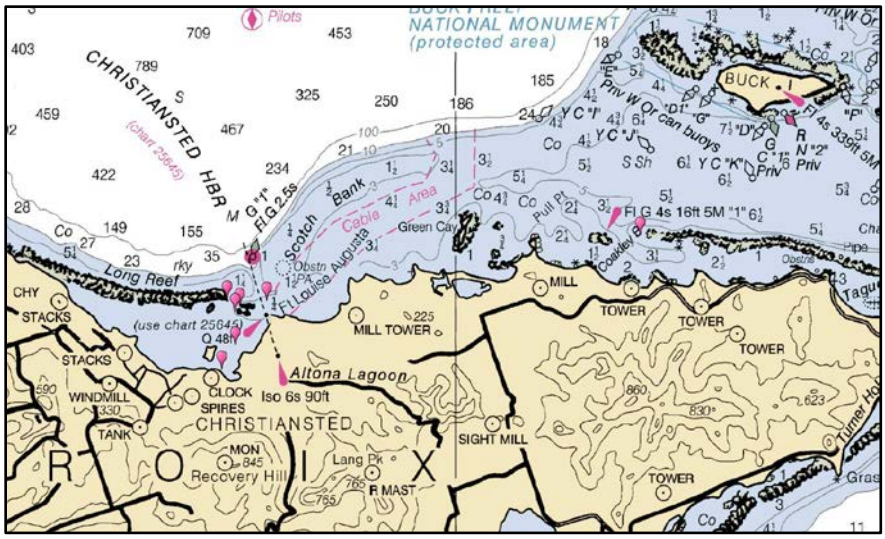
UNITED STATES COAST GUARD – CEU MIAMI
MIAMI, FLORIDA 33177-1630

DESIGN CHRISTIANSTED HARBOR CHANNEL LIGHTS
Christiansted, St Croix, US Virgin Islands

Site Visit Report

USCG Task Order	70Z08220FPACP0500
Contract No.	HSCGG1-16-D-PRV005
USCG Project No.	PN 12658004



March 2020

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1.0 INTRODUCTION

1.1 SUMMARY

This Site Visit Report was prepared by Appledore Marine Engineering, LLC (AME) for the United States Coast Guard Civil Engineering Unit Miami under Task Order No. 70Z08220FPACP0500. The project manager for the United States Coast Guard (USCG) is Mr. Mark Braxton.

Seven federal aid-to-navigation (ATON) structures, located in the vicinity of Christiansted Harbor, St. Croix, U.S. Virgin Islands (USVI), are to be replaced. This Site Visit Report provides a summary of the information collected during a site visit performed by AME on March 5th, 2020. Once the Site Visit Report has been reviewed by the USCG, the design will be progressed, and 35% design documents will be provided in accordance with the task order.

The purpose of the site visit was to confirm the conditions and hardware of the existing structures and identify and document existing conditions. The inspection consisted of 100% visual inspection and to observe and record general conditions of the existing range structures.

Table 1 provides the key personnel for the site visit.

Name	**Role**
Noah Elwood, PE	Principal
Lukian Harris, PE	Project Manager
Joseph Cushing	Engineering Tech - Diver
Edward Lavarini	Diver
Kenneth Shull	Boat Captain

Table 1 – site visit key personnel

1.2 BACKGROUND

The purpose of this project is to further the design completed by AME in May 2012 to completely remove and replace five federal aid-to-navigation (ATON) structures located in Christiansted Harbor, St. Croix, U.S. Virgin Islands (USVI). This project will include these five structures as well as two additional structures: Daybeacon 16 and Coakley Bay Light 1.

The Christiansted Harbor Channel Lights 7, 9, 10, 11, 13, Daybeacon 16, and Coakley Bay Light 1 are all steel H-pile structures that failed during the 2017 hurricane season. Corrosion of the steel is severe and beyond repair. This report includes site investigations on all seven structures.

Six of the seven ATON structures are located in Christiansted Harbor and the seventh is located southwest of Buck Island. Table 2 provides the latitude and longitude coordinates for each structure and the locations are depicted on Figure 1 and 2.

Structure	**Latitude**	**Longitude**
Christiansted Harbor Channel Light 7	17° 45' 25.881"N	64° 41' 40.040"W
Christiansted Harbor Channel Light 9	17° 45' 22.721"N	64° 41' 54.360"W
Christiansted Harbor Channel Light 10*	17° 45' 26.501"N	64° 42' 01.060"W
Christiansted Harbor Channel Light 11	17° 45' 20.271"N	64° 41' 56.771"W
Christiansted Harbor Channel Light 13	17° 45' 03.385"N	64° 41' 56.650"W
Christiansted Harbor Channel Daybeacon 16	17° 44' 50.153"N	64° 42' 04.271"W
Coakley Bay Light 1*	17° 45' 58.902"N	64° 38' 40.507"W

*Coordinates provided in SOW do not match coordinates verified in field. Based on the site visit, the approximate coordinates of Light 10 are 17° 45' 25.45"N, 64° 42' 1.01"W, and the approximate coordinates of Light 1 are 17° 45' 58.64"N, 64° 38' 21.88"W.

Table 2 – latitude and longitude of existing lights

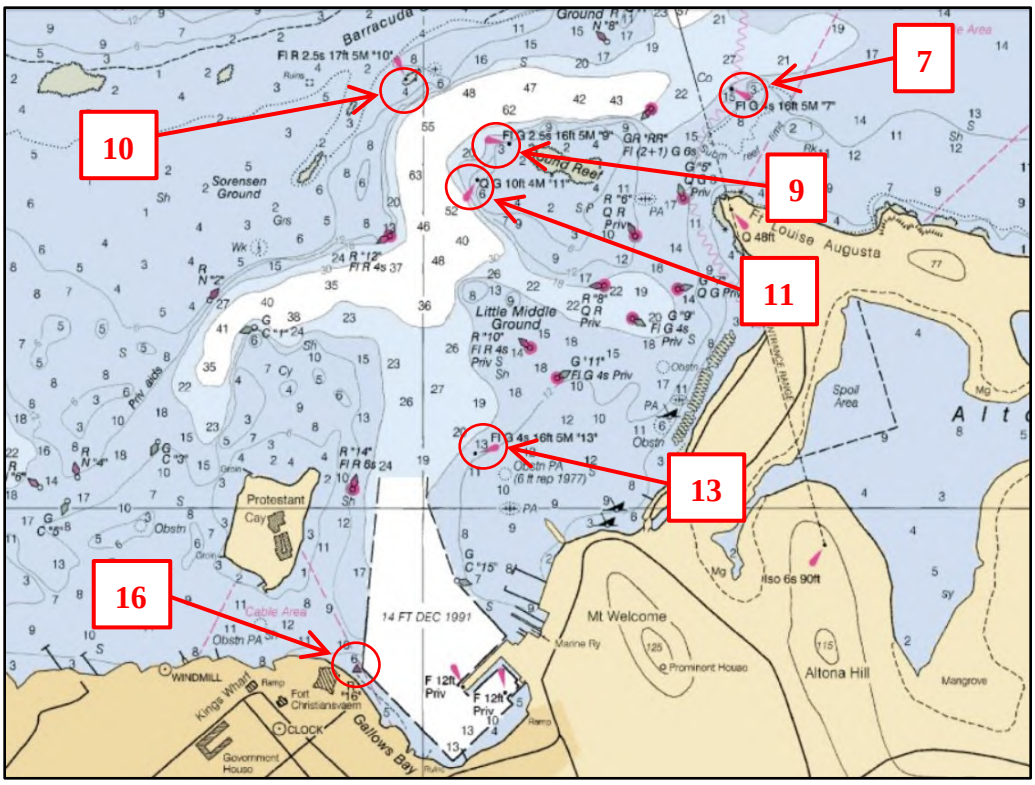

Figure 1 – NOAA Chart 25645 with existing Christiansted Harbor ATON locations

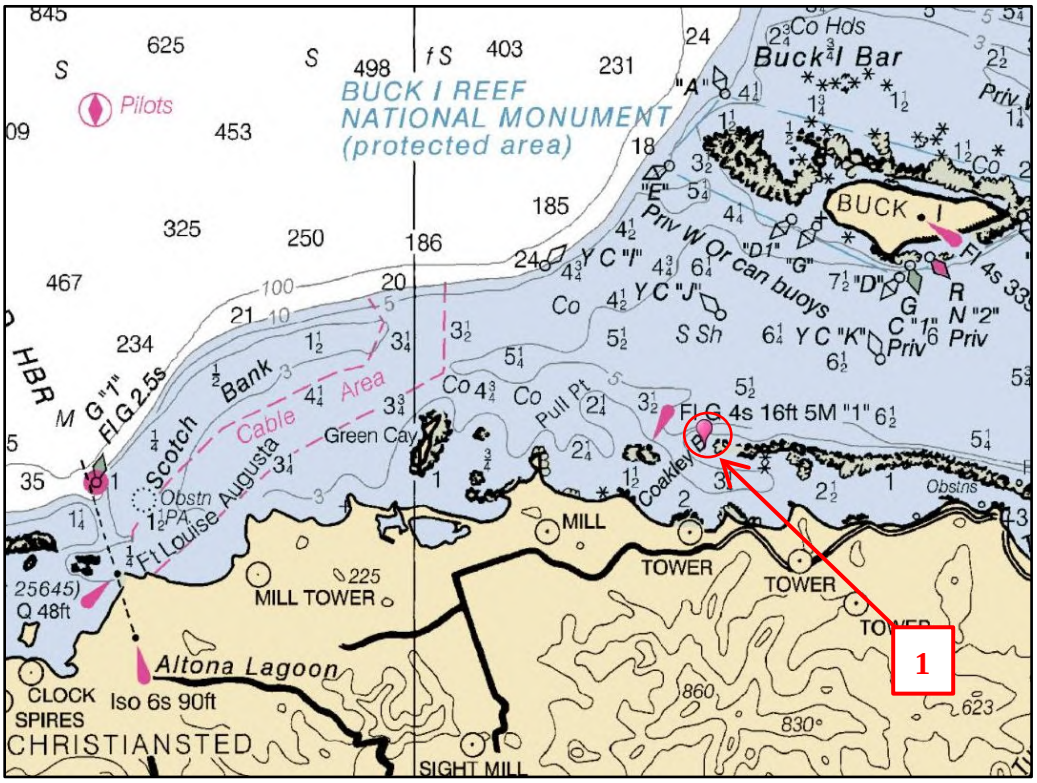

Figure 2 – NOAA Chart 25641 with existing Coakley Bay ATON location

2.0 EXISTING SITE CONDITIONS

2.1 CHRISTIANSTED HARBOR CHANNEL LIGHT 7 (LLNR 32895)

Christiansted Harbor Channel Light 7 consists of four battered steel H-piles and one centered plumb steel H-pile. Welded steel bracing connects the top of the piles together. The steel H-piles are 12 in. by 12 in. in cross section and approximately 3/8 in. thick. The entire structure has widespread severe corrosion. The ladder, platform, and light have fallen off and are located on the seafloor near the structure's base.

The water depth around the light is approximately 22 ft with a sandy bottom with about 2 ft of scour noted around the base of the piles. There are remnants of a fiberglass boat approximately 12 ft long near the base of the structure. There is a 1.5 in. diameter utility line running in a north-south direction approximately 9 ft to the east of the base of the structure.

Refer to Section 2.8 for a description of the electrical utility service for the light.

Photo 1: existing Christiansted Harbor Channel Light 7

2.2 CHRISTIANSTED HARBOR CHANNEL LIGHT 9 (LLNR 32910)

Christiansted Harbor Channel Light 9 consists of four battered steel H-piles and one centered plumb steel H-pile. Welded steel bracing connects the top of the piles together. The steel H-piles are 12 in. by 12 in. in cross section and approximately 3/8 in. thick. The entire structure has widespread severe corrosion. The ladder, platform, and light have fallen off and are located on the seafloor near the structure's base.

The water depth around the light is approximately 18 ft with a mostly sandy bottom. There is a 10 ft rock cliff adjacent to the east side of the base of the tower running roughly in a north-south direction.

Refer to Section 2.8 for a description of the electrical utility service for the light.

Photo 2: existing Christiansted Channel Harbor Light 9

2.3 CHRISTIANSTED HARBOR CHANNEL LIGHT 10 (LLNR 32915)

Christiansted Harbor Channel Light 10 consists of one plumb steel H-pile with a platform, light and ladder. The steel H-pile is 12 in. by 12 in. in cross section and approximately 3/8 in. thick. The pile has severe corrosion and the ladder has advanced corrosion in the splash zone.

The water depth around the light is approximately 17 ft. The seafloor in the vicinity of the structure is sandy with no significant debris.

The existing Light 10 position is approximately 130 ft south of the coordinates provided in the SOW. The approximate coordinates of Light 10 taken by GPS during the site visit are 17° 45' 25.45"N, 64° 42' 1.01"W. The coordinates provided in the SOW correspond to remnants of deteriorated concrete foundation in shallow water over reef.

Refer to Section 2.8 for a description of the electrical utility service for the light.

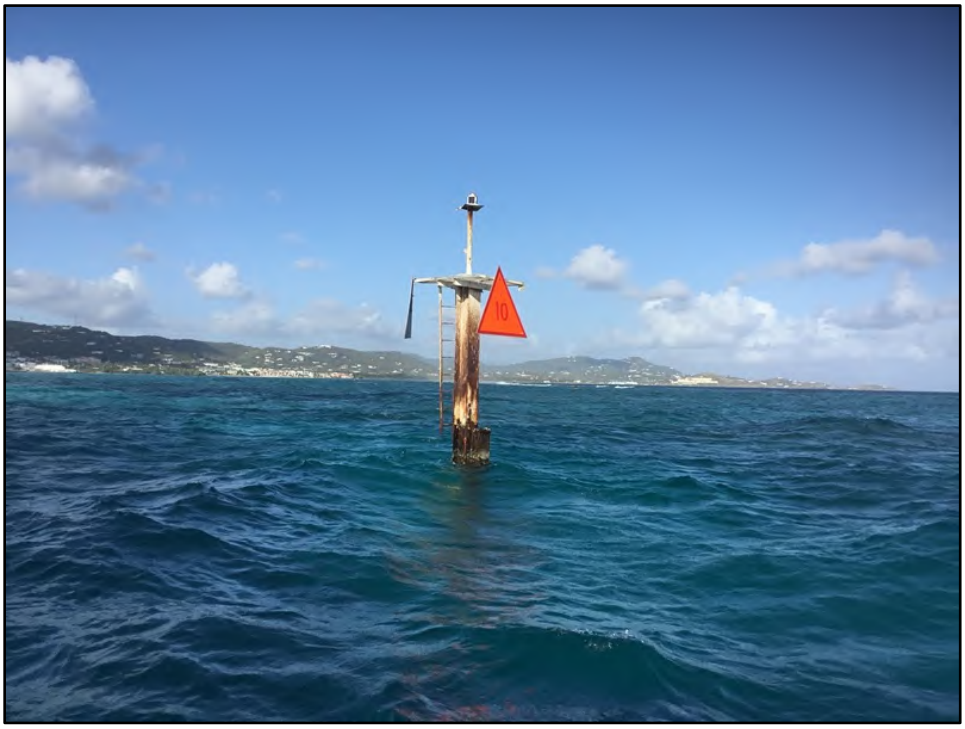

Photo 3: existing Christiansted Harbor Channel Light 10

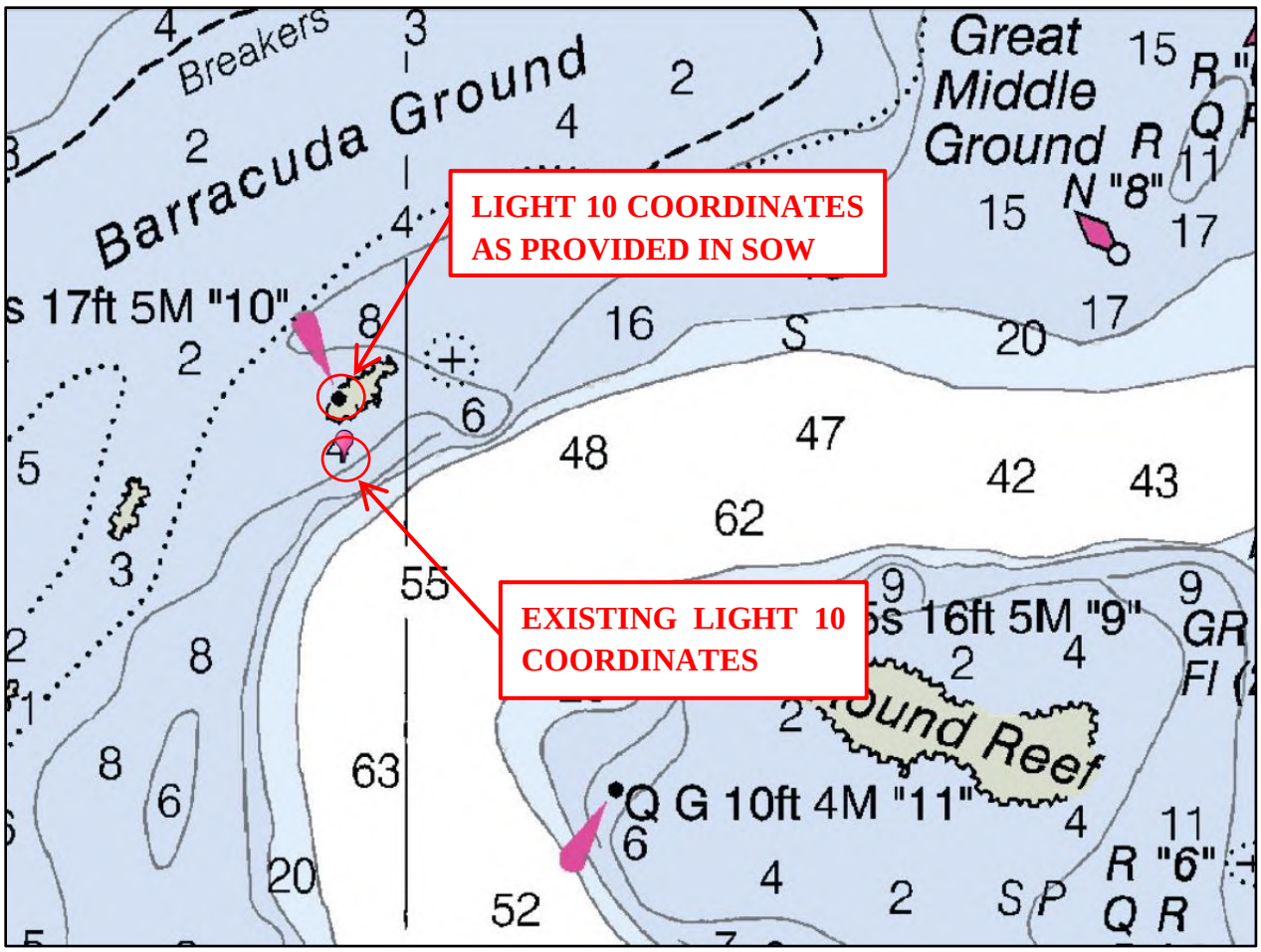

Figure 3 – NOAA Chart 25645 with existing and SOW coordinates for Christiansted Harbor Channel Light 10

2.4 CHRISTIANSTED HARBOR CHANNEL LIGHT 11 (LLNR 32920)

Christiansted Harbor Channel Light 11 consists of four battered steel H-piles and one centered plumb steel H-pile. Welded steel bracing connects the top of the piles together. The steel H-piles are 12 in. by 12 in. in cross section and approximately 3/8 in. thick. The entire structure has widespread severe corrosion. The ladder, platform, and light have fallen off and are located on the seafloor near the structure's base.

The water depth around the light is approximately 12 ft with a reef bottom. In the vicinity around the base, there are remnants of what appears to be at least two prior structures, consisting of cutoff pile stubs and debris including a battery and the old platform. The channel near the base of the structure drops off to a depth of about 20 ft.

Refer to Section 2.8 for a description of the electrical utility service for the light.

Photo 4: existing Christiansted Harbor Channel Light 11

2.5 CHRISTIANSTED HARBOR CHANNEL LIGHT 13 (LLNR 32930)

Christiansted Harbor Channel Light 13 consists of one plumb steel H-pile with a platform, light and ladder. The steel H-pile is 12 in. by 12 in. in cross section and approximately 3/8 in. thick. The pile has severe corrosion and the bottom ladder connection has advanced corrosion in the splash zone.

The water depth around the light is approximately 19 ft. The seafloor in the vicinity of the structure is sand and seagrass with no significant debris.

Refer to Section 2.8 for a description of the electrical utility service for the light.

Photo 5: existing Christiansted Harbor Channel Light 13

2.6 CHRISTIANSTED HARBOR CHANNEL DAYBEACON 16 (LLNR 32945)

Christiansted Harbor Channel Daybeacon 16 consists of one plumb steel H-pile. The steel H-pile is 12 in. by 12 in. in cross section and approximately 3/8 in. thick with severe corrosion.

The water depth around the light is approximately 6 ft. The seafloor in the vicinity of the structure consists of sand, small stones, and seagrass. There are four utility cables wrapped around the base of the structure running in an inshore-offshore direction.

The seafloor at the proposed location for the new structure is 19 ft deep with sand and eelgrass and no significant debris identified at the time of inspection.

Refer to Section 2.8 for a description of the electrical utility service for the light.

Photo 6: existing Christiansted Harbor Channel Daybeacon 16

2.7 COAKLEY BAY LIGHT 1 (LLNR 33055)

Coakley Bay Light 1 consists of one plumb steel H-pile. The steel H-pile is 12 in. by 12 in. in cross section and approximately 3/8 in. thick with severe corrosion. The ladder, platform, and light have fallen off and are located on the seafloor near the structure's base.

The water depth around the light is approximately 18 ft. The seafloor in the vicinity of the structure consists of sand and seagrass. The reef edge is approximately 6 ft to the east of the base of the structure and runs in a northeast-southwest direction.

The existing Light 1 position is approximately 1800 ft east of the coordinates provided in the SOW. The approximate coordinates of Light 1 taken by GPS during the site visit are 17° 45' 58.68"N, 64° 38' 22.02"W.

Refer to Section 2.8 for a description of the electrical utility service for the light.

Photo 7: existing Coakley Bay Light 1

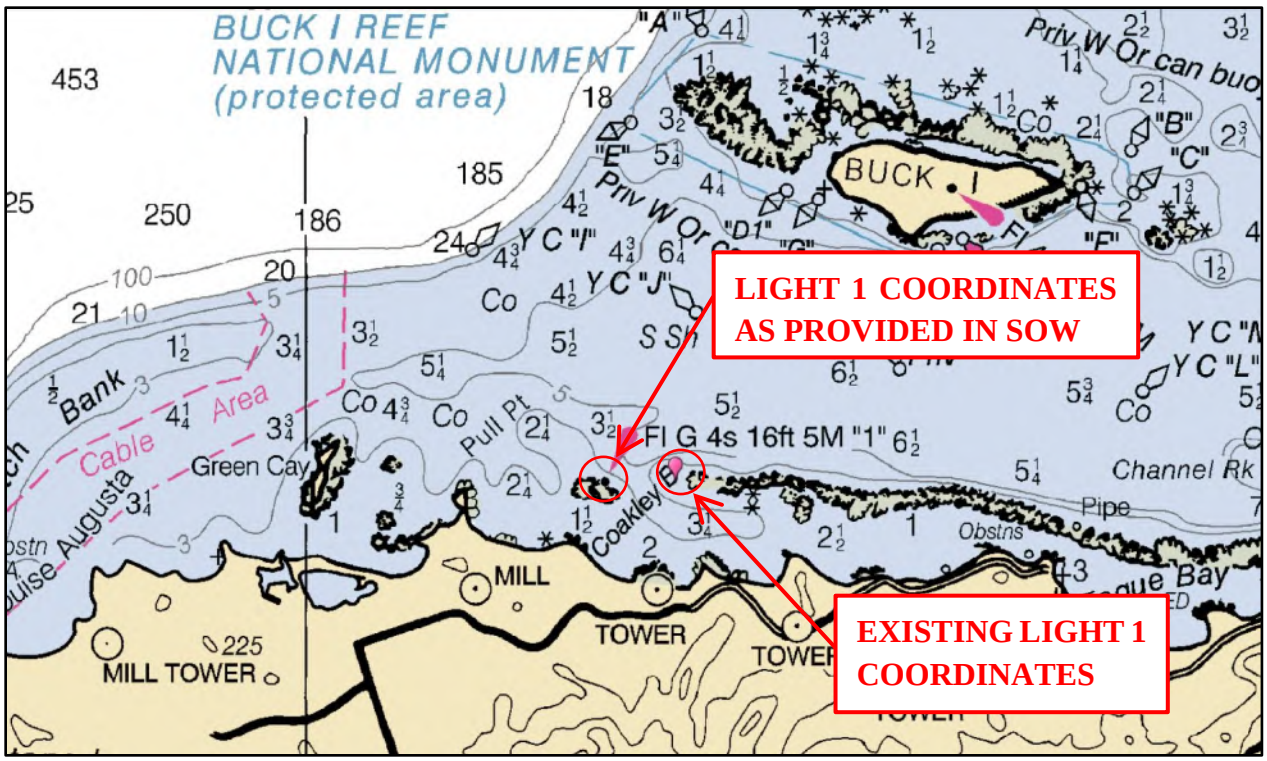

Figure 4 – NOAA Chart 25641 with existing and SOW coordinates for Coakley Bay Light 1

2.8 EXISTING UTILITIES

Christiansted Harbor Channel Light 10 and 13 are the only two structures that currently have lights. The solar lights on both structures are in overall satisfactory condition with minor corrosion on the light stands. The lights for the remaining aids were typically found on the seafloor near the base of each structure.

Photo 8: Existing Solar Powered Light on Christiansted Harbor Channel Light 10

Photo 9: Existing Solar Powered Light on Christiansted Harbor Channel Light 13

3.0 OPERATIONAL CRITERIA/REQUIREMENTS

The seven new structures will be located in the same positions with the exception of the Christiansted Harbor Channel Daybeacon 16. The proposed latitude and longitude coordinates for Christiansted Harbor Channel Daybeacon 16 is provided in Table 3 below. A map of the proposed location in comparison to the existing location is provided on figure 5.

Structure	Latitude	Longitude
Christiansted Harbor Channel Daybeacon 16	17° 44' 51.200"N	064° 42' 03.900"W

Table 3 – Christiansted Harbor Channel Daybeacon 16 coordinates

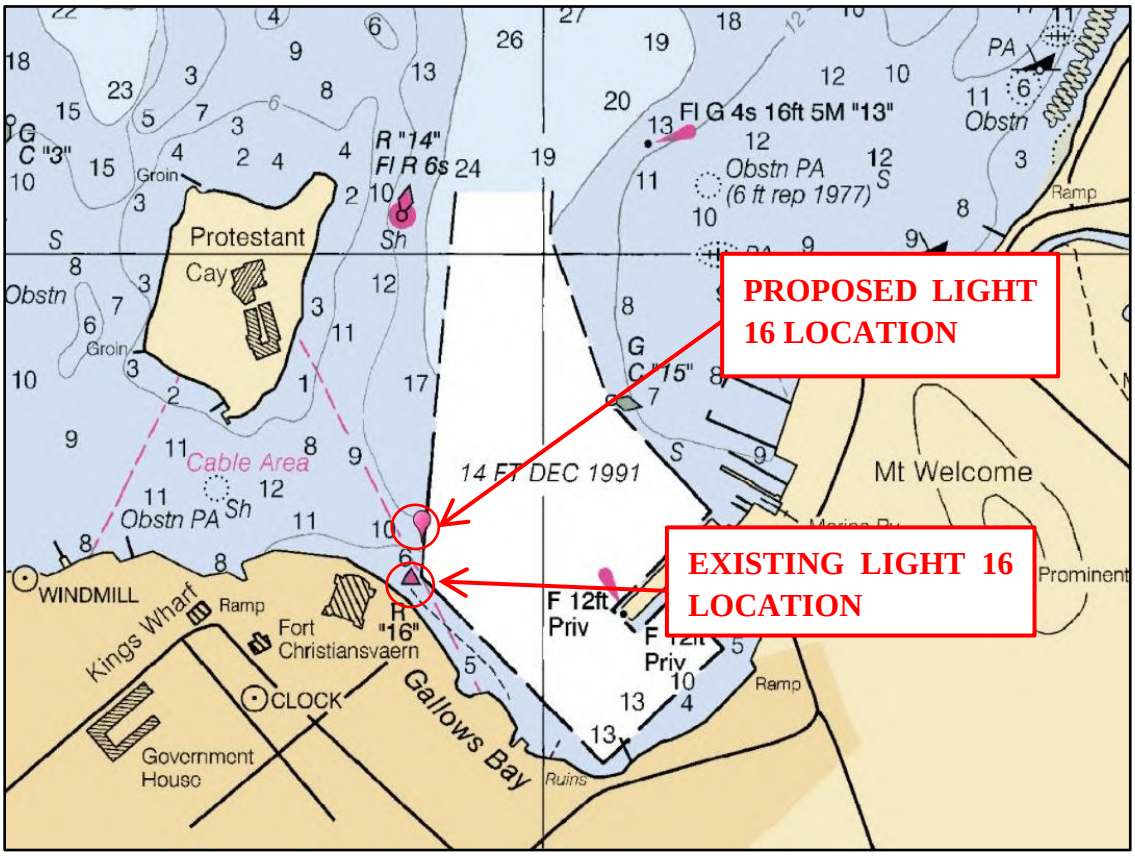

Figure 5 – NOAA Chart 25645 with existing and proposed locations of Christiansted Harbor Channel Daybeacon 16

Christiansted Harbor Daybeacon 16 is anticipated to be single driven H-pile with a fiberglass jacket. The remaining six structures are anticipated to be tripod type construction, with shop fabricated pile jacket systems that will also serve as pile driving templates during construction. Any structural steel submerged or exposed to ocean spray will have protective coating. A cathodic protection system will be used on the submerged steel piles.

Each light tower will have a platform atop of it that will be no less than 25 square feet, with a minimum 2 ft of working space around the lantern stand. The platforms will have an OSHA approved railing system so technicians can move about the deck without a fall restraint device.

All seven structures will comply with API Recommended Practice 2A-WSD for Category L-3 structures and be designed to nominal API 2MET 100-year wave return period. All structures will also be designed to API 2MET 100-yr wind return period or ASCE Standard 7-16, Minimum Design Loads for Buildings and Other Structures (Risk Category III).

All seven structures will be designed for a 50-year service life with minimum to no expected maintenance. As such, consideration will be given to maximize the incorporation of composite and corrosion resistant material in the structure design.

Platform structural members will at a minimum meet ASTM standard A36 and be hot-dip galvanized to meet ASTM A123. All structural steel tower fasteners will conform to ASTM A325 and galvanized to ASTM Standard A153.

Each platform will include an optical lantern stand that can accommodate a Vega VRLB-67 LED Lantern at the required focal height. The platforms will also include mounting brackets to accommodate a wooden dayboard on opposite sides of the platform so that each board can be installed in accordance with the requirements of the dayboard specifications included in the Scope of Work and COMDTINST M16500.25A AIDS TO NAVIGATION MANUAL-STRUCTURES. The optical lantern and dayboard mounting brackets will be arranged so that they are easily accessible by maintenance personnel. Table 4 provides the specified focal height and dayboard configuration for each aid.

Structure	Focal Height (ft MHW)	Dayboard Type
Christiansted Harbor Channel Light 7	16	3SG
Christiansted Harbor Channel Light 9	16	3SG
Christiansted Harbor Channel Light 10	17	4TR
Christiansted Harbor Channel Light 11	10	3SG
Christiansted Harbor Channel Light 13	16	3SG
Christiansted Harbor Channel Daybeacon 16	10	4TR
Coakley Bay Light 1	16	3SG

Table 4 – focal height and dayboard configuration for each aid

3.1 ADDITIONAL INFORMATION REQUIRED FOR DESIGN

The following are some items that we are looking to clarify in order to proceed with the design.

3.1.1 Locations of Structures

The existing Christiansted Harbor Channel Light 10 and Coakley Bay Light 1 structure locations do not match those provided in the SOW (see Section 2.3 and 2.7). If Christiansted Harbor Channel Light 10 is to be moved to match the SOW, construction costs may increase as that location is in shallow water (approximately 3 ft) over reef. We would like to confirm whether the locations for the new structures will remain in the same positions as they are currently in, or if they will be moved to match the SOW.

Christiansted Harbor Channel Light 9 and Coakley Bay Light 1 are in close proximity to the reef (see Section 2.2 and 2.9). It is anticipated that construction and mitigation costs can be limited if their target locations can be moved by approximately 10 ft, to keep the footprints of the new structures where the seafloor is sand. We would like to confirm if there is there any flexibility in the target locations of the new structures?

3.1.2 Height of Structures

As per SOW, the focal heights for the proposed light structures are all at least 16 ft, except for Christiansted Harbor Channel Light 11 which is 10 ft. We would like to confirm that the intent is for Light 11 to have a lower focal height than the other structures.

APPENDIX A

Site Investigation Photographs

Photo A1: Platform, ladder and light at base of Light 7

Photo A2: remnants of a fiberglass boat approximately 12 ft long at base of Light 7

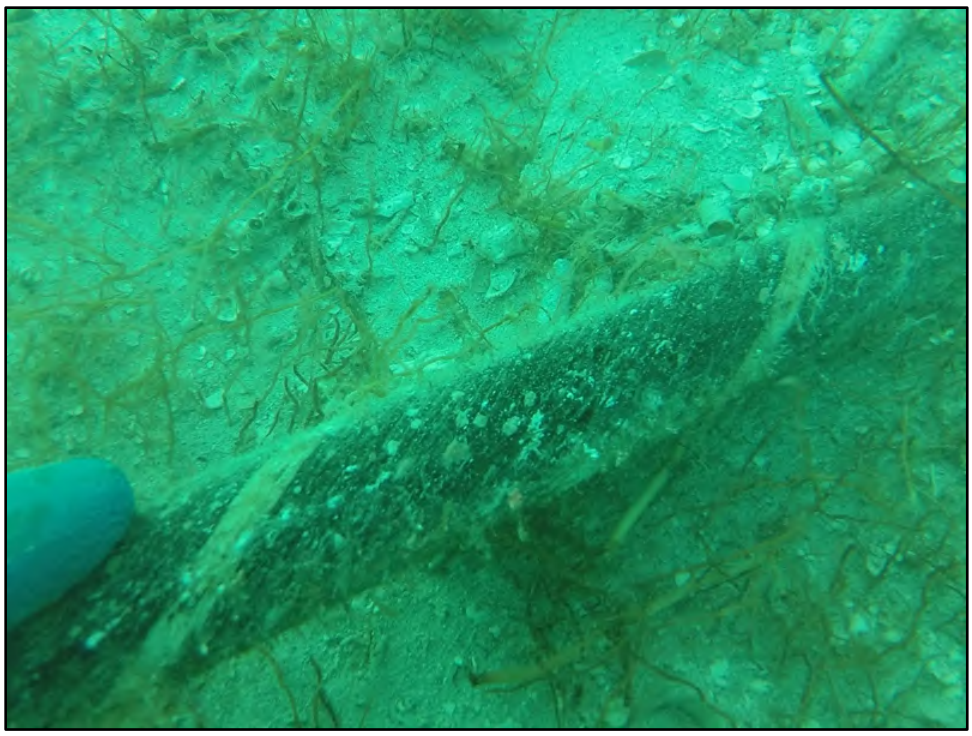

Photo A3: 1.5 in. diameter utility line running in a north-south direction approximately 9 ft to the east of the base of Light 7

Photo A4: sandy bottom at Light 7 with about 2 ft of scour noted around the base of the piles

Photo A5: 10 ft rock cliff adjacent to the east side of the base Light 9 running roughly in a north-south direction

Photo A6: Platform, ladder and light at base of Light 9

Photo A7: Sandy bottom at base of Light 9

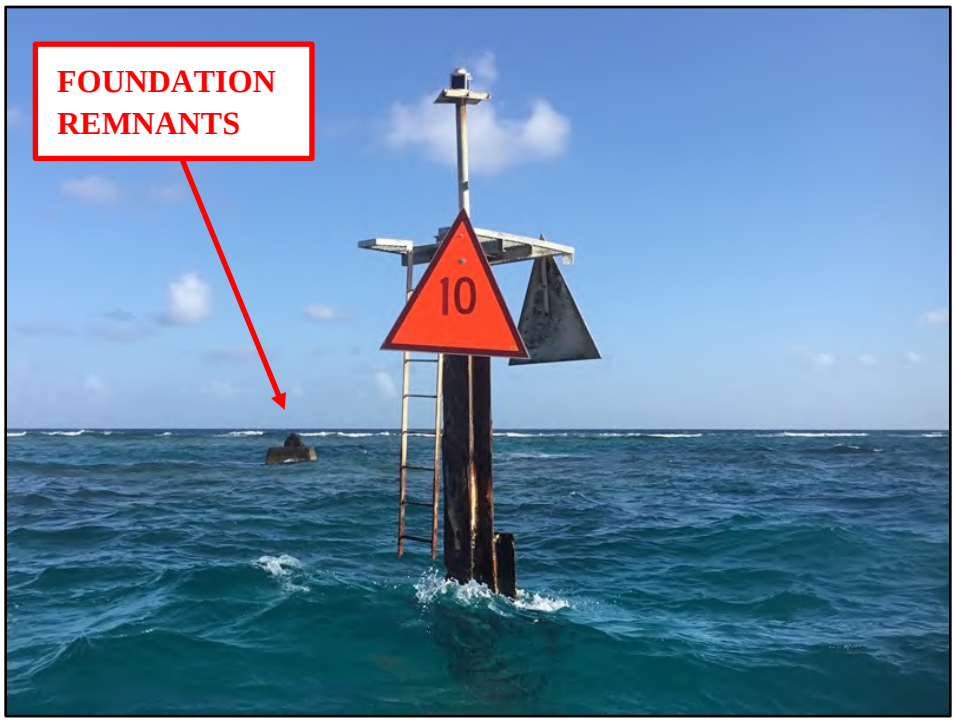

Photo A8: view of existing Light 10 and of old remnants of concrete foundation 130 ft to the north (at coordinates provided in SOW)

Photo A9: Sandy bottom at base of Light 10

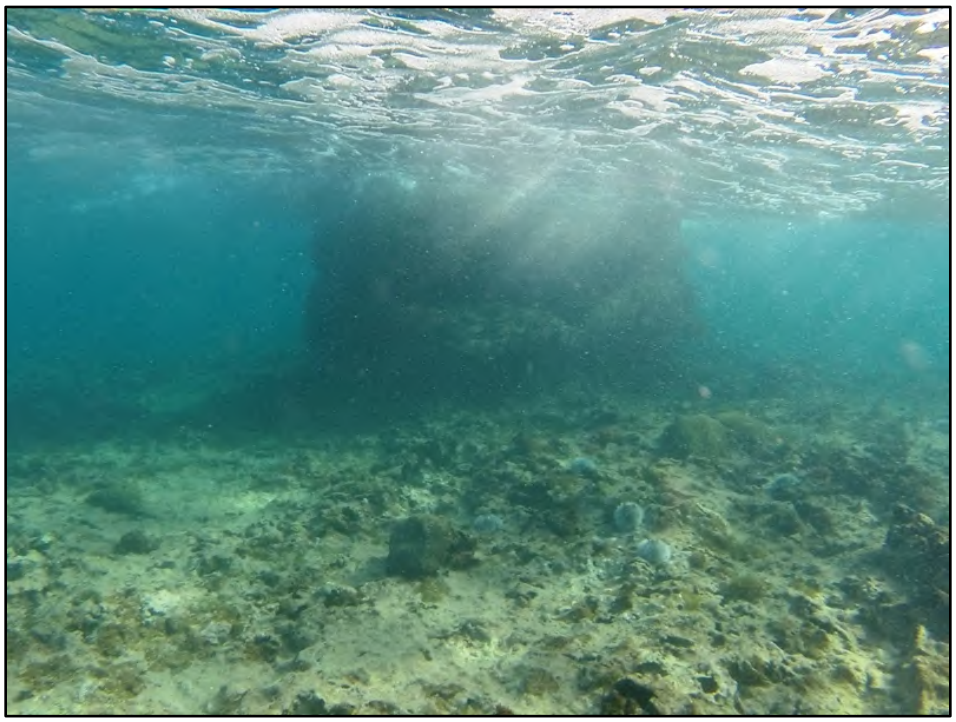

Photo A10: underwater view of remnants of concrete foundation 130 ft north of existing Light 10 (at coordinates provided in the SOW)

Photo A11: reef bottom at base of Light 11

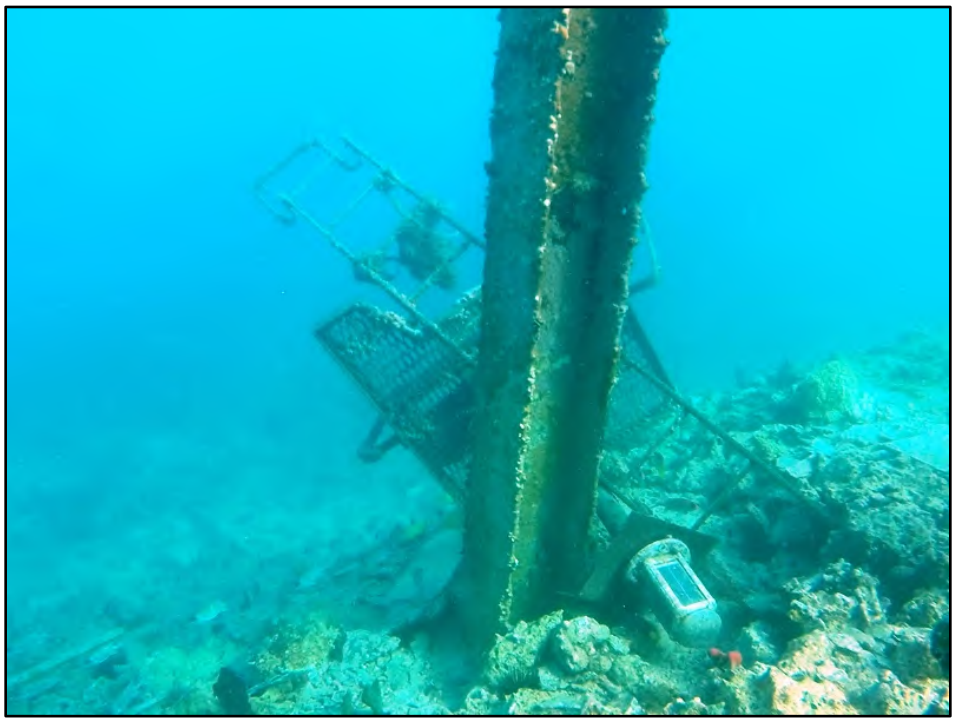

Photo A12: platform, ladder and light on seafloor at the base of Light 11

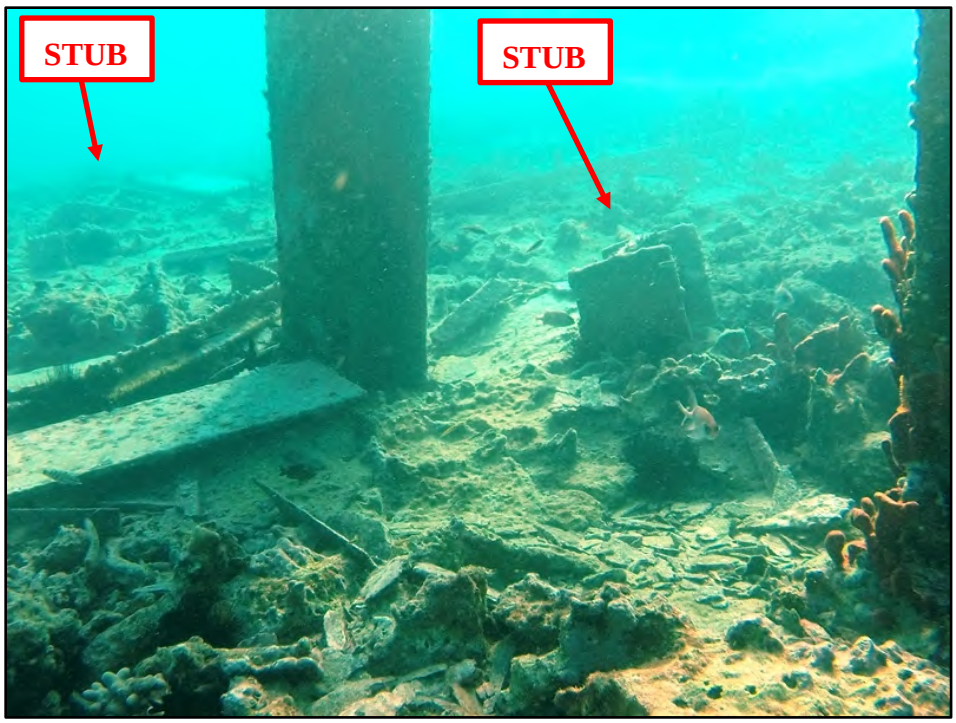

Photo A13: remnants of what appears to be at least two prior structures, consisting of cutoff pile stubs and debris at the base of Light 11

Photo A14: underwater view of channel near the base of the Light 11 that drops off to a depth of about 20 ft

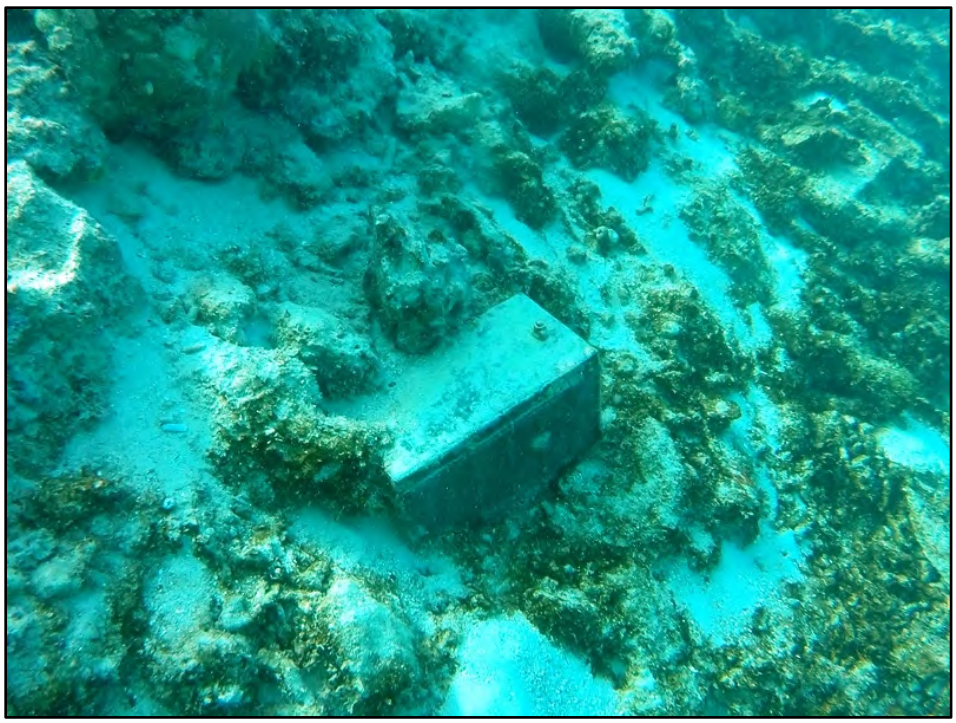

Photo A15: battery on seafloor at base of Light 11

Photo A16: seafloor at base of Light 13 with sand and seagrass

Photo A17: seafloor at Daybeacon 16 with sand, small stones, and seagrass

Photo A18: underwater view of four utility cables wrapped around the base of Daybeacon 16 running in an inshore-offshore direction

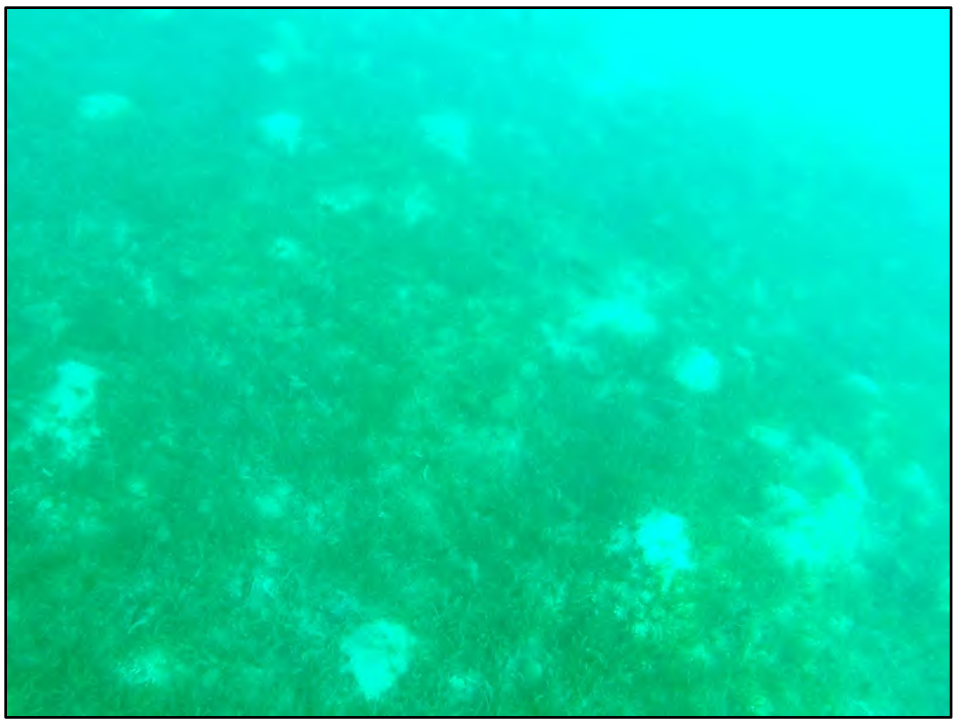

Photo A19: seafloor at proposed location of Daybeacon 16 with sand and seagrass

Photo A20: platform, ladder and light near base of Light 1

Photo A21: seafloor at base of Light 1 with seagrass and nearby reef