and Drilling Studies, scientific diver and 40' vessel captain to investigate and document potential offshore sand mining areas for concrete production using a vibra-core system to collect sediment core samples - Anguilla, BWI and St. Croix, VI (VI Marine Advisors for the British Overseas Development Office and NOAA)

1995 - **Aquatic Habitat Surveys, Mapping and Water Quality Monitoring of Cenotes (underwater caves)**, baseline surveys to determine potential impacts of tourism development in these unique and fragile marine and fresh water environments - Cozumel, Mexico (Island Caves Research Center for the Mexican Government)

1994 - Construction of an Artificial Reef for Beach Restoration, restore to historical conditions the sandy beach and it's adjacent coral reef via the placement of one hundred 8,000 lb. rocks to replace the natural coral reef destroyed by previous dredging operations - Sugar Bay, St. Thomas, USVI (VI Marine Advisors for Lennar Partners, Inc.)

1993 - **Marine Life Surveys of the Remote Coral Reefs of the Sulu Sea**, photo-document various and unusual oceanic and benthic marine life reported to be at some of the most remote and least visited islands and reefs of the Sulu Sea - Philippines (7 Seas Ltd.)

1991 & 1992 - **Benthic Habitat Surveys and Environmental Monitoring (see also 1988)**, Baseline and regular benthic surveys including water quality analysis to assess potential dredging impacts before and during the new Schooner Channel dredging project - St. Croix, USVI (V.I. Port Authority)

1990 - **Post Hurricane Marine Habitat Surveys,** video documentation of environmental damage caused by hurricane Hugo to the south shore sewage treatment plant offshore outfall pipe and to the Buck Island Reef National Monument south forereef, St. Croix, USVI (V.I. Dept. of Public Works and The National Park Service)

1989 - **Marine Habitat Surveys and Environmental Monitoring (see also 1987),** photographic data collection and laboratory water quality analysis to determine possible pre-construction impacts and environmental monitoring during construction of a new docking facility - Gordon A. Finch Molasses Pier, St. Croix, USVI (Island Resources Foundation)

1988 - **Marine Archaeological Survey of Christiansted Harbor**, baseline benthic survey using side scan sonar to locate potential cultural resources (shipwrecks, etc.) prior to the schooner channel dredging project - St. Croix, USVI (Island Resources Foundation)

1987 - **Marine Archaeological Survey of Limetree Bay (see also 1988) prior to new dock construction (see 1989)** - St. Croix (Island Resources Foundation)

1**978-89 - Owner and Captain of the 40' trimaran "Romany Road",** sailing, SCUBA diving and video production charters in the US and British Virgin Islands (Self Employed).

Employment Experience and Education:

1986 – Present: Seven Seas Ltd., Essentially a change of business name from "Diving Unlimited" to “Seven Seas Ltd.” to reflect the broader range of locations and services offered.

1983-86: **Diving Unlimited,** Founder/Owner/Operator, Commercial and Scientific diving services, vessel captaining services.

1981-83: **West Indies Laboratory (WIL) of Fairleigh Dickinson University (FDU)**, Instructor for the college credited semester long course "Advanced Diving for Scientific Studies", NAUI & PADI SCUBA Instructor and NAUI SCUBA Instructor Course Director, Captain of the R/V “Sarima”, care and maintenance of all boats and SCUBA equipment (**see also 1977-80 below**).

1980-81: **Cay Divers**, Start-Up Consultant, Manager, Captain, NAUI and PADI SCUBA Instructor for a new full-service SCUBA diving shop and training facility at Hotel on the Cay on Protestant Cay, Christiansted Harbor; captain of the 40’ custom diving and snorkeling vessel “Cay Diver”, NPS certified Buck Island National Monument SCUBA diving and snorkeling tours.

1977-80: **WIL of FDU (see also 1981-83 above),** Facility Diving Supervisor, NOAA Hydrolab Underwater Habitat (NULS-1) Diving Coordinator, Air Saturation Diver (NOAA Aquanaut), Research Diving Instructor and Captain of various WIL & NOAA vessels, U.S. Dept. of Commerce Recompression Chamber Operator (1978).

1975-77: Underwater Research Center, Manager, Boat Captain and SCUBA Instructor of a complete marine center with a main shop and four additional staffed hotel outlets in St. Maarten, Netherlands Antilles and St. Martin, French West Indies, Developer/Instructor for secondary school Oceanography Summer Course.

1974-75: **Carriacou Marine School of the Canadian Junior College**, Develop and teach semester and summer courses in Environmental Biology and Oceanography in Carriacou, Grenada, West Indies, Certified as a Grade 13 Instructor by the Canadian Ministry of Education.

1972-74: **California State University, Sacramento (**formerly Sacramento State College), full time student with summer jobs teaching Oceanography and Marine Biology (see 1971-73 below), graduated with a BA degree in Environmental Biology with Minors in Math and Chemistry.

1971-73: **Summer Camp Afloat (aka the US Intercostal Marine Squadron)** Teach Oceanography and Marine Biology Courses, guide SCUBA dives in **1973** at Palm Beach, Florida, in **1972** at West End, Grand Bahama, and in **1971** at Spanish Wells, Bahamas.

Henry E. Tonnemacher, Environmental Biologist (1974) – Founder, Owner and Operator of **Video Seven Seas Ltd**., marine consulting and contracting continuously licensed since 1986 and specializing in: Aquatic Habitat Surveys, Environmental Monitoring, Scientific Research and Coral Reef Reconstruction and Restoration; U.S.C.G. licensed 100-ton Master (Captain) for power and sailing vessels continuously since 1978; Certified as a: PADI Research Diving Instructor 1977, NAUI Cave Diver 1983, NAUI/PSI SCUBA Cylinder Inspector 1987, NAUI Instructor Trainer 1989, TDI NITROX Diver 2003 and TDI Prism Topaz Closed Circuit Rebreather (CCR) Diver 2017; **Contact information**: **Cell # 340-725-5499, mail: 4031 Little Princess, Christiansted, VI 00820-4227, email:** go7seas@gmail.com

One Seven Seas Ltd. Project selected from each year 1987 to 2020 with information summarized by:

Year Completed – **Project Title**, Brief Project Description – Project Location **(Client)**

2020 – **Aquatic Habitat Surveys,** Document the current environmental conditions at seven USCG aids to navigation (ATONs) being the Christiansted Harbor & Coakley Channel Navigation Lights for the US Army Corp of Engineer Permit, CZM & DPNR Permits and a Coral Relocation Plan, submit coral relocation/permitting plan reports to ESA – St. Croix, **USVI (Environmental Science Associates (ESA) for Appledore Marine Engineering, LLC)**

2019 –Acoustic Receiver Equipment Recovery and Maintenance, Captain of the NPS Research Vessel "Osprey" for live boat diving operations with certified National Park Service SCUBA divers, assist with: receiver equipment recovery, data downloads and maintenance of all associated research equipment – Buck Island Reef National Monument out to the tip of Lang Bank, St. Croix, **USVI (US National Park Service, Southeast Region)**

2018 – **Aquatic Habitat Surveys,** Consultant and Vessel Captain to update the 2012 Seven Seas Ltd. report titled ***A Marine Resource Survey Around 5 Channel Lights*** prepared for Appledore Marine Engineering, Inc. to document any endangered species and any remediation that may be required to demolish and replace of seven aids to navigation (ATONs) – Christiansted Harbor & Coakley Bay, St. Croix, USVI **(Tetra Tech Inc. for the USGS)**

2017 – **Aquatic Habitat Surveys,** Submit a report with video and photo documentation describing three different benthic communities to determine the best location for a large floating platform in 5'-6' deep water, and including a path over the beach for an amphibious RIB, with the least environmental impact to receive permits from the US-ACoE, VI-DPNR and VI-CZM – Coakley Bay, St. Croix **(CariTech Group, LLC)**

2016 – **Aquatic Habitat Surveys of the South Shore Industrial Complex** – Designed & submitted a survey of the coral, seagrass and sediments assessing the current condition of the marine environment consisting of over 4,600 acres **(Industrial Economics, Inc. for The Hovensa Environmental Response Trust on behalf of The Department of Planning and Natural Resources, Government of the United States Virgin Islands)**

2015 – Pilot Port Sampling Project, Project Manager for the Staffing, Implementation and Oversight of the program on St. Croix and funds manager for St. Thomas to document the size, weight, species, number and method of capture for fish and lobster catches of fishers at various landing sites to help establish NOAA species catch limits – St. Thomas & St. Croix **(MER Consultants for DPNR and NOAA's Southeast Fisheries Science Center)**

2014 – **Commercial Diving and Vessel Captaining**, Serving as a vessel captain, diving supervisor and/or commercial diver for numerous underwater projects including large ship inspections for ABS/Lloyds/DNV/Insurance certifications, repairs, propeller polishing and hull cleaning; various underwater scientific research projects – Numerous Caribbean Islands **(Cruzan Maritime Services, LLC and The National Park Service)**

2013 – **Water Quality Study**, A full year of extensive water quality field data collection using a YSI multi-probe sonde and other equipment to determine the best location for a seawater system intake for the proposed Salt River Bay Marine Research and Education Center (MREC) overlooking the Salt River Bay National Historical Park and Ecological Preserve - St. Croix, USVI **(CoastWorks for UNCW, DOI & NPS)**

2012 – **Aquatic Habitat Surveys**, Collect sediment samples and perform biological surveys near the HOVENSA refinery to evaluate the exposure of natural resources to contaminants by collecting and chemically analyzing sediments and to observe potential impacts to biological communities. – St. Croix, USVI **(Law Offices of John K. Dema, P.C. for Stratus Consulting, Inc. & Vicente & Associates Inc.)**

2011 – Pilot Cooperative Fishery Independent Survey Project, 40 new fish traps were designed, constructed and baited identically to eliminate bias then set and collected at 638 locations by commercial fishers along with scientific staff to photograph and measure all catches to assist NOAA in setting annual catch limits for commercial fish species – St. Croix, USVI **(MER Consultants, NOAA, NMFS-SE & Fisheries Science Center)**

2010 – **Aquatic Habitat Surveys and Installation of the STX EEMP Boundary Marker Buoys**, Select and document benthic habitats to eliminate environmental impact then design, assemble and install the USCG approved buoys with their tackle, chain, line and moorings- East End Marine Park (EEMP), St. Croix, USVI **(The Nature Conservancy and the Virgin Islands Department of Planning and Natural Resources)**

2009 - **Reef Reconstruction & Restoration After Ship Groundings**, The 115m long Sichem Amethyst and a sport boat ran aground causing extensive reef damage which was mitigated by reattaching over 650 live coral colonies and fragments and stabilizing over 1,000 dislodged limestone fragments - Buccaneer Reef and Long Point Reef, St. Croix, USVI **(Jimenez, Graffam & Lausell, Attorneys at Law, and Polaris Applied Sciences)**

2008 – Shark Acoustic Tagging, Capturing and surgically implanting small acoustic tags into sharks body cavities to document their growth and track their movements in and around the Buck Island Reef National Monument - St. Croix, USVI **(National Park Service)**

2007 - **Aquatic Habitat Surveys with Mitigation Proposals**, Document the varied marine habitat locations and associated species data with videos and photos and report mitigation recommendations for the proposed Amalago Bay Marina and Resort development - Estate William & Punch, Frederiksted, St. Croix, USVI **(Island Resources Foundation for McComb Engineering & the Mashantucket Pequot Tribal Nation)**

2006 – Sampling of African/Sahara Dust Air Masses in Air and Seawater for Microbes and Contaminants, A five year project collecting sea water samples via a specially designed teflon based collector and obtaining dust samples from air by vacuuming known air volumes through filters; both of which were stabilized and sent off-island for laboratory analysis – East End, St. Croix, V.I. **(Texas A&M University and the U.S. Geological Survey)**

2005 - Elkhorn Coral Study of Bleaching, Disease and Population Densities, long term photo and data collection project done before, during and after the first *A. palmata* (elkhorn coral) bleaching event ever recorded - Buck Island Reef National Monument, St. Croix **(National Park Service)**

2004 - **Aquatic Habitat Surveys**, Benthic surveys off shore of two proposed beachfront resort and community developments to produce baseline habitat and species maps - Frenchman's Bay and Nazareth Bay, St. Thomas **(Dr. Dennis Hubbard, Oberlin College, for McComb Engineering)**

2003 - **Water Quality Monitoring for the Wetlands and Riparian Areas Inventory**, Extensive data collection and analysis using Hydrolab multi-probe sondes and water sample collections for laboratory analysis to assess the health of these endangered environments on the islands of St. Croix, St. John and St. Thomas- U.S. Virgin Islands **(Island Resources Foundation for the V.I. Dept. of Planning and Natural Resources)**

2002 – Aquatic Habitat Surveys at an Ocean Outfall (6th year), Complete benthic surveys to species level to anticipate and document any possible impacts of process water effluent from manufacturing plants outfall pipe - Freeport, Grand Bahama **(V.I. Marine Advisors for Ramboll Environ)**

2001 - **Environmental Monitoring During New Dock Construction**, Collect data from a multi-probe sonde, secchi disc and water samples sent for laboratory analysis to prevent potential water quality degradation from piling driving, etc. - St. Croix, V.I. **(Hess Oil Virgin Islands Corporation)**

2000 - Aquatic Habitat Surveys for a Proposed Subsea Fiber-optic Cable Network, Benthic surveys to determine the possible impacts of seafloor cable laying operations from deep sea to land - U.S. Virgin Islands **(V.I. Marine Advisors for Innovative Communications Corp.)**

1999 – **Aquatic Habitat Surveys of Easter Island**, A follow-up visual, video and photographic survey documenting the island's coral reefs and their inhabitants to determine the potential impacts of increased tourism and establish limits to visitor numbers - Easter Island **(The Science Museum of Long Island / The Explorer's Club / U. S. National Park Service)**

1998 - **Aquatic Habitat Surveys of Some Malaysian Offshore Islands**, Photograph local marine flora and fauna for the promotion of SCUBA diving around the islands of Sipadan, Mabul, Kapalai and others - Sabah, Borneo, Malaysia **(Malaysia Tourism Promotion Board)**

1997 – **Aquatic Habitat Surveys and Monitoring of an AT&T Submarine Cable Lay**, Document the associated environmental damage of spilled drilling mud and other impacts during a directed subterranean drilling project – Frederiksted, St. Croix **(VI Marine Advisors / V.I. Government)**

1996 - Underwater Coring and Drilling Studies, Investigate possible offshore mining areas for construction sand via analyzing core samples collected deep into the substrate- Anguilla and St. Croix **(VI Marine Advisors for the British Overseas Development Office and NOAA)**

1995 - **Aquatic Habitat Surveys, Mapping and Water Quality Monitoring of Cenotes and Underwater Caves**, Collect baseline data to determine the possible impacts of tourism development from increased human traffic and environmental alterations in these understudied, fragile and archeological significant aquatic environments - Cozumel, Mexico **(Island Caves Research Center for the Government of Mexico)**

1994 - Construction and Environmental Monitoring of a 100 Unit Offshore Artificial Reef with Associated Beach Restoration, Restore to original conditions the sandy beach after dredging damage to the adjacent coral reef - St. Thomas, USVI **(VI Marine Advisors for Lennar Partners, Inc.)**

1993 - **Aquatic Habitat Surveys of the Remote Coral Reefs in the Sulu Sea**, Photograph various previously undocumented oceanic and benthic marine life reported at uninhabited and/or remote islands and coral reefs - Sulu Sea, Philippines **(7 Seas Ltd.)**

1991-92 - **Aquatic Habitat Surveys and Environmental Monitoring for the Schooner Channel Dredging Project**, Baseline mapping and benthic habitat surveys of marine life including water quality analysis sediment deposition volume and rates to assess potential dredging impacts before and during the dredging project in Christiansted Harbor- St. Croix, USVI **(V.I. Port Authority)**

1990 - **Aquatic Habitat Surveys Post Hugo,** Video documentation of damage caused by hurricane Hugo to a treated sewage discharge pipe and its associated rock covering marine life habitats and to coral reef paralleling Buck Island's southeast shore – STX South Shore Sewage Treatment Plant Offshore Outfall Pipe and the Buck Island Reef National Monument, St. Croix **(V.I. Dept. of Public Works and The National Park Service)**

1989 - **Aquatic Habitat Surveys and Environmental Monitoring,** Photographic and other field data collection including laboratory water quality analysis to determine possible construction impacts to marine life and its habitats, also the monitoring during construction of a new ship docking facility with extensive landfill areas - Gordon A. Finch Molasses Pier, St. Croix, USVI **(Island Resources Foundation)**

1988 - **Marine Archaeological Survey of Christiansted Harbor**, Aquatic habitat survey to document any cultural resources (shipwrecks, graves, etc.) that could be damaged or altered by the schooner channel dredging project – St. Croix, USVI **(Island Resources Foundation)**

1987 - **Marine Archaeological Survey of Limetree Bay,** Aquatic habitat survey to document any cultural resources (shipwrecks, graves, etc.) that could be damaged or altered by the construction of the Gordon A. Finch Molasses Pier - St. Croix, USVI **(Island Resources Foundation)**

Work Experience and Education:

1986 – Present: Seven Seas Ltd., See top of page 1

1983 - 86: **Diving Unlimited,** Henry E. Tonnemacher Founder/Owner/Operator; commercial, scientific and sport diving services; underwater photo and video; sailing charters aboard the 40' trimaran *Romany Road*.

1981 - 83: **The West Indies Laboratory (WIL) of Fairleigh Dickinson University (FDU)**, Instructor for the college credited semester long course *Advanced Diving for Scientific Studies*, NAUI & PADI SCUBA Instructor, NAUI SCUBA Instructor Trainer and Course Director (see additional duties listed in 1977-80).

1980 - 81: **Cay Divers**, Start-Up Consultant, Manager, Captain and NAUI/PADI SCUBA Instructor for a full-service dive shop and training facility at Hotel on the Cay on Protestant Cay, St. Croix; captain of the 40' custom diving and snorkeling vessel "Cay Diver", NPS licensed Buck Island National Monument SCUBA tours

1977 - 80: **WIL of FDU (see also 1981-83 above),** Diving Supervisor, NOAA Hydrolab Underwater Habitat (NULS-1) Diving Coordinator 1977-78, Air Saturation Diver (NOAA Aquanaut), Research Diving Instructor and Research Vessel Master (Captain), U.S. Dept. of Commerce Recompression Chamber Operator 1978.

1975 - 77: Underwater Research Center, Manager, Boat Captain and SCUBA Instructor of a complete marine center with a main shop and four additional staffed hotel outlets in St. Maarten, Netherlands Antilles and St. Martin, French West Indies, Developer/Instructor for secondary school Oceanography Summer Course.

1974 - 75: **Canadian Junior College Carriacou Marine School**, Develop and teach semester/summer courses in Environmental Biology and Oceanography at Carriacou, Grenada, West Indies with an additional Literature School in Lausanne, Switzerland, Certified as a Grade 13 Instructor by the Canadian Ministry of Education.

1972 - 74: **California State University, Sacramento (CSUS)**, Full time student in biological sciences, graduated with a BA degree in Environmental Biology with Minors in Math and Chemistry; marine biology and oceanography instructor for Summer Camp Afloat during summers of 1972 and 1973 (see 1971-73 below).

1971 - 73: **Summer Camp Afloat (US Intercostal Marine Squadron)** Oceanography, Marine Biology and U/W Photography Instructor for summer programs at: Palm Beach Shores, Florida (1973), West End, Grand Bahama Island (1972) and Spanish Wells, Bahamas (1971), assistant instructor for SCUBA and scientific/research diving.

1970 - 72: **Sierra College, Rocklin, California**, Full time student, graduated with an AA degree in Biology, teacher for the oceanography section of Dr. R. A. Underhill's general biology course; curator, life support operator and technician of all marine aquaria including those in a 48 degree refrigerated walk-in room.

1970: **Encina High School and the Sacramento Junior Museum and Science Center**; With a $91,000 Federal Library Grant developed and then taught the first accredited semester long course in Oceanography for high school students in the United States; Oceanography instructor at the Mendocino, California coast for marine studies through the Sacramento Junior Museum and Science Center for grade 7-12 students.