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Data Report for the South Shore Industrial Complex – Coastal Marine Environment Baseline Assessment

St. Croix, U.S. Virgin Islands

FINAL | May 2017

prepared for:

The Hovensa Environmental Response Trust

on behalf of:

The Department of Planning and Natural Resources

Government of the United States Virgin Islands

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SECTION 1. INTRODUCTION

As part of the conditions of the sale and transformation of the former Hovensa oil refinery on St. Croix Island in the U.S. Virgin Islands, Hovensa was required to fund a baseline characterization assessment designed to provide information on the current condition of the coastal and nearshore marine environment adjacent to the site. The Hovensa site has been repurposed as an oil terminal and storage facility operated by Limetree Bay Terminals, LLC (SCRG 2016), and is located on the St. Croix South Shore Industrial Complex[1] which also hosts a former alumina manufacturing facility (Century Aluminum Company) and Diageo, which operates a rum distillery that manufactures Captain Morgan products.

Industrial operations, including discharges and accidental spills, at the former oil refinery may have led to the release of contaminants in the nearby environment. Releases into the marine environment have been documented in numerous incident reports. Contaminants documented in marine and groundwater environments at the site include petroleum, methyl-*tertiary*-butyl ether, chromium, nickel, vanadium[2], lead, arsenic, and mercury (Holmes et al. 2012). Previous site assessments are described in Section 6. The results of the baseline characterization assessment will help establish the current condition of the habitats and natural resources in the nearshore marine environment prior to the full-scale operation of the oil terminal facility at the site. This report provides an overview of the study area, a summary of the sampling methodology and data collection efforts, as well as the results of the assessment. Additional details on the assessment, sampling methodology and approach are provided in the *Work Plan for the South Shore Industrial Complex – Coastal Marine Environment St. Croix, U.S. Virgin Islands*, Final June 2016 (herein referred to as the "Work Plan").

1.1 STUDY AREA

The Study Area includes the coastline and marine area adjacent to the South Shore Industrial Complex on the south shore of St. Croix. The Study Area consists of approximately 4,601 acres of nearshore environment, which includes approximately 576 acres of dredged channels and approximately 4,025 acres of benthic habitat. The benthic habitat includes approximately 1,472 acres of submerged aquatic vegetation, 2,415 acres of corals, 49 acres of non-vegetated bottom habitat, and 89 acres of other habitat types

[1] Includes St. Croix Renaissance Group (SCRG) property to the west of the former Hovensa refinery.

[2] Only in groundwater.

(Exhibit 1-1). The coastal habitat surrounding the Study Area includes 540 acres of mangroves. No assessment activities were conducted in the upland areas under the Work Plan and only minimal sampling was conducted in the dredged areas of the turning basins and navigational channels.

1.2 PROJECT OBJECTIVES AND PROBLEM DEFINITION

Characterizing the current condition of the nearshore marine environment within the Study Area will help establish an understanding of the baseline condition of habitats and natural resources prior to operation of the Limetree Bay Terminals as a petroleum storage facility. In the event of a future oil spill or release of hazardous substances at the terminal, data generated as a result of this study may be used to establish the baseline conditions of the natural resources in the area.

The overarching goal of the assessment was to characterize current nearshore marine environmental conditions, by achieving the following specific objectives:

- Characterizing contaminant concentrations in sediment;
- Identifying the spatial extent of any observed contamination;
- Assessing habitat conditions in coral reef, submerged aquatic vegetation, and mangroves;
- Characterizing species diversity and abundance.

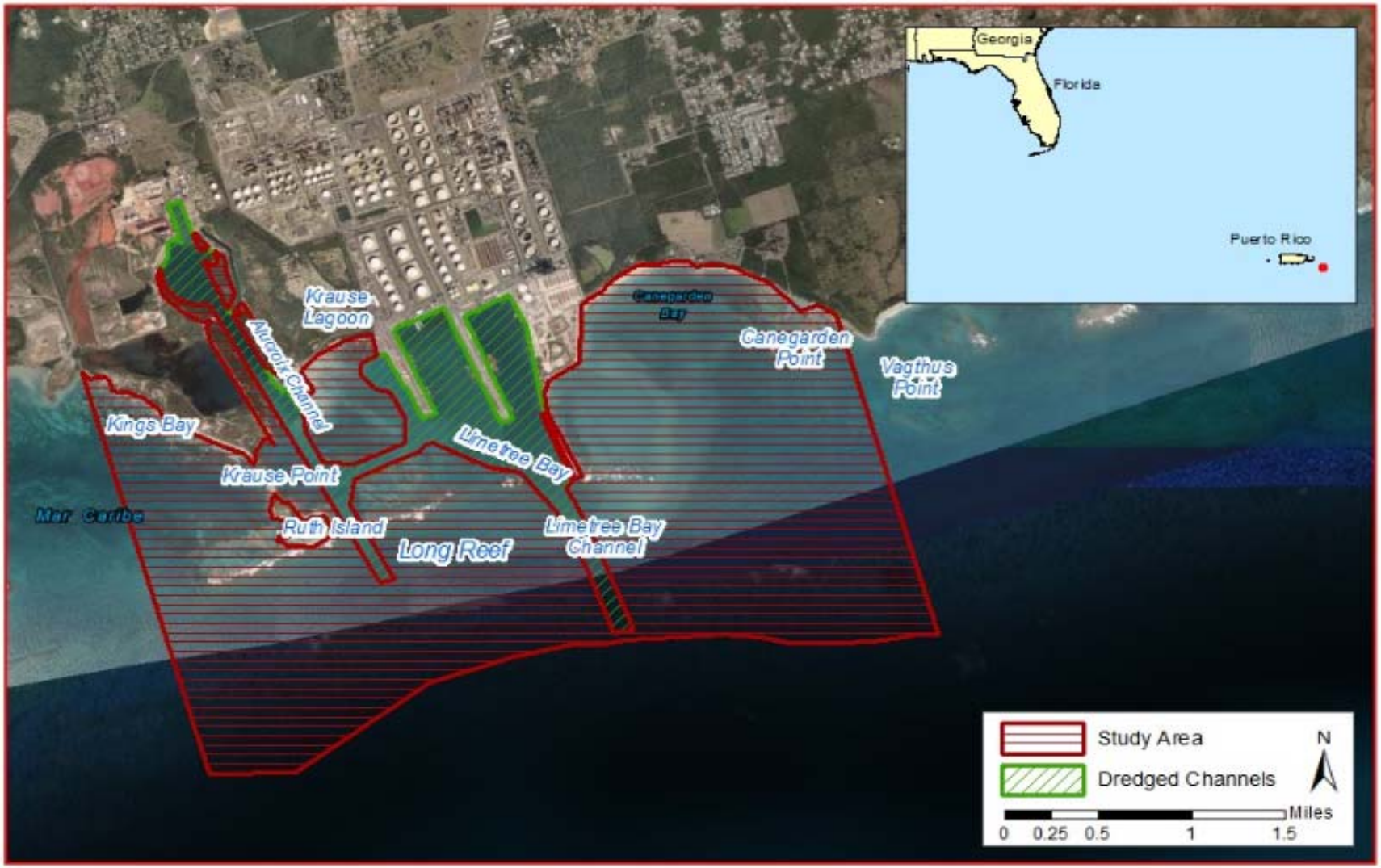
1.3 OVERVIEW OF DATA REPORT

This data report is structured as follows:

- Section 2 provides an overview of the study area and reference sites.
- Section 3 provides a summary of the study design and methodologies. [3]
- Section 4 includes a summary of the data collected.
- Section 5 provides the results and general implications of the data.
- Section 6 provides a summary of other data collected at the site.
- Section 7 includes information on data use and storage.
- Section 8 includes relevant references.

[3] The details regarding the methodology, sampling plan, and quality control/quality assurance plan are provided in the accompanying document: *Work Plan for the South Shore Industrial Complex- Coastal Marine Environment*.

EXHIBIT 1-1. MAP OF STUDY AREA



SECTION 2. OVERVIEW OF ASSESSMENT AREA

The environments studied as part of this assessment were grouped into three primary categories: benthic habitat, mangroves, and dredged channels. Each of these habitat types was assessed within the Study Area; and benthic habitat and mangroves were assessed in the Reference Area. The Reference Area consisted of two sites east of the Study Area, one for mangroves (Great Pond) and one for seagrass and coral (Halfpenny Bay; Exhibit 2-1). There were no dredged channels evaluated in the Reference Area. The benthic habitats included seagrass, non-vegetated, and coral habitats (Exhibit 2-2). Mangroves are included as important shoreline habitat that are directly connected to the marine environment. Lastly, the dredged channels were sampled as a separate part of the marine habitat, since the ecology had been directly altered from dredging when the ship channels and docks were created.

2.1 STUDY AREA DESCRIPTION

The northern boundary of the Study Area is defined by the coastline of the island of St. Croix and the industrial upland areas. The coastline is dominated by sandy shoreline, mangrove habitat, or developed hardscaping. The west boundary of the Study Area is designated as a line perpendicular to the shoreline extrapolated seaward from the property boundary between the South Shore Industrial Complex and the St. Croix landfill and wastewater treatment plant; the east boundary is a line defined in a manner similar to the west boundary but originating near Canegarden Point. The Study Area is bordered to the south by open ocean approximately two miles from the shoreline on the seaward side of the nearshore coral reefs, where ocean depths begin to increase. This area is microtidally influenced with winds from the south-southeast at approximately 6 knots (National Oceanic and Atmospheric Administration [NOAA] Station ID: 9751401). Currents in the area generally run from east to west, but navigational and turning basin dredge channels create more localized flow patterns (Advent 2000).

EXHIBIT 2-1. REFERENCE SITES RELATIVE TO STUDY AREA

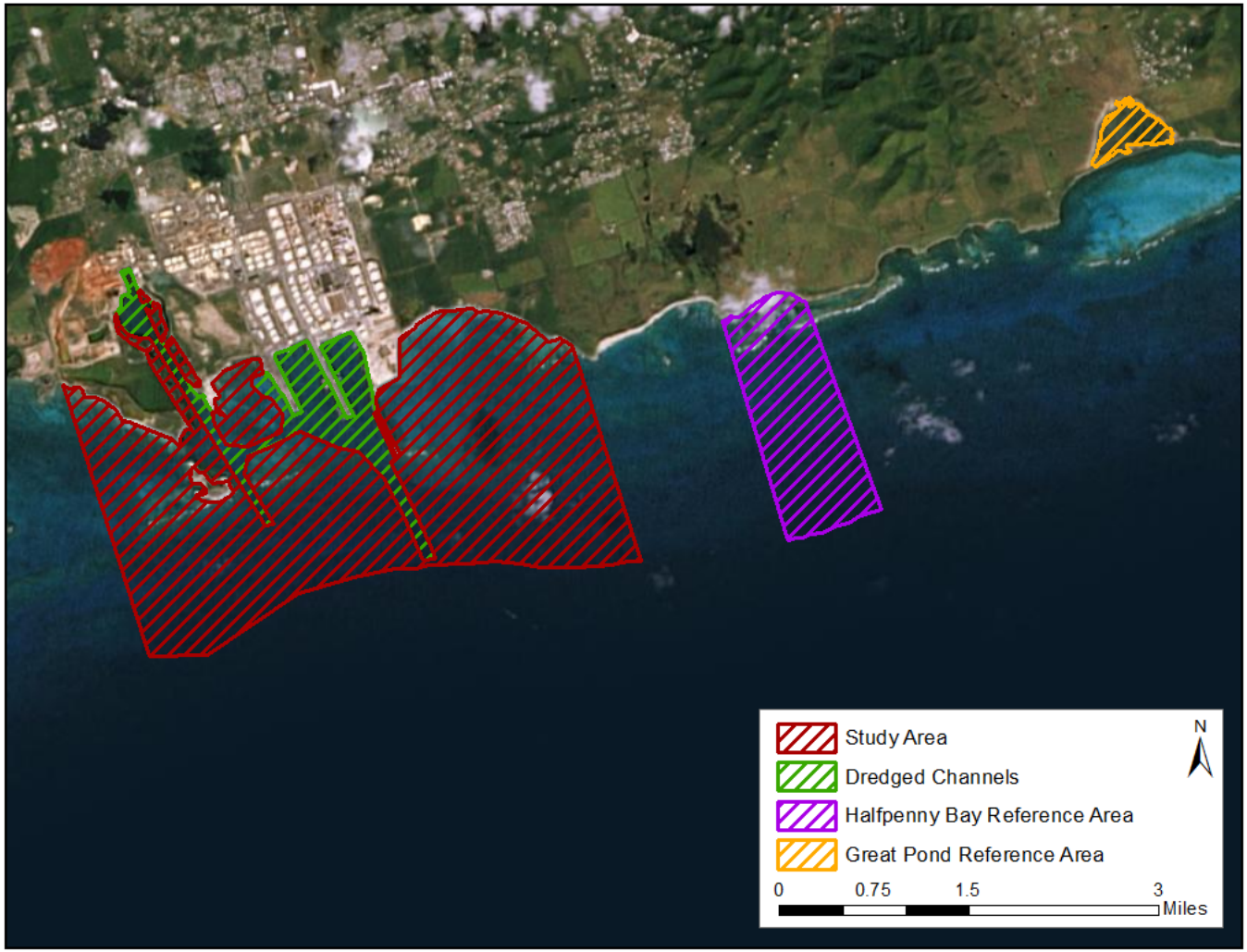
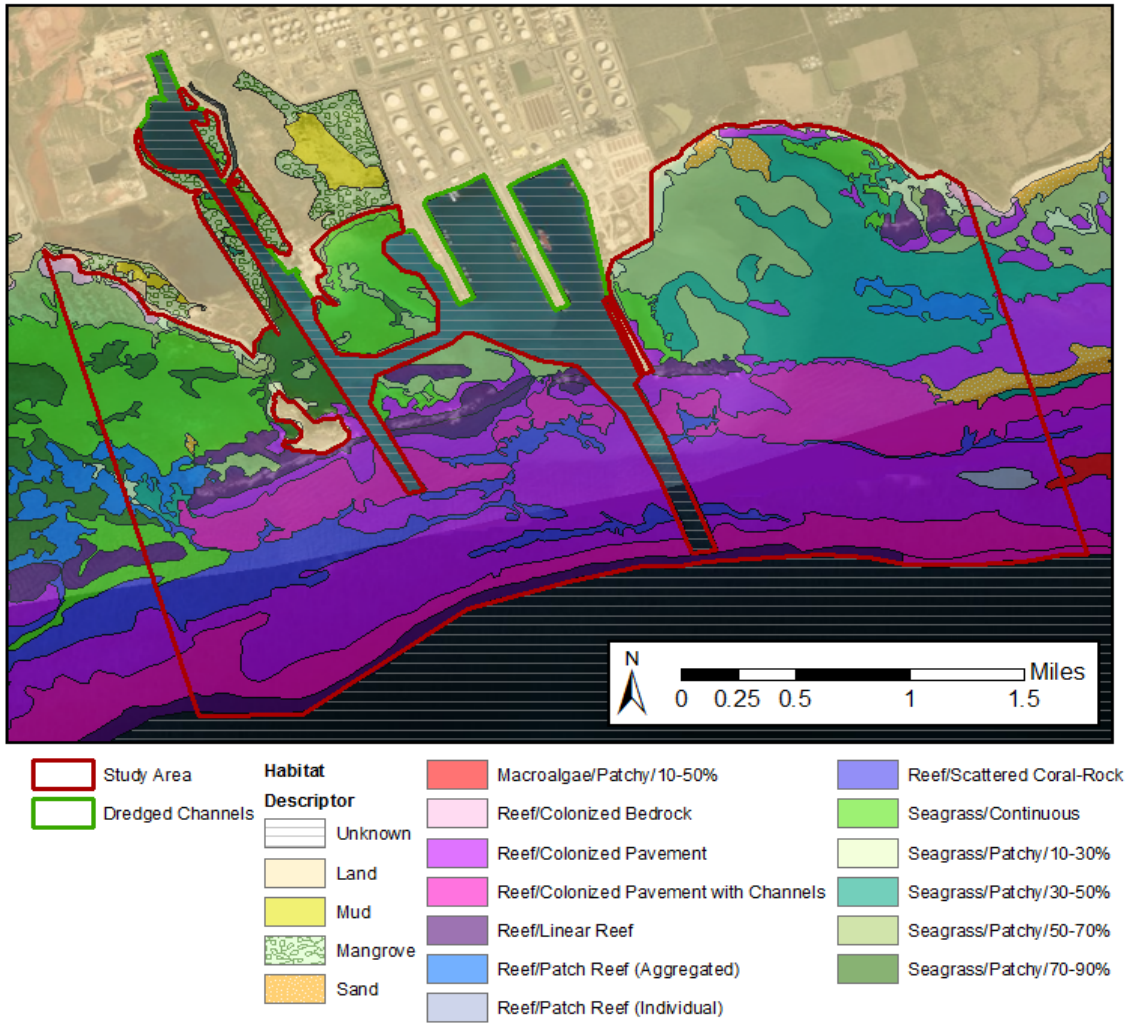


EXHIBIT 2-2. MAP OF STUDY AREA BY HABITAT TYPE



Note: Habitat types illustrated above are identified using NOAA NCCOS 2002.

2.1.1 TARGETED SAMPLING OF BENTHIC HABITAT IN THE STUDY AREA

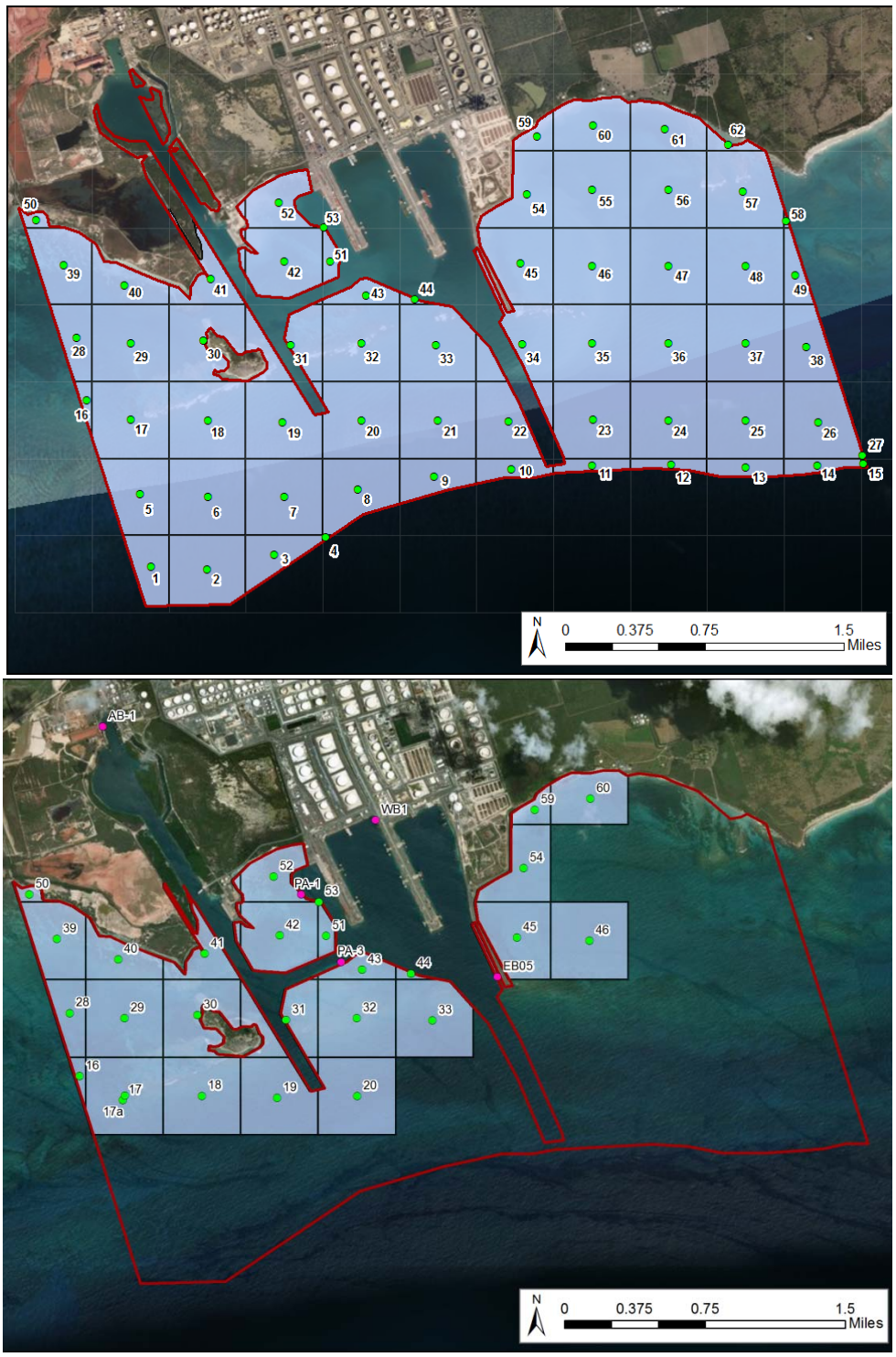
Potential sampling locations for benthic habitat assessment in the Study Area excluded the dredged channel area. Sampling locations were identified by dividing the Study Area into 650 m x 650 m grid cells and assigning a transect start location to the centroid of each cell (Exhibit 2-3). For cells that did not fit completely within the Study Area, the centroid was assigned to the middle of the cell area within the Study Area. The identified habitat, according to the NCCOS habitat layer (NOAA 2002), where the centroid lay (Exhibit 2-2) was the habitat assigned to the cell. The centroid was targeted for sampling and each site was coded based on the grid cell number, followed by the area it was located (SA for Study Area or RS for Reference Site), followed by the habitat type that was identified at the centroid (i.e., NVB for non-vegetated, SAV for submerged aquatic vegetation, and CR for coral reef). A total of 62 grid cells and associated transects were identified (Exhibit 2-3, top); however, a subset of these cells (Exhibit 2-3, bottom) were targeted and evaluated as part of the assessment due to the results of the overview survey (described in Section 2.1.1.1) and feasibility and resource constraints.

2.1.1.1 Overview Survey

To refine the scope of sampling sites evaluated within the Study Area, the team conducted an overview survey to ground truth transect locations and confirm the presence of habitat types as identified by NCCOS. Sites where the centroid of the grid had sparse habitat or was non-vegetated and the NCCOS habitat layer designated the area as seagrasses or corals, were photographed and excluded from further assessment (i.e., no transect selected for that grid cell). The overview survey resulted in the shifting and clustering of target grid cell sites to the north of the fringe reef and in the western half of the Study Area, with fewer sites sampled in Canegarden Bay due to the homogeneity of the habitat.

Specifically, sites seaward of the fringe reef and multiple sites in Canegarden Bay were excluded from evaluation (sites 1-15, 23-27, 35-38, 47-49, and 57-58), reducing the number of sites from 62 to 26 cells targeted for habitat analysis via transect surveys (Exhibit 2-3). However, the final number of transects evaluated was 27, because grid cell 17 was sampled twice due to the habitat and corals found in the vicinity of the centroid.

EXHIBIT 2-3. STUDY AREA ORIGINAL GRID CELLS (TOP) AND TARGETED SITES FOR BENTHIC HABITAT AND SEDIMENT SAMPLING (BOTTOM).



Note: in the bottom figure, green circles are benthic habitat sites, while pink circles are dredged channel sites.

2.1.2 TARGETED SAMPLING OF DREDGED CHANNELS IN THE STUDY AREA

Sampling in the dredged channels targeted locations where sediment samples had been collected and analyzed as part of prior efforts (e.g., previous assessments conducted by Vicente 2012, 2002; Exhibit 2-4). Each site was coded based on the previously assigned site code from the study authors, followed by the area it was located (SA was used for all dredged samples because they are only located in the Study Area), followed by the letter "D" for dredged site.

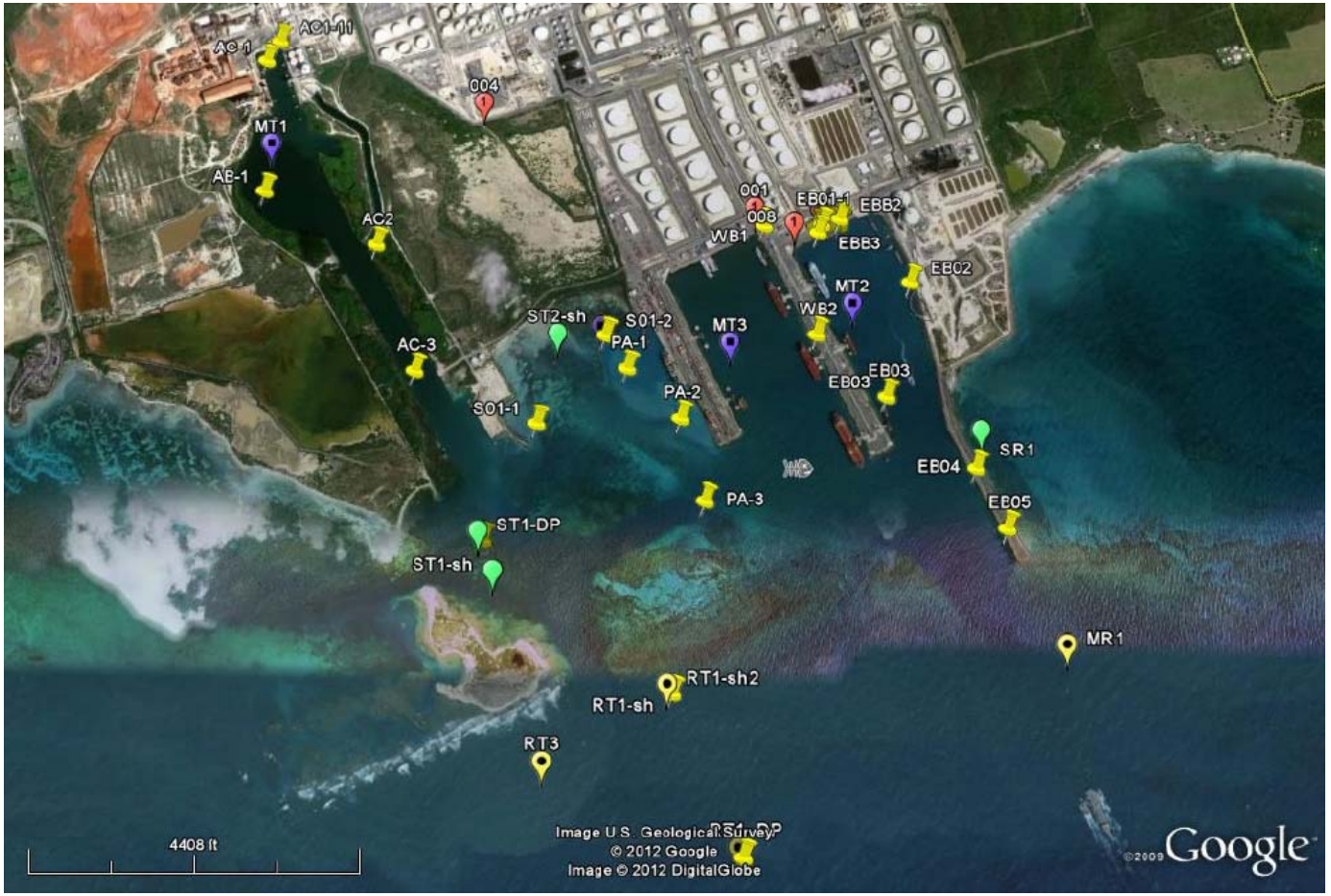
Out of 33 dredge channel sites previously sampled in other assessments, we identified a subset of 13 potential sampling sites, distributed throughout the dredged channels within the Study Area that would portray the range of sediment chemistry throughout the site. The 13 potential dredge sampling sites are noted in Exhibit A-1. Of these 13, five sites were evaluated due to feasibility and logistical concerns (i.e., sampling in dredge sites have to be coordinated with ship traffic). The dredge channel sites were selected to demonstrate the potential diversity in sediment chemistry throughout the Study Area. The five dredge channel sampling sites are displayed as pink circles in the bottom map of Exhibit 2-3 and the GPS coordinates for each site are provided in Exhibit A-1.

2.1.3 TARGETED SAMPLING OF MANGROVES IN THE STUDY AREA

To identify mangrove habitat within the Study Area, we relied on the U.S. Forest Service International Institute of Tropical Forestry's mangrove layer for the U.S. Virgin Islands (Kennaway et al. 2008), the NCCOS habitat layer (NOAA 2002), and on information from local contractors with experience at this site. A total of 34 potential mangrove transects were identified prior to study implementation, by evenly spacing the transects along the perimeter of the Study Area; each transect was 50 m x 10 m (Exhibit 2-5). 16 of the 34 transects were evaluated as part of the assessment, based on proximity to the marine environment (i.e., if the shoreline edge of the transect started in the water) and feasibility.

The 16 transects assessed and associated GPS coordinates are shown in Exhibit 2-6 and Exhibit A-3, respectively. The 16 transects represent approximately three percent of the mangrove forest based on habitat cover layers.

EXHIBIT 2-4. MAP OF VICENTE & ASSOCIATES STATION LOCATIONS (REPRODUCED FROM VICENTE 2012)

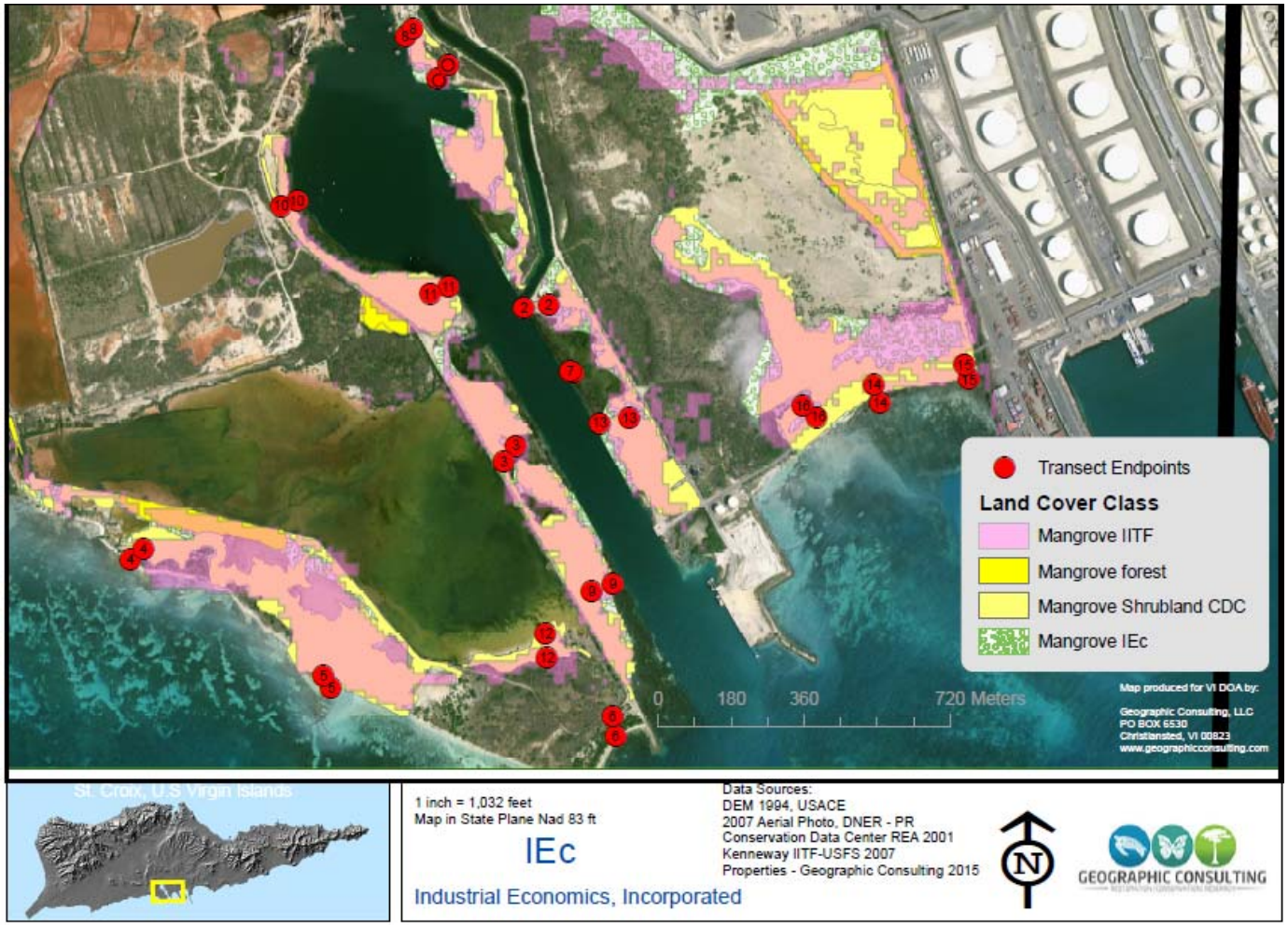


Note: station locations for all Vicente & Associates assessment efforts are displayed in the map above (i.e., 2002, 2003, and 2012). The yellow pins mark the station locations from the 2012 effort, while other colors represent sampling conducted prior to 2012.

EXHIBIT 2-5. POTENTIAL MANGROVE TRANSECTS (50X5 M)

Note: 34 potential mangrove transects are illustrated above, each evenly spaced throughout the study area. 16 of these transects were evaluated as part of the assessment based on proximity to the water and feasibility.

EXHIBIT 2-6. LOCATIONS OF THE START AND END OF THE 16 MANGROVE STUDY AREA TRANSECTS ASSESSED



Note: Figure is adapted from the SCRG Site Report.

2.2 REFERENCE AREA DESCRIPTION

The Reference Area includes benthic habitat and mangroves (Exhibit 2-1). There were no reference sites for dredged channels. Specific locations within the Reference Area were sampled as a control for the current conditions at the site and potential future conditions in the event of an incident. Currents on the south shore predominantly flow east to west, so all of the reference site evaluations and sampling were conducted east of the site along the southern coast of St. Croix. Information on environmental conditions at both the Study Area and Reference Area will allow for any post-incident sampling to inform a before-after-control-impact (BACI) study design, if needed. Such a BACI study design is particularly suited for the evaluation of impacts from events, such as oil spills and chemical releases.

2.2.1 TARGETED SAMPLING OF BENTHIC HABITAT IN THE REFERENCE AREA

We identified Halfpenny Bay, which is located 1.25 miles east of the eastern border of the site, as the reference site for benthic habitat, particularly seagrass and coral habitat (Exhibit 2-7). The Halfpenny Bay reference location encompasses approximately 810 acres of nearshore environment.

There are 15 potential sampling locations in Halfpenny Bay (Exhibit 2-8). Grid cells for this reference site were assigned using the same methods as those for the benthic habitat in the Study Area (described in Section 2.1.1). The habitat characterizations for the grid cells were defined using the NCCOS habitat layer (NOAA 2002). A subset of the identified grid cells (six of the 15 identified locations) were evaluated as part of the assessment based on the results of the overview survey (described in Section 2.1.1.1) and feasibility and resource constraints.

After the Overview Survey, we clustered target sampling locations closer to the shoreline and avoided those in deeper waters, seaward of the fringe reef. The reference sites evaluated as part of the assessment are depicted in Exhibit 2-8.

2.2.2 TARGETED SAMPLING OF MANGROVES IN THE REFERENCE AREA

Great Pond is located on the southeast side of the island, east of the Study Area, and was used as the mangrove reference site. The Great Pond reference site has a perimeter with a linear distance of 3,453 m and covers 100 acres, with a mix of mangrove and other habitat types (Exhibit 2-9).

A total of 20 potential mangrove transects were identified prior to study implementation by evenly spacing transects along the perimeter (~173 m intervals) of the reference site that would result in five percent of the area being sampled (Exhibit 2-9). Only a subset of the transects (10 of the 20 transects identified) were evaluated as part of the assessment based on habitat quality (i.e., sampled transects were concentrated in healthier areas of Great Pond) and feasibility. The transects sampled in the Reference Area mangrove habitat are shown in Exhibit 2-10, with their start and end GPS coordinates listed in Exhibit 9-3.

EXHIBIT 2-7. MAP OF REFERENCE AREA BY HABITAT TYPE

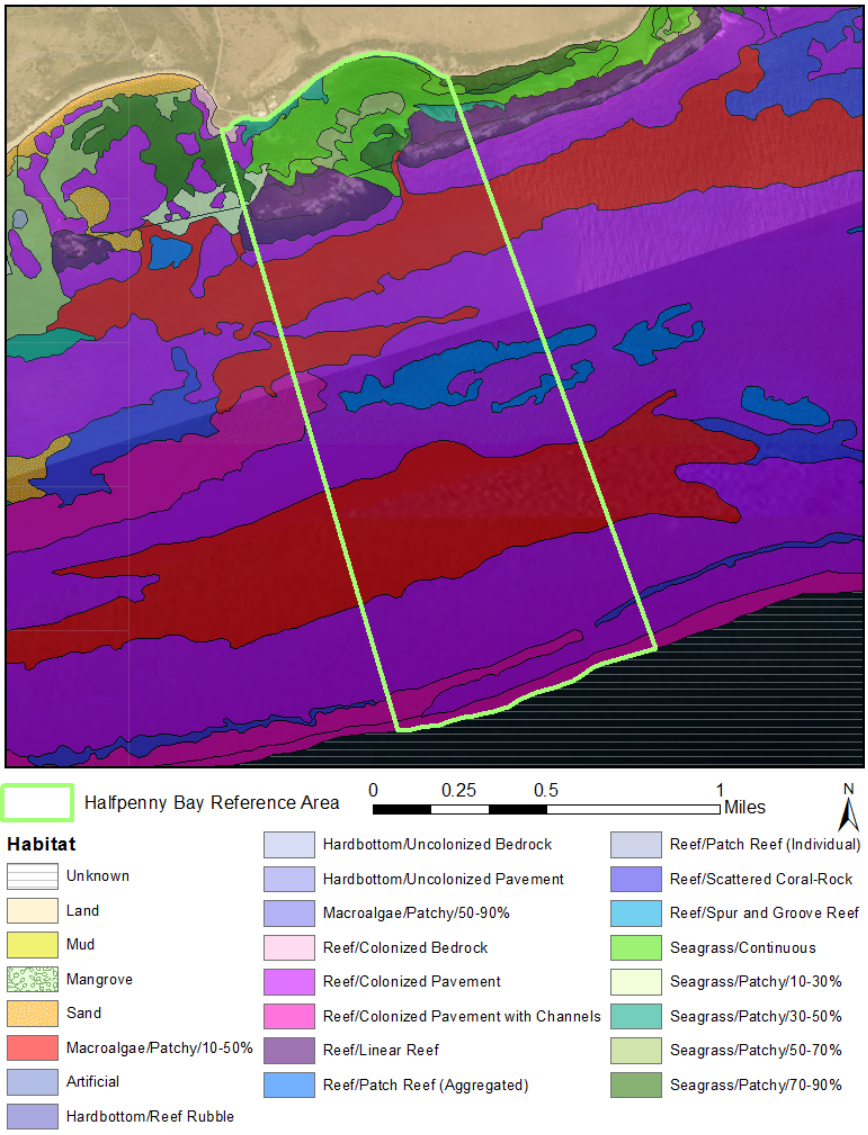
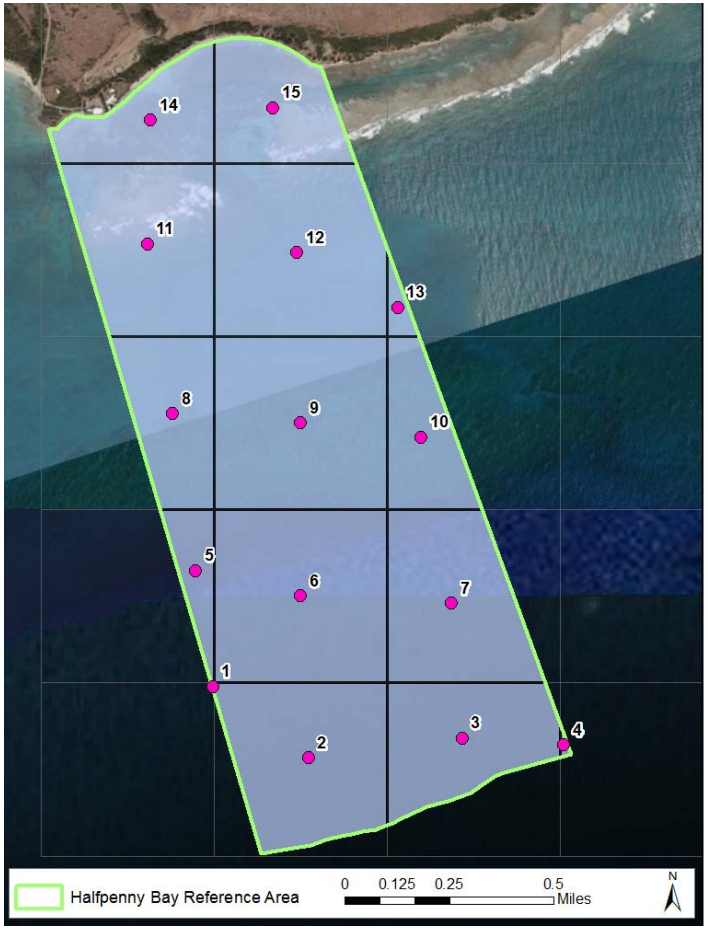


EXHIBIT 2-8. HALFPENNY BAY REFERENCE SITE ORIGINAL GRID CELLS (LEFT) AND TARGETED HABITAT AND SEDIMENT SAMPLING SITES (RIGHT).



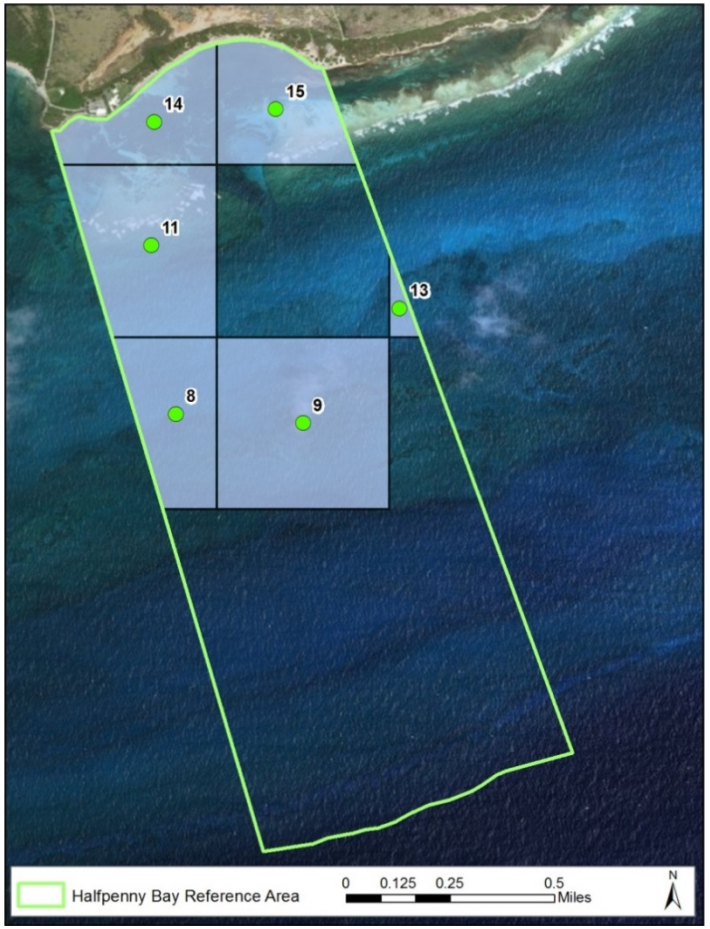
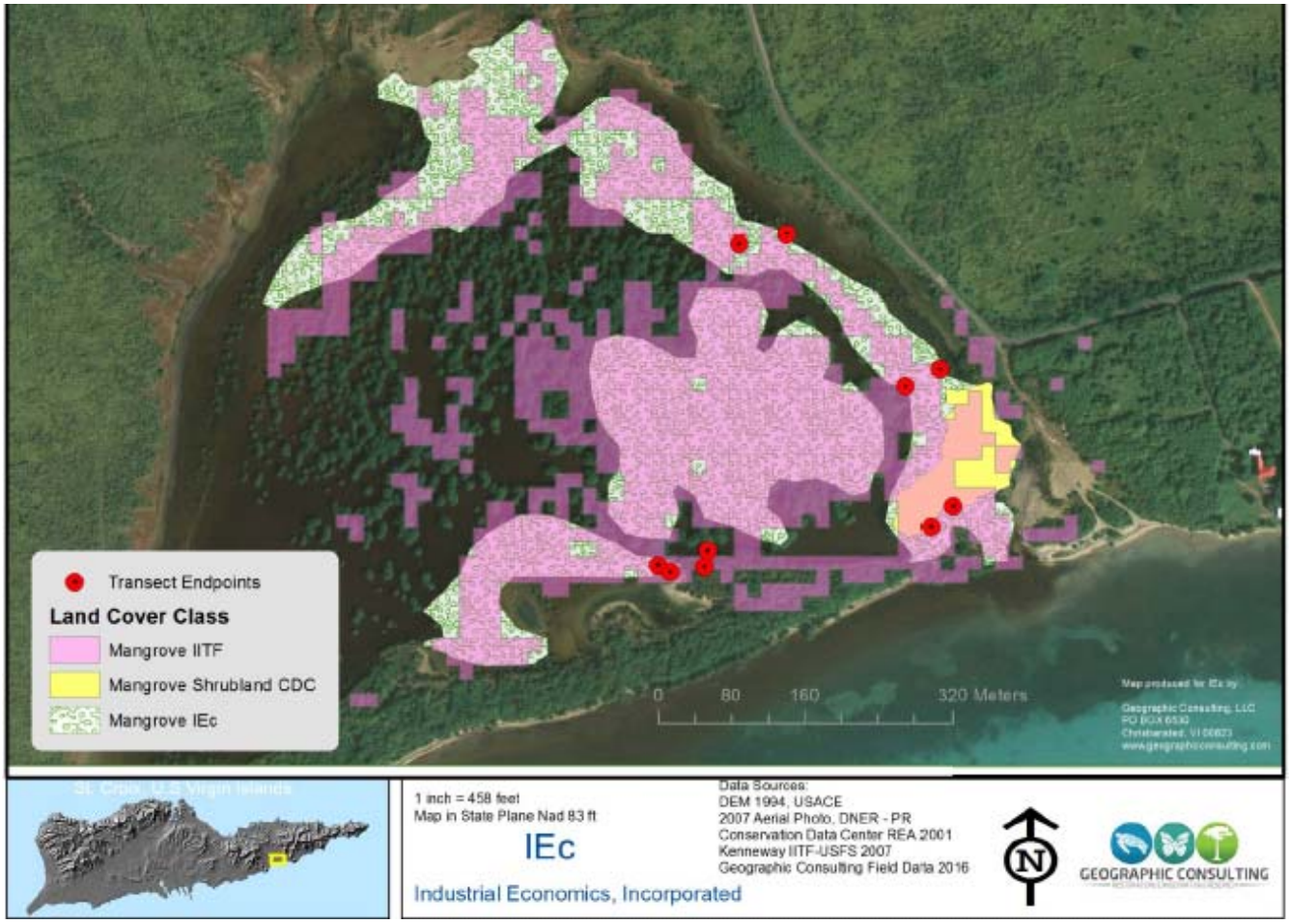


EXHIBIT 2-9. GREAT POND REFERENCE SITE PERIMETER MANGROVE TRANSECT LOCATIONS

EXHIBIT 2-10. GREAT POND REFERENCE SITE HABITAT ASSESSMENT TRANSECTS



Note: Figure is adapted from the Great Pond Reference Site report.

SECTION 3. SAMPLING METHODOLOGY

As noted previously, sampling efforts occurred in mangroves, benthic habitat, and dredged channels. For mangroves and benthic habitat, outside of the dredged channels, samples were collected within the Study Area and Reference Area for comparative purposes. Again, there were no reference sites for dredged channels. The habitats were assessed to evaluate general habitat health, including species abundance and diversity, and flora/fauna health in addition to water quality and sediment chemistry; dredged channels were only assessed for sediment chemistry. These metrics can be used to assess baseline environmental health prior to the full-scale operation of the oil terminal facility.

3.1 HABITAT SAMPLING AND ASSESSMENT METHODS

Sampling and assessment efforts were conducted within the Study Area and Reference Area using a variety of techniques. Both observational and contaminant chemistry data were collected. Observational data was collected for mangrove, submerged aquatic vegetation (SAV or seagrass), coral reef, and sediment/non-vegetated habitats; and, sediment samples were collected for contaminant chemistry analysis. The mangrove and benthic habitats were assessed along a series of transects. For dredged sites, only sediment samples were collected for chemical analyses along with water quality data, but no habitat transects were conducted. Data collection methods varied depending on habitat type and are summarized below. Additional sampling details are provided in the Work Plan.

3.1.1 BENTHIC HABITAT SAMPLING METHODS

Benthic habitat was assessed for habitat, fish abundance and diversity, water quality, and sediment chemistry. The total number of habitat transects assessed and sediment samples taken are listed in Exhibit 3-1. The table that was provided to the field team displaying target transects, site habitat designations, potential sampling days, sediment sampling, and bearings is provided in Exhibit A-4.

Submerged aquatic vegetation, non-vegetated bottoms (areas between patchy habitat), and coral reef were assessed in the Study Area and at the Halfpenny Bay reference site using the Line Point-Intercept (LPI) methods specified by the National Coral Reef Monitoring Program (NCRMP 2015, 2016). Briefly, LPI methods enable data to be collected every 15 cm along 15 m transects (100 data points detailing substrate, habitat type, species, and one photo; for more details please refer to the Work Plan). The bearing of each transect was determined randomly using a random number generator in Excel. Random numbers were generated between 1 and 360 corresponding to the directional degrees, with 360 degrees corresponding to due north, 90 degrees corresponding to due east, etc. Transect directions could be adjusted in the field based on expert opinion for health and safety or habitat

characterization purposes. All the site GPS coordinates, transect directions, and actual sites sampled are listed in Exhibit A-2[4].

The types of data collected during benthic transects included water quality information (Section 3.2), GPS coordinates, fish species, sediment samples, depth, rugosity, relief, and fish and invertebrate survey information. Fish and invertebrate surveys were conducted along each transect in SAV, coral, and non-vegetated benthic habitats.

EXHIBIT 3-1. NUMBER OF TRANSECTS ASSESSED BY AREA AND HABITAT TYPE

SAMPLING AREA AND HABITAT	NUBMER OF SITES VISITED	NUMBER OF HABITAT TRANSECTS ASSESSED	NUMBER OF SEDIMENT SAMPLES TAKEN	SITES WITH WATER QUALITY MEASUREMENTS TAKEN
Study Area- Seagrass and Non-vegetated	19	19	18	19
Study Area- Coral	8	8	8	8
Study Area- Mangrove	16	16	0	0
Study Area- Dredged Channels	5	0	5	5
Reference Site-Halfpenny Bay Seagrass	2	2	1	2
Reference Site-Halfpenny Bay Coral	4	4	4	4
Reference Site- Great Pond mangroves	5	5	0	0

3.1.2 DREDGED CHANNEL SAMPLING METHODS

Sediment samples and water quality data were collected in dredged areas (Section 3.2 and 3.3). The number of sites visited and the number of sediment samples taken are listed in Exhibit 3-1. Photographs of the sites were also collected during dredge channel sampling (Section 3.2).

3.1.3 MANGROVE SAMPLING METHODS

Mangroves were assessed for habitat health via transect surveys. Briefly, transects were oriented perpendicular to the water and were up to 50 m long (5 m in width), or to the edge of the mangrove forest (additional sampling details may be found in the Work Plan). The types of data collected during mangrove transect surveys included average tree height, tree crown diameter, diameter at breast height, tree health, number of stems,

[4] Sites are identified via unique site labels (i.e., site ID's). The site ID is the site number (according to grid cell on the original maps), the acronym for the Study Area (SA) or Reference Site (RS) and the habitat type acronym for coral reef (CR), non-vegetated bottom (NVB), submerged aquatic vegetation (SAV), or dredged channel (D). The dredged channel sampling locations use a slightly different code; instead of a cell number first, they use the site code they were given in prior studies (e.g., Vicente 2012).

species, number of seedlings, canopy cover, and health of seedlings. The number of mangrove sites visited in the Study and Reference Areas are listed in Exhibit 3-1.

3.2 WATER QUALITY

Water quality data were collected at each benthic site (habitat and dredged channels). Metrics collected include GPS coordinates, depth, temperature, dissolved oxygen, pH and salinity. Water quality measurements were taken at 38 sites (five dredge channel locations, six reference sites in Halfpenny Bay, and 27 sites in the Study Area).

3.3 SEDIMENT SAMPLES

Sediment samples were collected along benthic transects and in targeted dredge sites and analyzed for the presence of contaminants. Targets for contaminant chemistry analysis include polycyclic aromatic hydrocarbons (PAHs); total petroleum hydrocarbons (TPH; measured as individual alkanes and isoprenoids and total extractable matter: C9-C44); benzene, toluene, ethylbenzene, and xylene (BTEX); biomarkers; and a standard suite of metals, including arsenic, cadmium, chromium, copper, lead, nickel, zinc, and mercury.

Sediment samples were taken from subtidal non-vegetated substrate areas. Composite samples were analyzed for PAHs, TPH, biomarkers, ICP metals, and mercury. Each composite sediment sample was comprised of two separate samples taken from within one meter of each other and composited in the laboratory. A separate (non-composited) sediment sample was taken at designated locations for BTEX. These volatile samples were collected adjacent to composite samples, but only at a fraction of the sampling locations (17 at benthic habitat sites and five at all dredge channel sediment sampling sites; see Exhibit A-1 and Exhibit A-2). Composite samples were collected opportunistically along transects where soft sediment was encountered. The analytes and the methods used for chemical analysis are provided in Exhibit 3-2.

EXHIBIT 3-2. ANALYTES AND ANALYTICAL METHODS FOR SEDIMENT SAMPLES AND RINSATE BLANKS

MATRIX	ANALYTE	PREPARATION METHOD	ANALYTICAL METHOD
Sediment, Water	Mercury	EPA 7474	7474
Sediment	ICP Metals	6020A	EPA 3050B
Water	ICP Metals	6020A	EPA 3020A
Sediment	PAH	Shaker Table Extraction (Lab SOP; SOP 2261 Rev. 5	Alkylated Polynuclear Aromatic Hydrocarbons; 8270M; SOP 2247 Rev. 9
Water	PAH	Organic Prep Separatory Funnel; 351; SOP 2165 Rev. 13	Alkylated Polynuclear Aromatic Hydrocarbons; 8270M; SOP 2247 Rev. 9
Sediment	TPH	Shaker Table Extraction (Lab SOP; SOP 2261 Rev. 5	Total Saturated Hydrocarbons by GC/FID; 8015M; SOP 2246 Rev. 7

MATRIX	ANALYTE	PREPARATION METHOD	ANALYTICAL METHOD
Water	TPH	Organic Prep Separatory Funnel; 351; SOP 2165 Rev. 13	Total Saturated Hydrocarbons by GC/FID; 8015M; SOP 2246 Rev. 7
Sediment, Water	BTEX	PIANO Volatile Hydrocarbons by GC/MS; 8260B; SOP 2255 Rev. 4	PIANO Volatile Hydrocarbons by GC/MS; 8260B; SOP 2255 Rev. 4
Sediment	Biomarkers	Shaker Table Extraction; Lab SOP; SOP 2261 Rev. 5	Alkylated Polynuclear Aromatic Hydrocarbons; 8270M; SOP 2247 Rev. 9
Water	TOC	9060A	9060A

A total of 36 composite samples were analyzed for PAH, TPH, metals, and mercury, and 22 sediment samples were analyzed for BTEX. Five samples were taken in the dredged areas; 26 in the Study Area across SAV and coral habitats; and five samples in the Halfpenny Bay Reference Site (Exhibit 3-1).

Biomarker analysis was conducted on specified samples after preliminary sediment chemistry data were analyzed for PAH concentrations. We identified samples for biomarker analysis by summing all individual PAH compounds that were identified above the detection limit; these PAHs were summed for each site to produce a ∑PAH value. ∑PAH values across all sites were compared to select sites for biomarker analysis. The sites selected for biomarker analysis were those with ∑PAH values higher than 6 µg/kg and two reference sites with relatively higher ∑PAH values. The resulting 13 samples were submitted for biomarker analysis: 41-SA-SAV, 52-SA-SAV, PA-3-SA-D, PAI-SA-D, 42-SA-SAV, 29-SA-SAV, 53-SA-NVB, EB05-SA-D, WBI-SA-D, ABI-SA-D, 28-SA-SAV, 13-RS-CR, and 15-RS-SAV. These results can be used for comparison with other data to identify sources of PAHs.

3.4 RINSATE BLANKS

Deionized (DI) water was provided by Limetree Bay Terminals DI system. Two sets of rinsate blanks were collected. The rinsate blanks were collected when the sediment sampling containers were filled with DI water. The first rinsate blank was collected prior to sampling on 8/16/2016 and the second blank was collected on 8/22/2016. These samples were sent to the analytical laboratory for the same chemical analyses as the sediment samples: mercury, ICP metals, PAH, TPH, BTEX, and TOC. The analytes and the methods used for analysis are listed in Exhibit 3-2. The majority of analytes were not detected in the water samples. Naphthalene was detected in the rinsate blanks at concentrations of approximately 30 ng/L; other lightweight organics (e.g., toluene) were also detected. However, these concentrations are below levels of concern for cross-contamination of sediment sampling. No correction was made based on concentrations in the rinsate blanks.

SECTION 4. DATA COLLECTED AND PROVIDED

This section includes all of the data collected during this baseline assessment. This section may be used to quickly navigate the metrics sampled, the number and units assessed, and the format and location of those data.

Exhibit 4-1 includes a summary of the types of data collected by habitat and the associated units, along with the file format. Exhibit 4-2 provides the type of data compiled after completion of this baseline assessment by habitat type including the file format, file or folder name (how to find the data), the status of the data (i.e., final product or raw data), a description of the data, and if they are incorporated in the database (described in Section 5).

EXHIBIT 4-1. DATA METRICS COLLECTED BY HABITAT

HABITAT	NUMBER OF TRANSECTS	DATA COLLECTED	UNITS	FILE FORMAT
Mangroves-Great Pond Reference Site -Study Area	5 reference site; 16 study area	Adult tree average height	Feet	Excel
		Adult tree average crown diameter	Feet	
		Adult tree average diameter at breast height	Inches	
		Average adult tree health	1-5 scale (1=excellent; 5=poor)	
		Adult tree average number of stems	Number	
		Species	N/A	
		Average number of seedlings by height class and species	#plants/1m^2	
		Canopy cover	Percent	
		Health of seedlings	1-5 scale (1=excellent; 5=poor)	
Benthic- Fish Data	33	Visibility	Meters	Excel
		Depth at center of fish cylinder survey	Meters	
		Species	N/A	
		Number of fish	Number	

HABITAT	NUMBER OF TRANSECTS	DATA COLLECTED	UNITS	FILE FORMAT
		Average length	Centimeters	
Benthic	33+dredge channels	GPS coordinates for all transects	WGS 84 DATUM	GPX
Benthic- Line Point Intercept Data	33	Site designation (algae, seagrasses, bare, hard and soft corals, invertebrates)	Percent	Excel
		Depth	Centimeters	Excel
		Habitat Type	Classification	
		Relief	Centimeters	
		Macroinvertebrates	Count	
		Presence/Absence of endangered corals	Presence/Absence	
		Substrate cover ever 0.15 cm	Classification/Species	
		Video of transect		MP4 Video
Benthic-dredged channels	5 sites	Photos of substrate and site	N/A	JPEG
Benthic Sediment Sampling	38 sites	Number of bottles	Number	Excel
		Sample type	Composite or not (BTEX)	
		Transect distance sample was taken	Meters	
		Orientation from transect where sample was taken	Cardinal direction	
		Distance sample was taken from transect line	Meters	
		GPS data for start of transect	WGS 84 DATUM	
		Direction of transect	Magnetic degree	
Benthic habitat-water quality	38 sites	Date/Time	N/A	Excel
		Lat/Long	WGS 84 DATUM	
		Depth(s) sample(s) was/were taken	Meters	
		Vertical orientation in water column	Surface, middle, bottom	
		Temperature	°C	
		Dissolved oxygen	Mg/L	
		pH	Scale	
		Salinity	PSU	
Overview Study	15 sites	Photos of benthos	N/A	JPEG
Benthic habitat-sediment	38 sites	VOCs (Benzene, Toluene, Ethylbenzene, p/m-	µg/kg	Excel

HABITAT	NUMBER OF TRANSECTS	DATA COLLECTED	UNITS	FILE FORMAT
chemistry		Xylene, o-Xylene, Dibromofluoromethane, Toluene-d8, 4-Bromofluorobenzene)		
		Metals (total: aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, nickel, potassium, selenium, silver, sodium, thallium, vanadium, zinc, mercury)	Mg/kg	Excel
		PAHs (~70 compounds)	µg/kg	Excel
		TPH (~30 compounds)	Mg/kg	Excel
		Biomarkers (>50 compounds)	µg/kg	Excel

EXHIBIT 4-2. AVAILABLE PRODUCTS BY HABITAT

HABITAT	DATA COLLECTED	FORMAT	FILE OR FOLDER NAME	STATUS	ACCESSIBLE THROUGH DATABASE	DESCRIPTION
Mangroves	Great Pond Reference Site Report	PDF	Final Report_Great Pond	Final Product	No	Final report with summary data
	Great Pond Reference Site Transect Locations	JPEG	GreatPondTransects	Final Product	No	Map of Great Pond, habitat cover, start and end transect locations for all 5 transects.
	Great Pond Reference Site Adult Tree Data	Excel	GreatPond_Reference Site_ mangrove_adult Trees	Raw Data	Yes	Raw data from 5 transects for adult trees and health metrics
	Great Pond Reference Site Subplot Data	Excel	GreatPond_Reference Site_seedling_SUBPLOTS	Raw Data	Yes	Raw data from 51 subplots for seedlings and saplings over 5 mangrove transects
	SCRG Study Area Report	PDF	Final Report_SCRG Study Area	Final Product	No	Final report with summary data
	SCRG Study Area Transect Locations	PDF	SCRG final transect Map	Final Product	No	Map of SCRG property, habitat cover, start and end transect locations for all 16 transects.
	SCRG Study Area Adult Tree Data	Excel	Study Area_mangrove_adult Trees	Raw Data	Yes	Raw data from 16 transects for adult trees and health metrics
	SCRG Study Area Subplot Data	Excel	StudyArea_mangrove_ seedling_SUBPLOTS	Raw Data	Yes	Raw data from 213 subplots for seedlings and saplings over 16 mangrove transects
Benthic-Study Area and Reference Sites	Overview Study Photos	JPEG	Overview Study	Final Product	No	Photos of the benthos at the centroid of 15 grid cells in the Study Area to corroborate habitat type; photos are oriented towards shore.
	Overview Study Notes	Word	Study_Area_OverviewAssessment_May17_2016	Final Product	No	Notes from the overview assessment, corrections to the photo data, and results.
	LPI Data sheets	PDF	All 33 LPI Data Sheets	Raw Data Notes	No	33 benthic habitat transect sheets, original data
	LPI Data sheets	Excel	LPI_habitat_Datasheets Transcribed	Raw Data Notes	Yes	33 benthic habitat transect sheets, original data transcribed

HABITAT	DATA COLLECTED	FORMAT	FILE OR FOLDER NAME	STATUS	ACCESSIBLE THROUGH DATABASE	DESCRIPTION
	Fish Data	PDF	HT Fish Field Data Sheets Final	Raw Data Notes	No	Fish column counts along 33 transects for Diver 1
	Fish Data	PDF	RB Fish Field Data Sheets Final	Raw Data Notes	No	Fish column counts along 33 transects for Diver 2
	Fish Data	Excel	Fish Data - Final	Final Product	Yes	Counts and size bins of fish along each habitat transect (n=33 sites)
	LPI Data	Excel	LPI Data Summary - Final	Final Product	No	Percent of habitat type by transect and summary habitat stats by and across Reference Site and Study Area
	Transect LPI data	JPEG	33 LPI Sites with Photos & Video > Individual Field Day and Site folders with LPI folder of photos	Final Product	Yes	Photos of every 15 cm site on the 15m transect. Additional site photos
	Transect habitat video	MP4	33 LPI Sites with Photos & Video > Individual Field Day and site folders	Final Product	Yes	Video of the entire transect, some with start point and additional video
	GPS Coordinates	GPX	GPS cords final Sept. 2, 2016.gpx	Raw Data	No[1]	GPS coordinates for all 33 transects and 5 dredge channel sampling sites
	GPS Coordinates	Excel	Raw Transect Start Point GPS Downloads	Raw Data	Yes	Raw transect start data in excel sheet with station names
	Water Quality Data	Excel	Raw SmarTroll Downloads	Raw Data	No	Water quality data by sampling date and time
	Water Quality Data	PDF	Water Quality Data Sheets	Raw Data Notes	No	Water quality data by site, field notes
	Water Quality Data	Excel	Water Quality Instrument Readings	Final Product	Yes	Water quality data by site
	Water Quality GPS data	Excel	Raw WQ GPS Downloads	Raw Data	No	GPS coordinates for water quality data taken (3 bins of data)
	SmarTroll Instrument Calibration	PDF	Completed Instrument Calibration Sheets	Final Product	No	Instrument calibration data for water quality unit, SmarTroll

HABITAT	DATA COLLECTED	FORMAT	FILE OR FOLDER NAME	STATUS	ACCESSIBLE THROUGH DATABASE	DESCRIPTION
	Water Quality Sampling Notes	Word	Notes on Water Quality Sampling	Final Product	No	Overview of sampling unit, sampling methods, and data files for water quality
	Sediment Sampling	PDF	Completed Field and Sediment Sample Sheets	Raw Data Notes	No	Field notes on sediment samples
	Sediment Sampling and Fish	PDF	Dive sheets, Sediments & Fish	Raw Data Notes	No	Field notes on sediment sampling and fish observations
	Sediment Sampling	Excel	Sediment Sample Master Sheet	Final Product	No	Transect start data, transect orientation, location of sediment sample taken along the transect
	Sediment Sampling Notes	Word	Notes on Sediment Sampling	Final Product	No	Overview of sampling methods, data collection, and data synthesis documents.
	Sediment Sample Chain of Custody Forms	PDF	Completed Chain of Custody Forms	Final Product	No	Chain of custody forms for the first and second shipments of sediment samples to the analytical lab
Sediment Chemistry	Sediment Chemistry-Biomarkers	Excel	Biomarker_1609008IEC-StCroix_Bio addendum	Final Product	Yes	Biomarker data for three batches of samples
			Biomarker_1609009IEC-StCroix_Bio Addendum	Final Product	Yes	
			Biomarker_1609010IEC-StCroix_Bio Addendum	Final Product	Yes	
		PDF	Biomarker_1609008_USVI-ST-CROIX Bio Addendum	Raw Data	No	Raw biomarker analysis data for three batches of samples from Alpha Analytical
			Biomarker_1609009_USVI-ST-CROIX Bio Addendum	Raw Data	No	
			Biomarker_1609010_USVI-ST-CROIX Bio Addendum	Raw Data	No	
	Sediment Chemistry- Metals	Excel	Metals_L1629219IEC-StCroix	Final Product	Yes	Metals data for three batches of samples
			Metals_L1629221IEC-StCroix	Final Product	Yes	

HABITAT	DATA COLLECTED	FORMAT	FILE OR FOLDER NAME	STATUS	ACCESSIBLE THROUGH DATABASE	DESCRIPTION
			Metals_L1629223IEC-StCroix	Final Product	Yes	
			Metals_Rinsate_L1627270IEC-StCroix	Final Product	No	Metals rinsate blank data
		PDF	Metals_L1629219_USVI-ST-CROIX	Raw Data	No	Raw metals data for three batches of samples from Alpha Analytical
			Metals_L1629221_USVI-ST-CROIX	Raw Data	No	
			Metals_L1629223_USVI-ST-CROIX	Raw Data	No	
			Metals_Rinsate_L1627270_USVI-ST-CROIX	Raw Data	No	Raw metals rinsate blank data
	Sediment Chemistry-PAH and TPH	Excel	PAH_TPH_1609008IEC-StCroix	Final Product	Yes	PAH and TPH data for three batches of samples
			PAH_TPH_1609009IEC-StCroix	Final Product	Yes	
			PAH_TPH_1609010IEC-StCroix10272017	Final Product	Yes	
		PDF	PAH_TPH_1609008_USVI-ST-CROIX	Raw Data	No	Raw PAH and TPH data for three batches of samples from Alpha Analytical
			PAH_TPH_1609009_USVI-ST-CROIX	Raw Data	No	
			PAH_TPH_1609010_USVI-ST-CROIX	Raw Data	No	
	Sediment Chemistry- PAH, TPH, VOC	Excel	PAH_TPH_VOC_Rinsate_160802 2IEC-StCroix	Final Product	No	PAH, TPH, and VOC rinsate data
		PDF	PAH_TPH_VOC_Rinsate_160802 2_USVI-ST-CROIX	Raw Data	No	Raw PAH, TPH, and VOC rinsate data from Alpha Analytical
	Sediment Chemistry- VOC	Excel	VOC_1608021IEC-StCroix	Final	Yes	VOC (BTEX) data for two batches of

HABITAT	DATA COLLECTED	FORMAT	FILE OR FOLDER NAME	STATUS	ACCESSIBLE THROUGH DATABASE	DESCRIPTION
				Product		samples
			VOC_1609005IEC-StCroix	Final Product	Yes	
		PDF	VOC_1608021_USVI-ST-CROIX	Raw Data	No	Raw VOC (BTEX) data for two batches of samples from Alpha Analytical
			VOC_1609005_USVI-ST-CROIX	Raw Data	No	
[1]All GPS data are available in the database, just not via this file.						

SECTION 5. DATABASE STRUCTURE AND USE

This section provides an overview of the structure and layout of the database, its designated use, methods to access the data, and general uses for the data. All data discussed in Section 54, above, and the database described here, have been provided to the U.S. Virgin Islands Department of Planning and Natural Resources, on a flash drive. The data collected during this study and the references discussed in this report are publically available. Upon request, additional copies of this report and database can be provided to all parties involved in this baseline assessment. Personnel involved in this project, their roles, and responsibilities are listed in Attachment A, Exhibit A-5.

5.1 DATABASE STRUCTURE

The data listed in Section 4, Exhibit 4-2, designated as being incorporated in this database, are accessible to the user. These data are all contained in a Microsoft Access database titled "Hovensa Marine Baseline DB". The database skeleton is formed by 17 tables. Seven tables contain raw data transcribed from field data sheets. Eight tables have lookup and standardization information created by IEc. This database also has a user-friendly interface created using Access forms and queries which allows users to view data in the database or export to Excel.

5.2 DATABASE USE

The data are organized and accessible via seven predefined data categories (each of these categories of data are accessible via queries that extract information from the raw data files and group them by category). The seven categories include:

- **Sediment chemistry**: all sediment chemistry and affiliated rinsate blank data for all contaminants analyzed at 36 sites;
- **Fish data**: fish count and size class data by species for all 33 benthic transect sites;
- **Benthic habitat LPI**: transect data for every 100 points assessed along a transect at each site. Data includes all raw LPI data and two summary tabs for general site characteristics (e.g., depth, rugosity, presence absence of corals), and habitat data summary statistics for 33 sites;
- **Water quality**: water quality measurements taken at different depths in the water column at 36 benthic sites (including dredge channels);
- **Mangrove habitat**: mangrove assessment data for adult and seedling plots (available in two separate spreadsheets);

- **Dredge channel photos and videos**: a link to the folder with all photographs and videos taken at dredge channel sediment sampling sites (5 sites), organized by site name; and
- **LPI transect photos and videos**: a link to the folder with all LPI photos (100 per transect) and additional photographs and videos taken at the benthic habitat sites (33 sites).

To access these data, please follow these steps:

1. Open the database (Note: if a yellow bar appears that asks you to "enable content" click "enable" then answer "yes," to make this a Trusted Document).
    a. A Welcome screen appears with a map of the Study and Reference Areas. The seven data query categories are listed below the map.
2. Click on the desired data category.
    a. A map will be displayed of the areas for which we have data under that category.
3. Click the "View Data by Type" button to access the data.
4. A table will open with the data in the category requested. View and filter the data in the window within Microsoft Access, or click the "Export to Excel" button at the top left, under the data category heading, to use the data in Microsoft Excel.
    a. This Excel export file will be automatically saved to the same folder as the database (the file path is shown in a pop-up message).
5. To return to the main display screen with the maps and data categories, click "Return to Main Menu" in the upper left, next to the "Export to Excel" button.
6. To view all data types available for each location, click "View Data by Site".
    a. A table will open listing all sites for Benthic data.
    b. Click the "Mangrove" button to show all mangrove transects.
    c. Click site/transect name will export all data relevant to this location to Excel.

5.3 DATA USE

The data discussed in this report were collected according to the Work Plan to assess baseline marine and shoreline environmental conditions adjacent to the former Hovensa Refinery. Notes and corrections, an overview of the results, and interesting findings are discussed below and in subsequent sections to provide an objective introduction to the data and findings. The data include habitat evaluation information collected along transects and at sediment collection sites throughout the Study Area and Reference Area and can be used for environmental habitat comparison over time, general habitat condition, benthic mapping, endangered species location identification, or in the event of a contaminant release.

5.4 NOTES AND CORRECTIONS

This section discusses discrepancies in the data and reporting, or other sampling notes to understand prior to using these data.

5.4.1 MISLABELING

There were three instances of mislabeling as described below.

- The laboratory analysis for BTEX at site 11-RS-CR is mislabeled. The BTEX sample labeled 11-RS-CR is actually the BTEX sample for site 8-RS-CR. This mislabeling is present on the bottles, resulting in mislabeling on the Chain of Custody (COC) form and sediment chemistry results. The time the sample was taken, the Site Prioritization List, and the Sediment Sample Master Sheet confirm that this BTEX sample is from site 8-RS-CR. In the spreadsheet labeled "VOC_1608021IEC-StCroix" we added a note for every 11-RS-CR site explaining that it is actually site 8-RS-CR. Finally, on the COC form, "USVI ST Croix rec'd 20160830," we added a note regarding this mislabeling.
- A sample for site 3-RS-CR was listed on the COC form; however, we did not sample this site. The actual site sampled was 13-RS-CR. On the COC form, "NEWFIELD ST. CROIX 090716," we added a note that the sample labeled 3-RS-CR is actually 13-RS-CR.
- Dredged channel site labeled AB1-SA-D, was intended to sample the same sampling location from Vicente (2012) and Holmes et al. (2012) labeled AB1-01 (GPS coordinates 17.707787, -64.771751). However, the GPS coordinates were switched with site AC1-01 (GPS coordinates 17.707778, -64.771750). In comparing data over time between the Vicente (2012) and Holmes et al. (2012) study and data collected in this baseline assessment, our site labeled AB1-SA-D should be compared to their site AC1-01.

5.4.2 DEVIATIONS FROM WORK PLAN

There were only a few deviations from the Work Plan due to technical, safety, and logistical reasons. Bearings for transects were adjusted in the field for safety purposes or variable site conditions (e.g., transect bearing at site 50-SA-CR was changed from 140 degrees to 160 degrees to avoid going onshore; bearing at site 31-SA-SAV changed from 250 to 180 to avoid the ship channel). The bearings in the sampling guide table provided to the field team (Exhibit A-4) can be compared to those in Exhibit A-2 to identify any changes.

According to the Work Plan, sediment samples were to be analyzed for total organic carbon (TOC). However, the sediment consisted mostly of calcium carbonate which reacted violently with the acid. As such, most samples would not dissolve completely and prevented reliable results. Therefore, the laboratory was unable to analyze any of the sediment samples for TOC.

5.4.3 ADDITIONAL SAMPLING NOTES

For Field Days 1 and 2 (8/18/2016 and 8/19/2016; sites 50-SA-CR, 39-SA-SAV, 40-SA-SAV, 41-SA-SAV, 17-SA-SAV, 16-SA-CR, 28-SA-SAV, 30-SA-SAV), the LPI point is directly under the center of the tape. The rest of the sampling sites took the point from directly under the top edge of the measuring tape (see Exhibit 5-1). All photographs are taken at a distance of 30 cm from the substrate (yellow guide; Exhibit 5-1) to try to show 3 LPI points in each photograph and with the numbers on the tape always "right-side-up" so as to be easily readable.

5.5 RINSATE BLANKS

In accordance with the Work Plan, and for QA/QC purposes, we analyzed all rinsate blanks for the same compounds analyzed in the sediment samples. Although TOC was analyzed on rinsate blanks, no TOC analysis was conducted on sediment samples due to complications during sample processing.

Rinsate blanks had concentrations of select PAH, BTEX, and metals; however, concentrations were orders of magnitude lower than detected concentrations in samples. For example, concentrations of compounds detected in rinsate blanks were in parts per trillion concentrations, while in site sediment samples they were in parts per million to parts per billion concentrations, depending on the analyte.

EXHIBIT 5-1. LPI TRANSECT METER TAPE PHOTOGRAPH

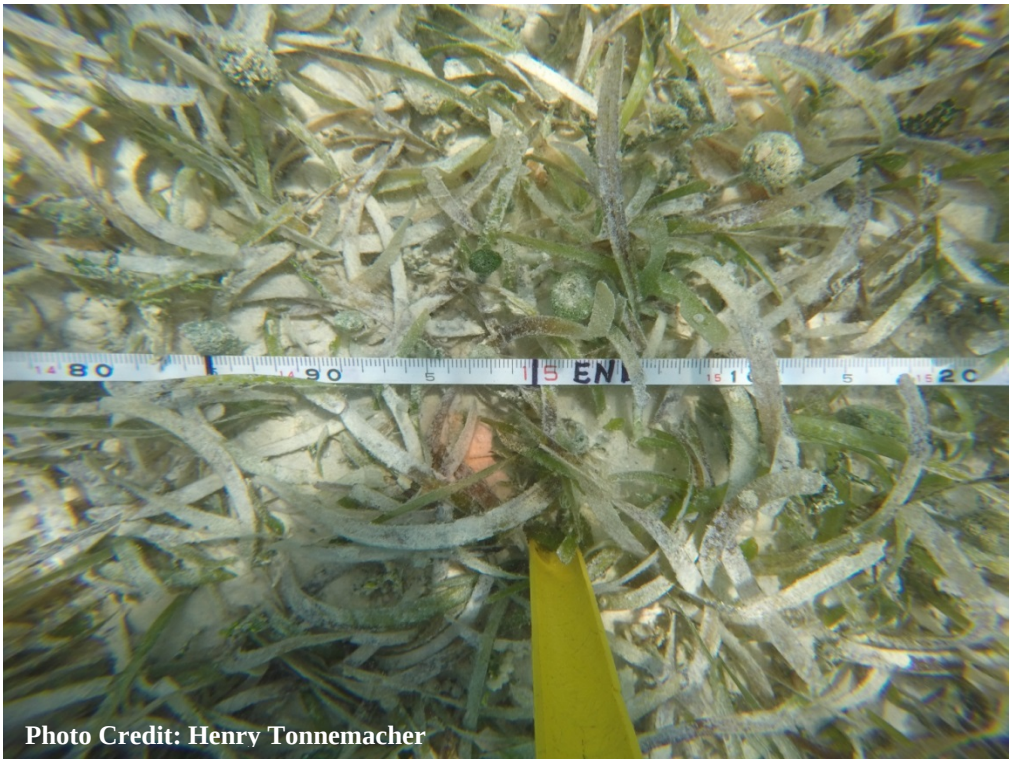


Photo Credit: Henry Tonnemacher

SECTION 6. RESULTS

6.1 STUDY AREA

6.1.1 BENTHIC HABITAT AND DREDGED CHANNEL RESULTS

Not including dredged channels, the majority of the benthic habitat was bare substrate in the 27 sites with habitat transects assessed (approximately 60% was bare substrate). The summary table below demonstrates the percent of habitat cover across all 27 sites (Exhibit 6-1).

EXHIBIT 6-1. PERCENT OF HABITAT DESIGNATION IN THE STUDY AREA ACROSS 27 SITES

HABITAT DESIGNATION	HABITAT COVER (%)	SPECIES TYPE
Bare substrate	59.9	Sand
Seagrasses	19.8	*Thalassia*, *Syringodium*, *Halodule*
Hard Corals	0.7	*Porites astreoides*, *Millepora*, *Orbicella annularis*, *Montastraea cavernosa*, *Diploria strigosa*, *Siderastrea radians*, *Siderastrea siderea*
Soft Corals	0.04	*Plexaurella*
Algae	19.3	*Halimeda*, *Penicillus*, *Dictyota*, Fleshy macroalgae (e.g., *Padina*, *Sargassum*), *Udotea*, *Codium isthmocladum*, *Caulerpa*, red algae
Invertebrates	0.2	*Diadema antillarum*, *Meoma ventricosa*, *Tripneustes*, *Echinometra*
Unidentified	0.0	N/A

Fish species observed along all transects assessed in the Study Area are listed in Exhibit 6-2. The most abundant species observed throughout the sites visited were wrasse species (i.e., 29% slippery dick followed by 19% bluehead wrasse).

EXHIBIT 6-2. NUMBER OF FISH BY SPECIES OBSERVED IN THE STUDY AREA

FISH COMMON NAME	SCIENTIFIC NAME	NUMBER OBSERVED	PERCENT OF TOTAL
Angel, Rock Beauty	*Holacanthus tricolor*	1	0.14%
Blackbar Soldier	*Myripristis jacobus*	3	0.41%
Blue Tang	*Acanthurus coeruleus*	23	3.12%
Butterfly, Banded	*Chaetodon striatus*	3	0.41%
Butterfly, Foureyed	*Chaetodon capistratus*	3	0.41%
Chromis, Brown	*Chromis multilineata*	17	2.31%
Damsel, Beaugregory	*Stegastes leucostictus*	2	0.27%
Damsel, Bicolor	*Stegastes partitus*	15	2.04%
Damsel, Dusky	*Stegastes adustus*	46	6.24%
Damsel, Longfin	*Stegastes diencaeus*	6	0.81%
Damsel, Seargent Major	*Abudefduf saxatilis*	20	2.71%
Damsel, Yellowtail	*Microspathodon chrysurus*	16	2.17%
Damsel, Unknown	*N/A*	21	2.85%
Doctor Fish	*Acanthurus chirurgus*	24	3.26%
Goatfish, Spotted	*Psuedupeneus maculatus*	3	0.41%
Goatfish, Yellow	*Mulloidichthys martinicus*	4	0.54%
Grunt, French	*Haemulon flovolineatum*	68	9.23%
Grunt, Blue stripped	*Haemulon sciurus*	1	0.14%
Hogfish, Spanish	*Bodianus rufus*	1	0.14%
Jack, Bar	*Caranx ruber*	18	2.44%
Jack, Blue Runner	*Caranx crysos*	9	1.22%
Jack, Unknown		1	0.14%
Parrotfish, Redtail	*Sparisoma chrysopterum*	1	0.14%
Parrotfish, Stoplight	*Sparisoma viride*	7	0.95%
Razorfish, Pearly	*Xyrichtys novacula*	2	0.27%
Razorfish, Rosy	*Xyrichtys martinicensis*	6	0.81%
Sand Tilefish	*Malacanthus plumieri*	1	0.14%
Snapper, Unknown	*N/A*	1	0.14%
Snapper, Mahogany	*Lutjanus mahogoni*	9	1.22%
Snapper, Yellowtail	*Ocyurus chrysurus*	4	0.54%
Squirrelfish, Common	*Holocentrus adscensionis*	2	0.27%
Squirrelfish, Longspine	*Holocentrus rufus*	2	0.27%
Surgeonfish, Ocean	*Acanthurus bahianus*	17	2.31%
Tobaccofish	*Serranus tabacarius*	4	0.54%
Trunkfish, Buffalo	*Lactophrys trigonus*	2	0.27%
Wrasse, Bluehead	*Thalassoma bifasciatum*	139	18.86%
Wrasse, Puddingwife	*Halichoeres radiatus*	8	1.09%
Wrasse, Slippery Dick	*Halichoeres bivittatus*	211	28.63%
Wrasse, Yellowhead	*Halichoeres garnoti*	7	0.95%
Unknown Fish	*N/A*	9	1.22%
Total Fish Observed		737	
Fish Species Observed		40	
Average Fish Per Transect		27	
Average Species Per Transect		4	

Sediment samples were compared to Effects Range-Low (ERL) toxicity threshold levels in marine sediments from NOAA SQuiRT Tables to provide relative comparisons for the data (Buchman 2008). We summed 16 parent PAH compounds into the ∑PAH value for consistent comparison with NOAA SQuiRT Tables. The 16 PAHs included in ∑PAH value are listed in bold in Exhibit 6-3, while the Total PAH values are a sum of the 57

analytes (sum of all the PAHs analyzed except carbazole, methylated compounds, and decalins) listed in Exhibit 6-3.

EXHIBIT 6-3. LIST OF 57 POLYCYCLIC AROMATIC HYDROCARBONS

PAH LIST	PAH LIST CONTINUED
Acenaphthene	C3-Benzo(b)thiophenes
Acenaphthylene	C3-Chrysenes
Anthracene	C3-Dibenzothiophenes
Benz[a]anthracene	C3-Fluoranthenes/Pyrenes
Benzo(b)fluorene	C3-Fluorenes
Benzo[a]fluoranthene	C3-Naphthalenes
Benzo[a]pyrene	C3-Naphthobenzothiophenes
Benzo[b]fluoranthene	C3-Phenanthrenes/Anthracenes
Benzo[e]pyrene	C4-Benzo(b)thiophenes
Benzo[g,h,i]perylene	C4-Chrysenes
Benzo[j]fluoranthene/Benzo[k]fluoranthene	C4-Dibenzothiophenes
Benzothiophene	C4-Fluoranthenes/Pyrenes
Biphenyl	C4-Naphthalenes
C1-Benzo(b)thiophenes	C4-Naphthobenzothiophenes
C1-Chrysenes	C4-Phenanthrenes/Anthracenes
C1-Dibenzothiophenes	**Chrysene/Triphenylene**
C1-Fluoranthenes/Pyrenes	**Dibenz[ah]anthracene/Dibenz[ac]anthracene**
C1-Fluorenes	Dibenzofuran
C1-Naphthalenes	Dibenzothiophene
C1-Naphthobenzothiophenes	**Fluoranthene**
C1-Phenanthrenes/Anthracenes	**Fluorene**
C2-Benzo(b)thiophenes	**Indeno[1,2,3-cd]pyrene**
C2-Chrysenes	**Naphthalene**
C2-Dibenzothiophenes	Naphthobenzothiophenes
C2-Fluoranthenes/Pyrenes	Perylene
C2-Fluorenes	**Phenanthrene**
C2-Naphthalenes	**Pyrene**
C2-Naphthobenzothiophenes	Retene
C2-Phenanthrenes/Anthracenes	
The 16 PAHs included in ∑PAH value are shown in bold.	

Sediment samples from the Study Area were under the ERL threshold limits for toxicity for ∑PAH 16, mercury, arsenic, chromium, lead, and nickel (Exhibit 6-4). Only zinc and copper were detected at concentrations above ERL thresholds (at two sites in dredged areas; Exhibit 6-4). Sediment samples across all sites in the Study Area were under the detection limits for all BTEX analytes except toluene, which was detected in low

concentrations (<5µg/kg) at most of the sites with toluene results above the detection limit. Additionally, mercury concentrations were under detection or very low for most sites sampled in the Study Area. Concentrations of copper, zinc, mercury, ∑PAH, and Total PAH are displayed in Exhibit 6-5, Exhibit 6-6, Exhibit 6-7, Exhibit 6-8, and Exhibit 6-9, respectively. While aluminum in sediment does not have a level of concern in the SQuiRT tables, levels were generally low relative to expected background levels, which are frequently between 1-10 percent of dry weight (10,000 to 100,000 mg/kg), due to the presence of aluminosilicates in the fine sediment fractions. The highest concentration was at Station ABI-SA-D in the Alucroix Channel, with an aluminum concentration of 22,200 mg/kg. All other stations were below 4,000 mg/kg.

EXHIBIT 6-4. SEDIMENT CONTAMINANT CONCENTRATIONS RELATIVE TO TOXICITY THRESHOLDS IN THE STUDY AREA

COMPOUND	THRESHOLD; EFFECTS RANGE-LOW (µG/KG DRY) FROM NOAA SQUIRT TABLES	HIGHEST CONCENTRATION (µG/KG DRY)	SITE	EXCEEDANCE OF THRESHOLD (Y/N)
∑PAH (16 parent compounds)*	4,022	302	PA1-SA-D	N
Total PAH**	N/A	1,975	WB1-SA-D	N/A
∑TPH	N/A	328,161	PA1-SA-D	N/A
Mercury	150	124	WB1-SA-D	N
Arsenic	8,200	4,660	WB1-SA-D	N
Chromium	81,000	30,900	AB1-SA-D	N
Copper	34,000	77,300	WB1-SA-D	Y
		36,800	AB1-SA-D	Y
Lead	46,700	13,400	WB1-SA-D	N
Nickel	20,900	13,300	WB1-SA-D	N
Zinc	150,000	369,000	WB1-SA-D	Y

*Sum of 16 PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz[*a*]anthracene, chrysene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene, benzo[*a*]pyrene, dibenz[*ah*]anthracene, benzo[*ghi*]perylene, and indeno[*1,2,3-cd*]pyrene.
**Not including carbazole, decalins, C1-C4 decalins, and methylated hydrocarbons.

EXHIBIT 6-5. COPPER CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE STUDY AREA

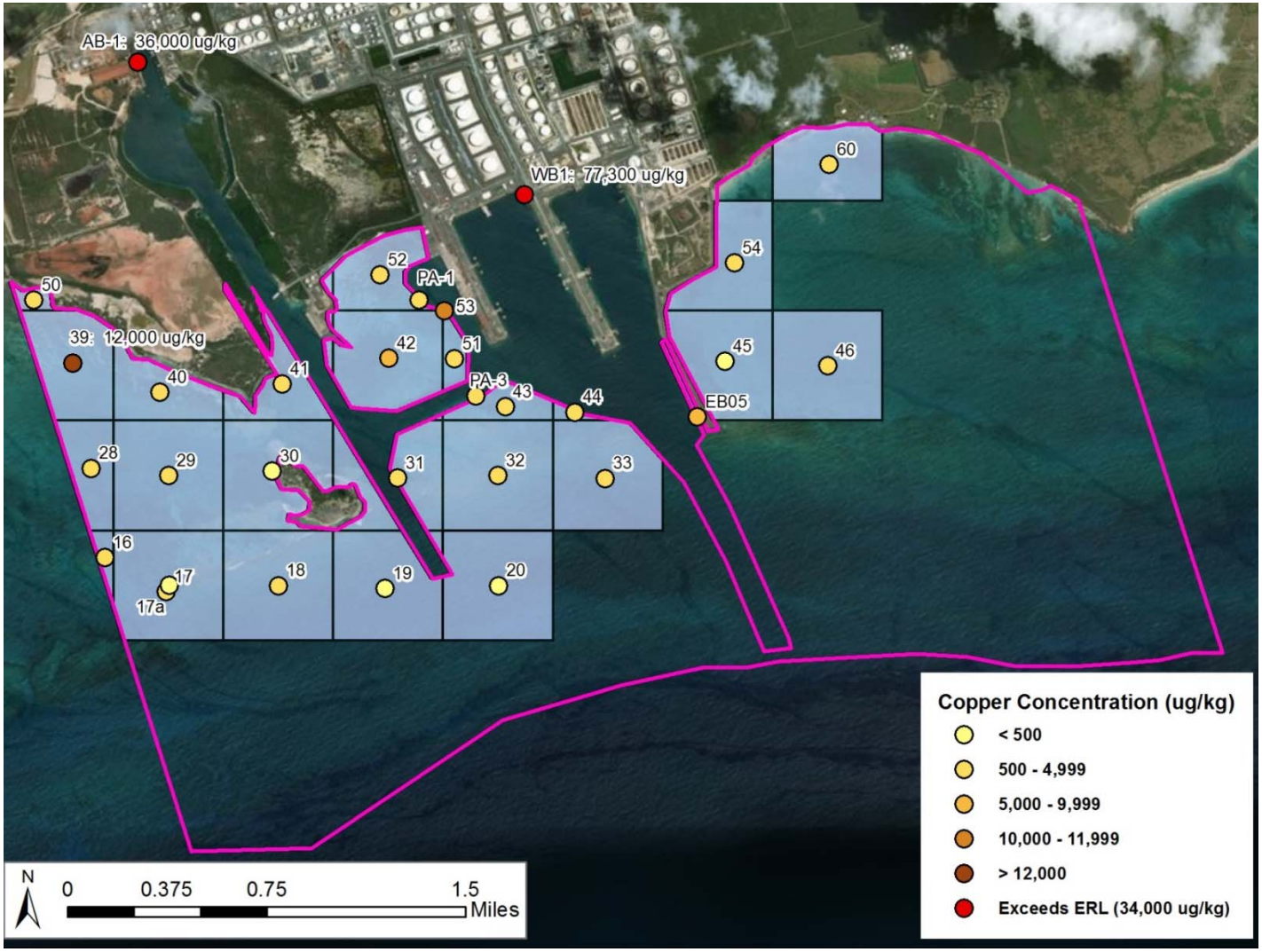


EXHIBIT 6-6. ZINC CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE STUDY AREA

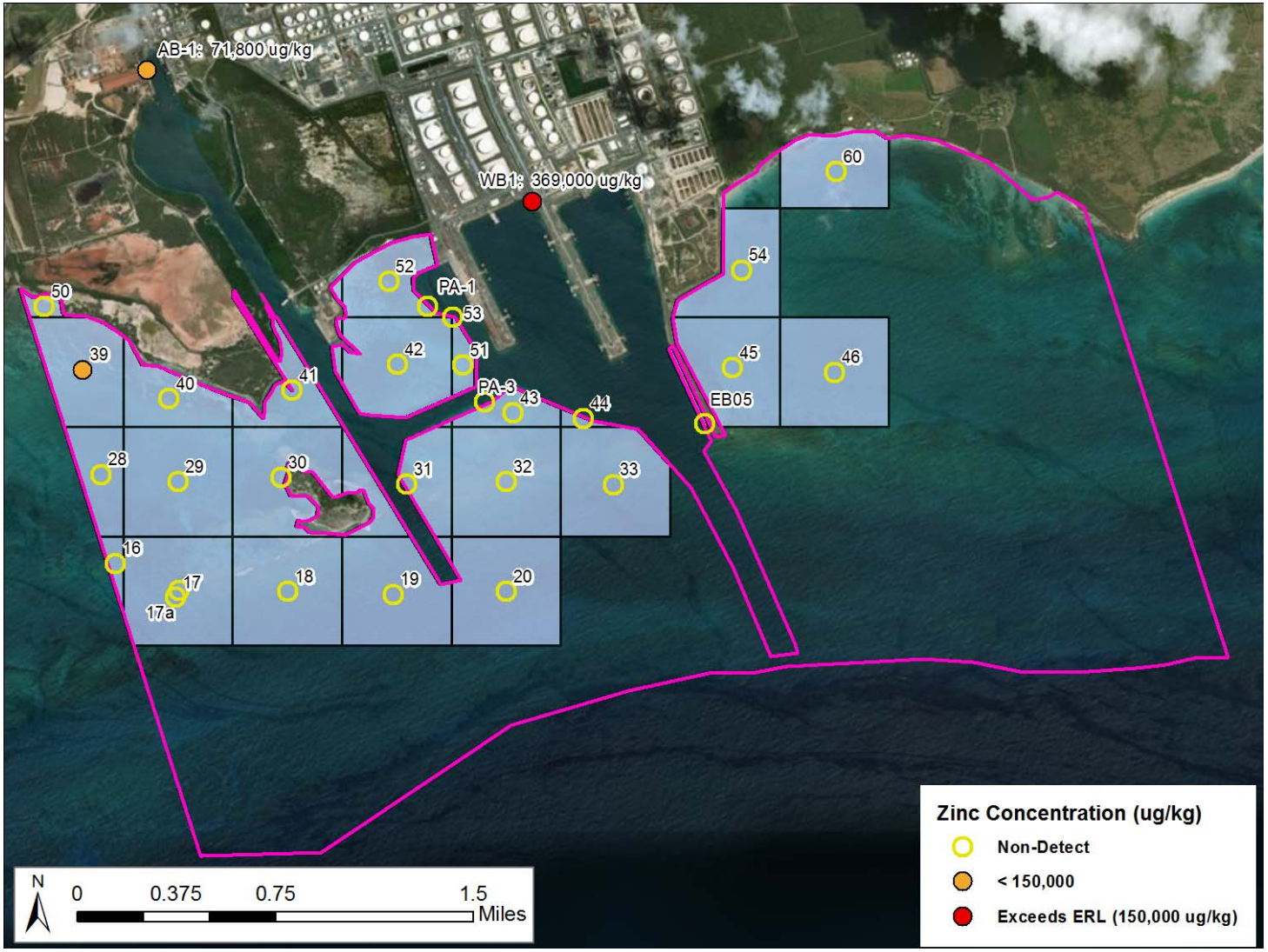


EXHIBIT 6-7. MERCURY CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE STUDY AREA

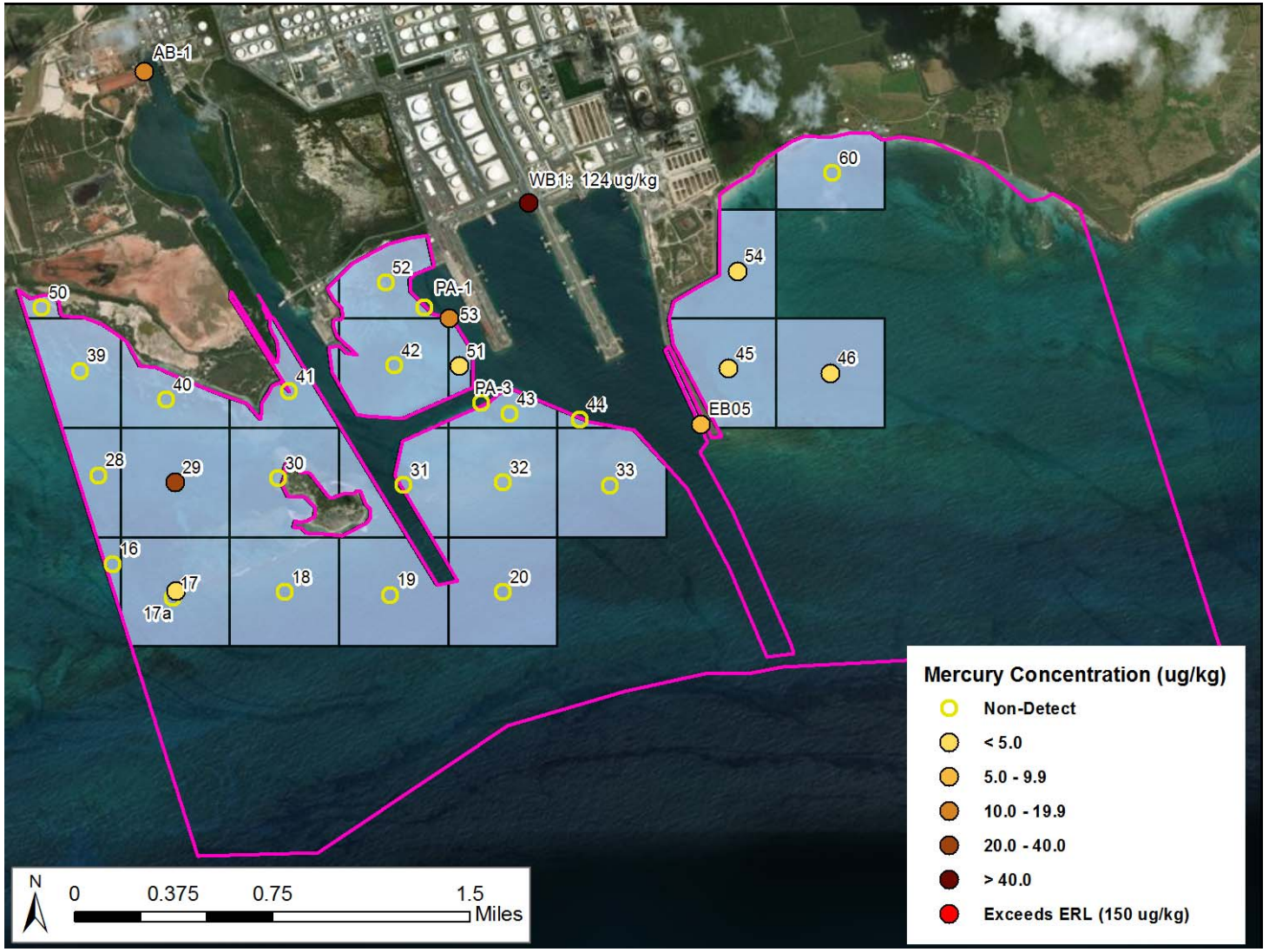


EXHIBIT 6-8. ΣPAH 16 CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE STUDY AREA

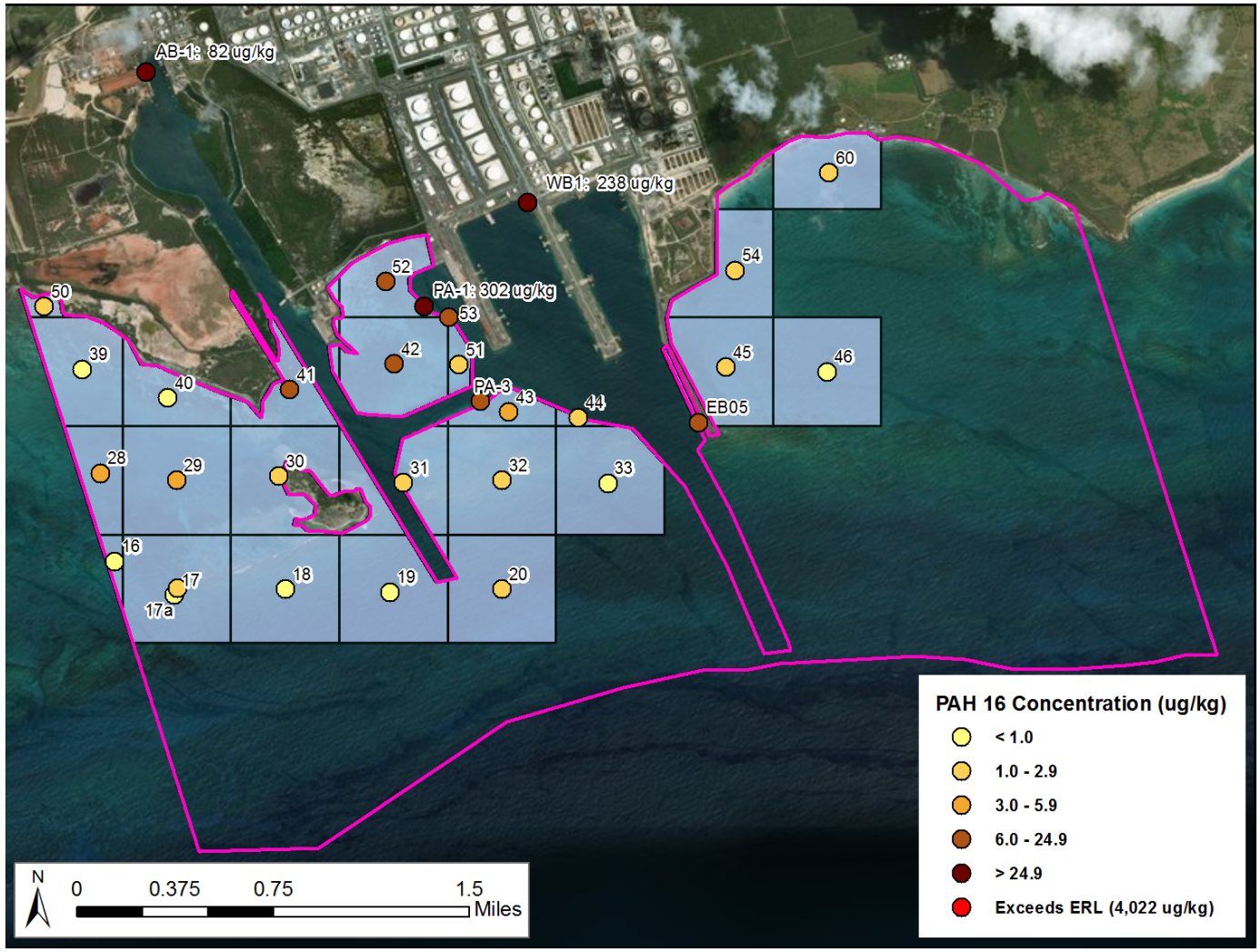
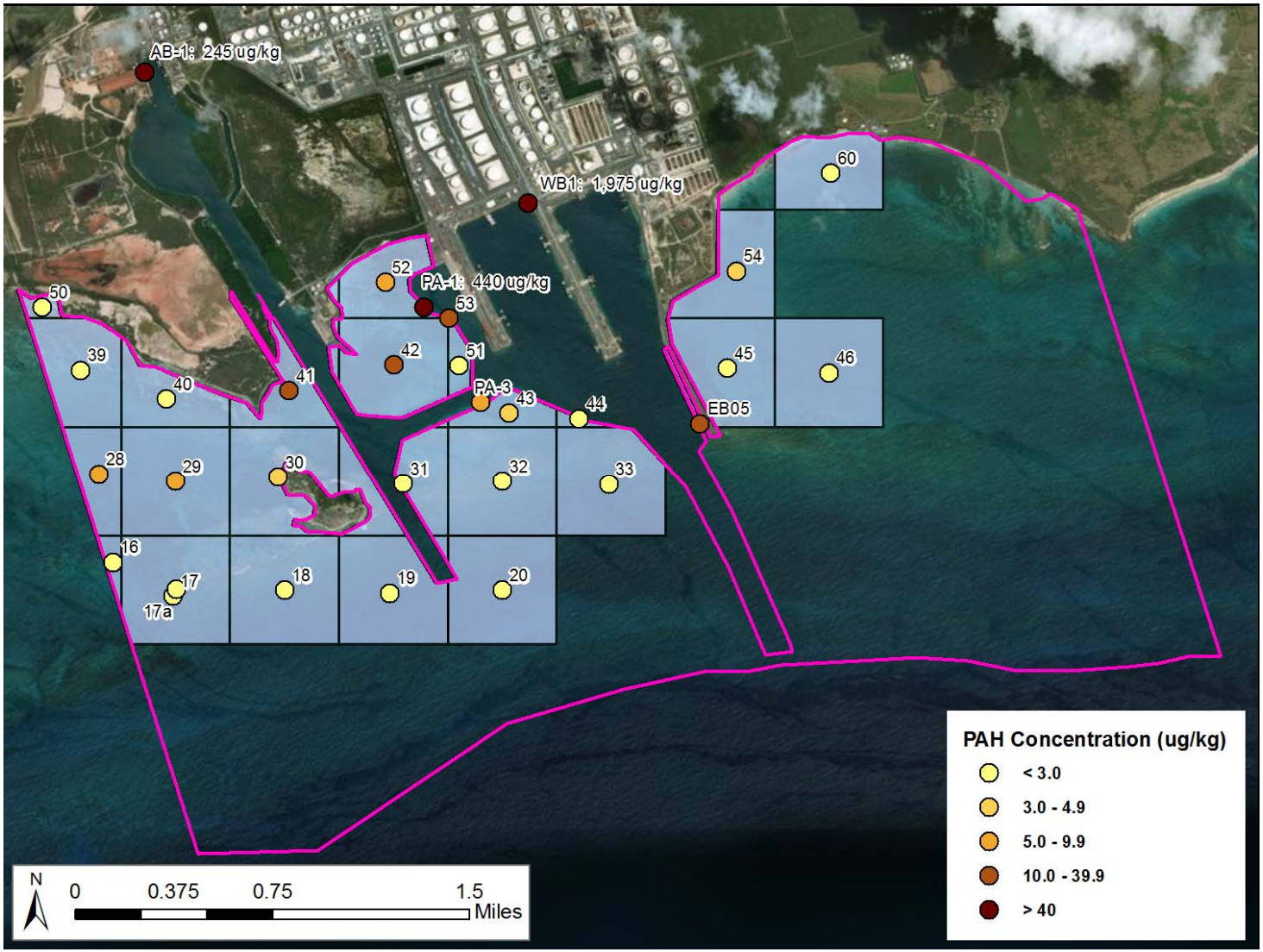
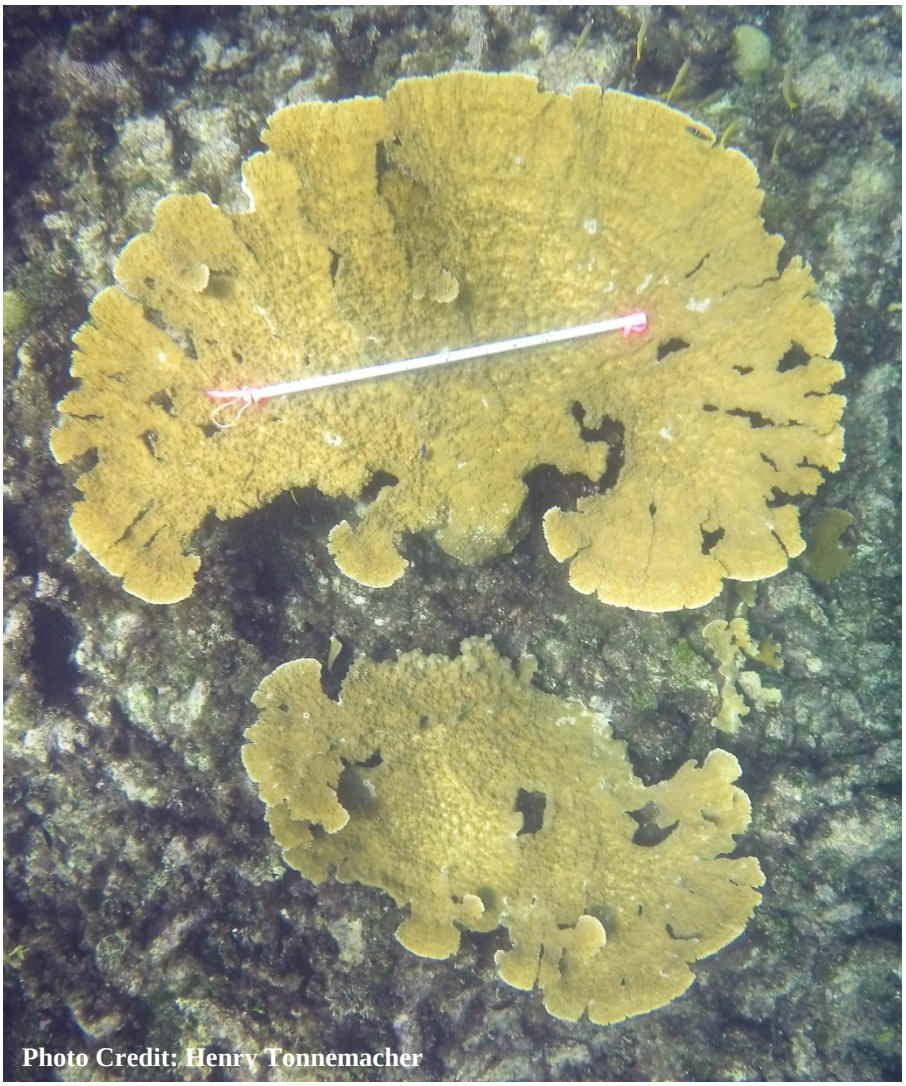


EXHIBIT 6-9. TOTAL PAH CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE STUDY AREA



At Study Area site 17, the divers noticed an endangered Elkhorn coral (*Acropora palmata*) species nearby (Exhibit 6-10). The white bar in the photo is a meter stick, for size comparison. An additional transect was added near this coral at site 17 to assess the habitat there (site 17-SA-APALMA).

EXHIBIT 6-10. ELKHORN CORAL WITHIN STUDY AREA SITE 17 (17.678892, -64.770209)



6.1.2 SCRG MANGROVE HABITAT RESULTS

A total of 71 quadrats were assessed along 16 transects on the SCRG property along the shoreline of the Study Area. The mangroves in the Study Area were predominately red mangrove (*Rhizophore mangle*), followed by white mangrove (*Laguncularia racemosa*), and black mangrove (*Avicennia germinans*). Additional species include buttonwood and seaside mahoe. The full list of tree species and their cumulative abundances across all 16

transects assessed are provided in Exhibit 6-11. All of the tree species observed in the mangrove forest along the perimeter of the Study Area are native to the U.S. Virgin Islands. There were a total of 2,677 seedling and saplings in the 213 subplots.

Additional results may be found in the accompanying report, "Mangrove Forests, St. Croix Renaissance Group and Surrounding Area, St. Croix, USVI."[5]

EXHIBIT 6-11. PERCENT OF SPECIES IN THE STUDY AREA ACROSS 16 SITES

GENUS	SPECIES	COMMON NAME	COUNT	PERCENT
Avicennia	*germinans*	Black Mangrove	127	9.9%
Conocarpus	*erectus*	Buttonwood	111	8.6%
Croton	*betulinas*	Pistarclebush	1	0.1%
Hippomane	*mancinella*	Manchineel	2	0.2%
Laguncularia	*racemosa*	White Mangrove	160	12.4%
Lantana	*involucrata*	Sage	8	0.6%
Pluchea	*odorata*	Fleabane	7	0.5%
Quadrella	*indica*	White Caper	1	0.1%
Rhizophore	*mangle*	Red Mangrove	816	63.5%
Thespesia	*populnea*	Seaside Mahoe	53	4.1%
TOTAL			**1,286**	**100.0%**

Wildlife observed in the mangrove forest along the Study Area include fish (juvenile and adult black mullet, juvenile Caribbean whiptail stingrays, eagle rays, juvenile sharks, and barracuda), birds (frigates, pelicans, nightjars), crabs (hermit crab, fiddler, and land crabs), and bivalves (mangrove oysters). Wildlife observations were opportunistically recorded, not methodically collected. As such, no data tables are provided.

6.2 REFERENCE SITES

6.2.1 HALFPENNY BAY BENTHIC HABITAT RESULTS

From the six sites assessed, the percent cover by habitat designation is listed in Exhibit 6-12. This summary table demonstrates that macroalgae, bare substrate, and seagrass were the dominant benthic habitats.

[5] File labeled "Final Report_SCRG Study Area."

EXHIBIT 6-12. PERCENT OF HABITAT DESIGNATION ACROSS 6 REFERENCE SITES

HABITAT DESIGNATION	HABITAT COVER (%)	SPECIES TYPE
Bare substrate	34.5	Sand
Seagrasses	22.0	*Thalassia, Syringodium*
Hard Corals	0.0	N/A
Soft Corals	0.0	N/A
Algae	43	*Halimeda, Penicillus, Dictyota*, Fleshy macroalgae (e.g., *Padina*), *Caulerpa*, *Turbinaria*, *Galaxaura*
Invertebrates	0.2	Sponges
Unidentified	0.3	N/A

Fish species observed along all transects assessed in the Halfpenny Bay Reference Area are listed in Exhibit 6-13. The most abundant species observed throughout the sites visited were wrasse species (i.e., 19% slippery dick followed by 12% yellowhead wrasse).

EXHIBIT 6-13. FISH COUNT BY SPECIES IN HALFPENNY BAY REFERENCE AREA

FISH COMMON NAME	SCIENTIFIC NAME	NUMBER OBSERVED	PERCENT OF TOTAL
Blue Tang	*Acanthurus coeruleus*	20	10.10%
Butterfly, Foureyed	*Chaetodon capistratus*	1	0.51%
Chromis, Brown	*Chromis multilineata*	1	0.51%
Damsel, Beaugregory	*Stegastes leucostictus*	2	1.01%
Damsel, Bicolor	*Stegastes partitus*	14	7.07%
Damsel, Dusky	*Stegastes adustus*	9	4.55%
Damsel, Yellowtail	*Microspathodon chrysurus*	1	0.51%
Doctor Fish	*Acanthurus chirurgus*	18	9.09%
Goatfish, Spotted	*Psuedupeneus maculatus*	3	1.52%
Goatfish, Yellow	*Mulloidichthys martinicus*	1	0.51%
Hogfish, Spanish	*Bodianus rufus*	1	0.51%
Jack, Blue Runner	*Caranx crysos*	3	1.52%
Parrotfish, Stoplight	*Sparisoma viride*	6	3.03%
Puffer, Sharpnose	*Canthigaster jamestyleri*	2	1.01%
Sand Tilefish	*Malacanthus plumieri*	1	0.51%
Squirrelfish, Common	*Holocentrus adscensionis*	21	10.61%
Surgeonfish, Ocean	*Acanthurus bahianus*	4	2.02%
Wrasse, Bluehead	*Thalassoma bifasciatum*	14	7.07%
Wrasse, Puddingwife	*Halichoeres radiatus*	7	3.54%
Wrasse, Slippery Dick	*Halichoeres bivittatus*	38	19.19%
Wrasse, Yellowhead	*Halichoeres garnoti*	23	11.62%
Wrasse, Unknown		8	4.04%
Total Fish Observed		198	
Fish Species Observed		22	
Average Fish Per Transect		33	
Average Species Per Transect		8	

All sediment samples analyzed from the Reference Site were under the ERL threshold limits for toxicity for all contaminants (Exhibit 6-14). Mercury and lead were below detection at most of the Reference Sites sampled, and zinc was below detection at all sites sampled. Concentrations of copper, zinc, mercury, ∑PAH 16, and Total PAH are displayed in Exhibit 6-15, Exhibit 6-16, Exhibit 6-17, Exhibit 6-18, and Exhibit 6-19, respectively.

EXHIBIT 6-14. SEDIMENT CONTAMINANT CONCENTRATIONS RELATIVE TO TOXICITY THRESHOLDS IN THE HALFPENNY BAY REFERENCE AREA

COMPOUND	THRESHOLD; EFFECTS RANGE-LOW (µG/KG DRY) FROM NOAA SQUIRT TABLES	HIGHEST CONCENTRATION (µG/KG DRY)	SITE	EXCEEDANCE OF THRESHOLD (Y/N)
ΣPAH (16 parent compounds)*	4,022	3	15-RS-SAV	N
Total PAH**	N/A	4	15-RS-SAV	N/A
ΣTPH	N/A	378	13-RS-CR	N/A
Mercury	150	4	13-RS-CR	N
Arsenic	8,200	2,530	13-RS-CR	N
Chromium	81,000	8,010	13-RS-CR	N
Copper	34,000	6,730	11-RS-CR	N
Lead	46,700	410	8-RS-CR	N
Nickel	20,900	4,070	13-RS-CR	N
Zinc	150,000	All sites below detection	N/A	N/A

* Sum of 16 PAHs: naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benz[*a*]anthracene, chrysene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene, benzo[*a*]pyrene, dibenz[*ah*]anthracene, benzo[*ghi*]perylene, and indeno[*1,2,3-cd*]pyrene.
**Not including carbazole, decalins, C1-C4 decalins, and methylated hydrocarbons.

EXHIBIT 6-15. COPPER CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE HALFPENNY BAY REFERENCE AREA

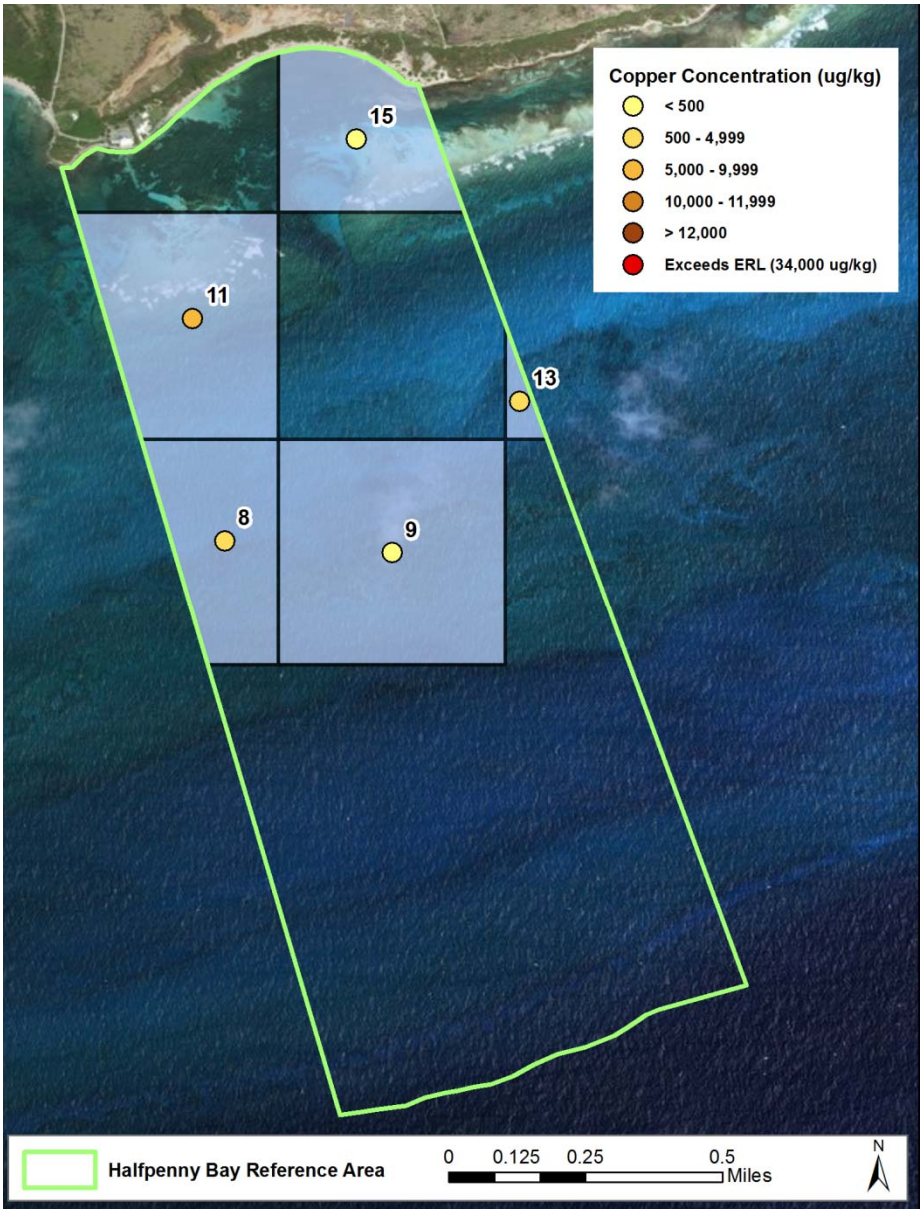


EXHIBIT 6-16. ZINC CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE HALFPENNY BAY REFERENCE AREA

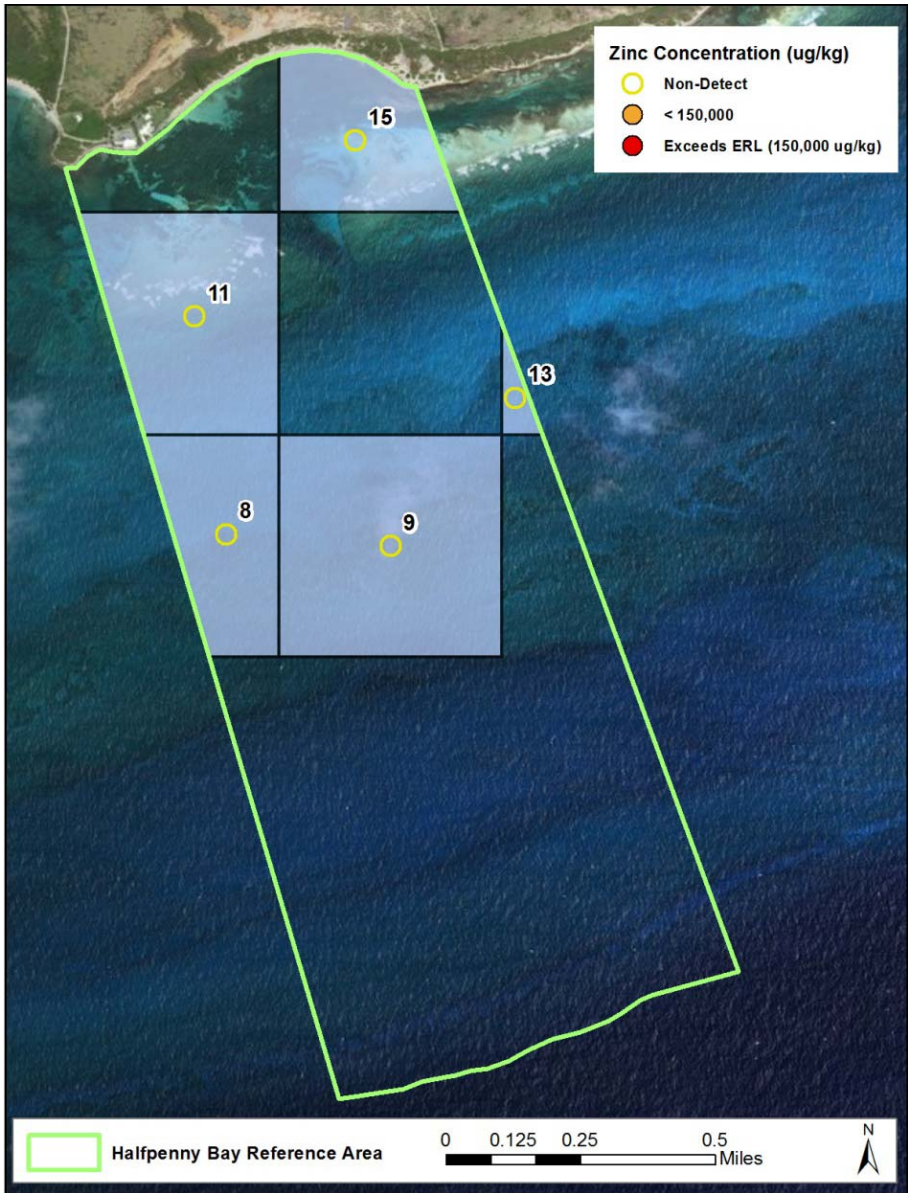


EXHIBIT 6-17. MERCURY CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE HALFPENNY BAY REFERENCE AREA

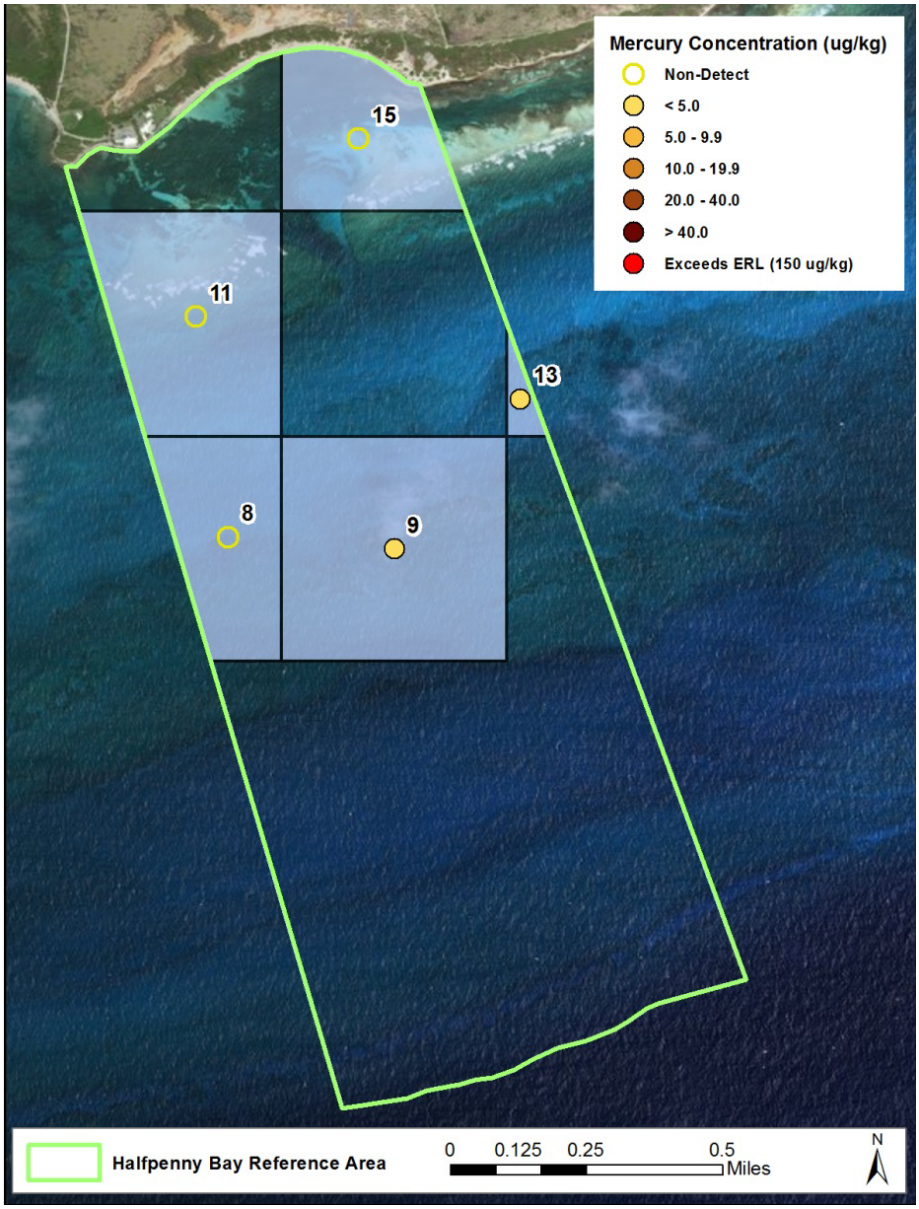


EXHIBIT 6-18. ΣPAH 16 CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE HALFPENNY BAY REFERENCE AREA

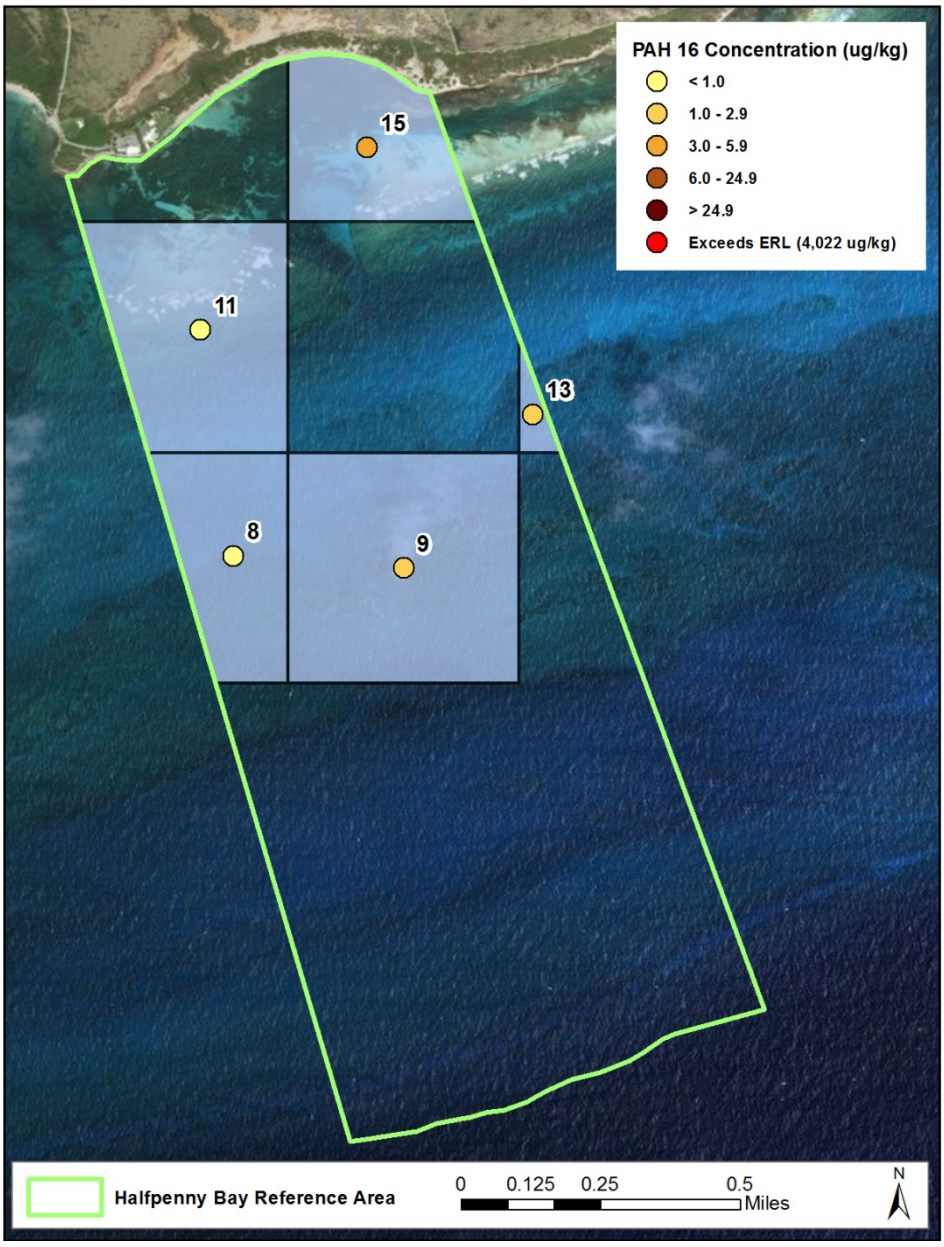
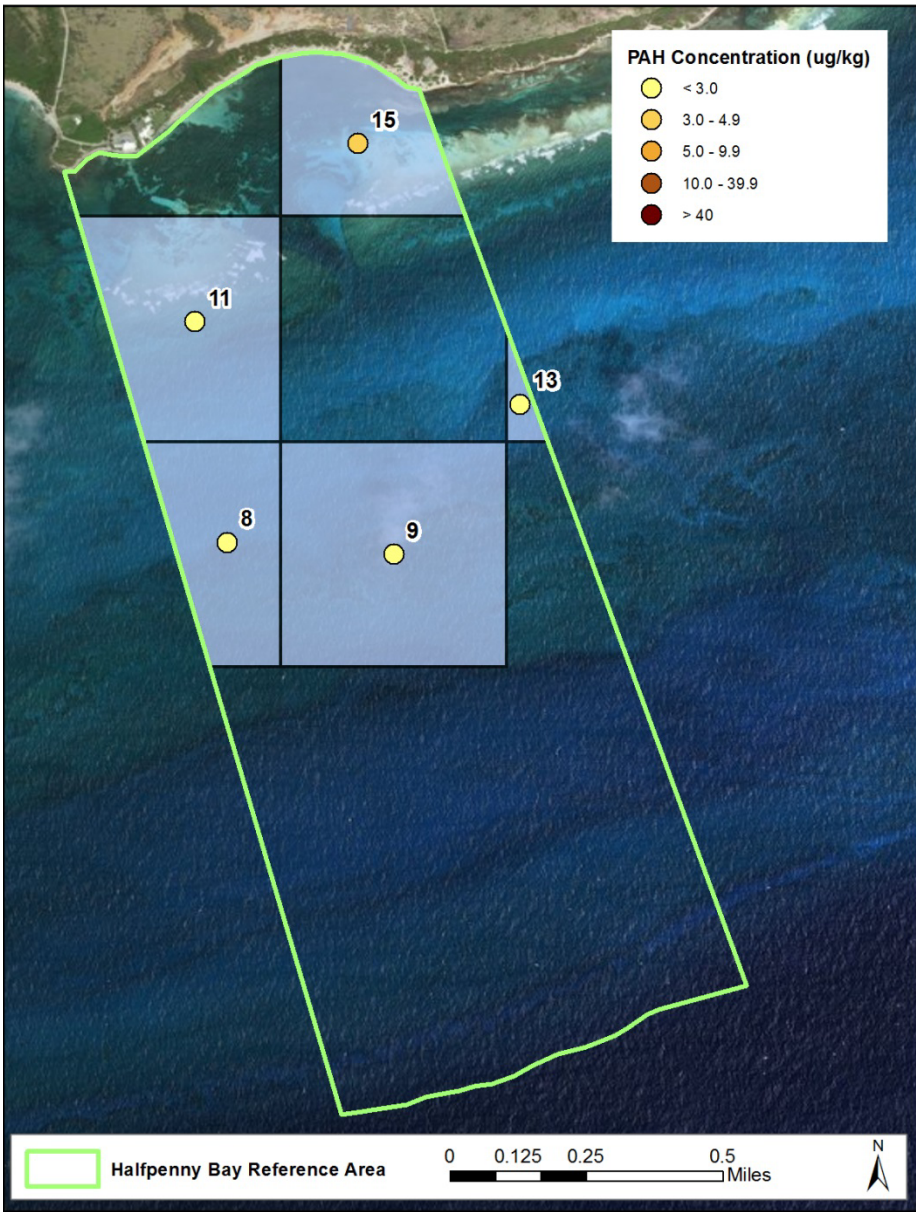
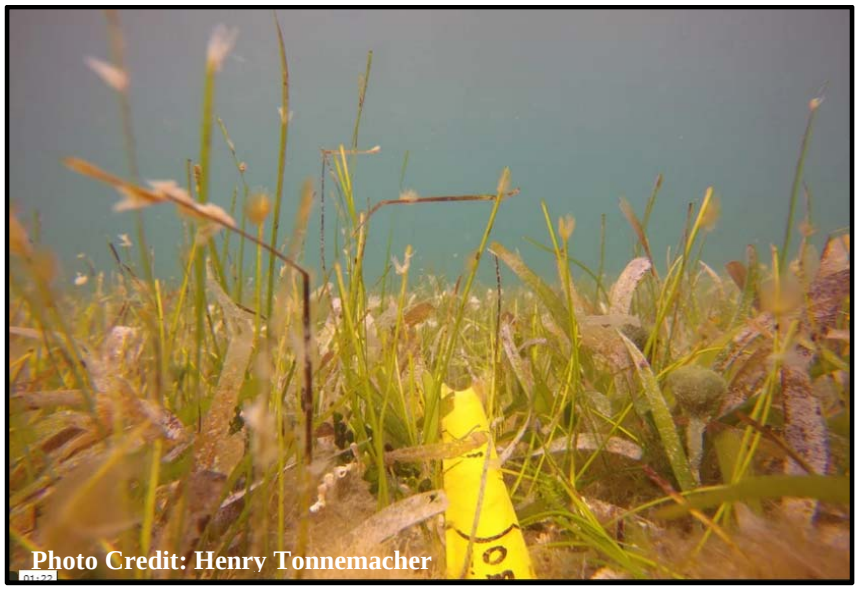


EXHIBIT 6-19. TOTAL PAH CONCENTRATIONS (µG/KG) IN SEDIMENT SAMPLES IN THE HALFPENNY BAY REFERENCE AREA



Reference site 14 (14-RS-SAV) had a very abundant seagrass bed, which prevented us from collecting any sediment samples (i.e., without uprooting seagrasses). Exhibit 6-20 is a photo of the seagrass at Reference Site 14 (coordinates 17.703401, -64.699687). The seagrass at this site consisted of *Thalassia* (56% of transect) and *Syringodium* (10% of transect) species with the rest of the transect consisting of macroalgae (e.g., *Dictyota*).

EXHIBIT 6-20. REFERENCE SITE 14 SEAGRASS BED



Near the reference site 9 (9-RS-CR) transect, the divers observed an endangered Elkhorn coral (*Acropora palmata*) species, shown in Exhibit 6-21

EXHIBIT 6-21. ELKHORN CORAL IN REFERENCE SITE 9

6.2.2 GREAT POND MANGROVE HABITAT RESULTS

The mangroves at the Great Pond reference area had many dead trees in the north and west portions of Great Pond, likely due to drought conditions and the isolation of the pond from the sedimentation in the inlet. Dead sections of Great Pond were avoided for habitat and transect analysis. The tree species in the five Great Pond transects were red mangrove (*Rhizophore mangle*), white mangrove (*Laguncularia racemosa*), black mangrove (*Avicennia germinans*) and Seaside Mahoe (*Thespesia populnea*), with red and black mangroves being the dominant species (Exhibit 6-22).

EXHIBIT 6-22. PERCENT OF SPECIES IN THE GREAT POND REFERENCE AREA ACROSS 5 SITES

GENUS	SPECIES	COMMON NAME	COUNT	PERCENT
Avicennia	*germinans*	Black Mangrove	106	39.0%
Laguncularia	*racemosa*	White Mangrove	4	1.5%
Rhizophore	*mangle*	Red Mangrove	160	58.8%
Thespesia	*populnea*	Seaside Mahoe	2	0.7%
TOTAL			**272**	**100.0%**

Additional results may be found in the accompanying report "Mangrove Forests, Great Pond, St. Croix, USVI: Canopy and Understory Structure, Composition and Health.[6]"

[6] File is labeled "Final Report_Great Pond".

SECTION 7. SUMMARY AND CONCLUSIONS

This section discusses initial interpretations of the ecological health of the Study Area and Reference Area, as compared to each other and data collected in the past.

7.1 BENTHIC HABITAT SUMMARY

Seagrass cover was similar in the Study Area and Reference Area. Non-vegetated areas were the most dominant habitat type along transects in the Study Area (~60%), while macroalgae was the predominant substrate habitat along transects in the Reference Area (Exhibit 7-10). There were no corals identified along transects in the Reference Area, while hard and soft corals covered less than one percent of the transect points in the Study Area. Macroalgae cover was twice as high in the Reference Area than the Study Area. Fish abundance was similar at both sites, but average diversity per transect analyzed was higher in the Reference Area (Exhibit 7-1).

EXHIBIT 7-1. HABITAT AND FISH ANALYSIS IN THE STUDY AREA AND REFERENCE AREA

METRIC	STUDY AREA	HALFPENNY BAY REFERENCE SITE
Seagrass (%)	20	22
Non-vegetated (%)	60	35
Corals (%)	<1	0
Algae (%)	19	43
Fish (#)	27	33
Fish Diversity (avg. # species/site)	4	8

Sediment samples in the Study Area had higher concentrations across all contaminants relative to the Reference Area. The highest concentrations in the Study Area were in the dredged channels. Exhibit 7-2 provides the average, high, and low sediment concentrations in the Reference Area, Study Area, and dredge channels separately. It was anticipated that industrialized areas would have higher contaminant concentrations than areas outside the industrialized zone. Only copper and zinc concentrations exceeded ERL toxicity threshold values, but both sites with exceedances were in the dredged channels (WB1-SA-D exceeded Cu and Zn thresholds; AB1-SA-D exceeded Cu threshold). No sites outside of the dredged channels or in the Reference Site exceeded ERL toxicity thresholds for any contaminant.

Only three sites were directly comparable to sediment chemistry data collected at the site in the past (AB1-SA-D, PA1-SA-D, and WB1-SA-D). Previous contaminants measured at the site include chromium, copper, lead, mercury, nickel, zinc, and sum of detectable PAHs.[7] All measurements were lower in this study at all sites except copper at AB1-SA-D and ∑PAH at PA1-SA-D which were both higher in this study (Exhibit 7-3).

EXHIBIT 7-2. AVERAGE CONTAMINANT CONCENTRATIONS AND RANGES IN THE STUDY AREA AND REFERENCE SITE

AREA	CONTAMINANT	AVERAGE CONCENTRATION (µG/KG)	LOWEST CONCENTRATION (µG/KG)	HIGHEST CONCENTRATION (µG/KG)
Study Area (no dredge channels)	ΣPAH (16 parent compounds)	3.7	0.3	23
	Total PAH	5.6	0.5	37
	ΣTPH	266	51	822
	Mercury	8	4	21
	Arsenic	1,809	580	3,360
	Chromium	7,963	2,390	16,500
	Copper	2.118	286	12,000
	Lead	971	349	4,750
	Nickel	3,935	1,530	7190
	Zinc	23,600	23,600	23,600
Dredge Channels Only	ΣPAH (16 parent compounds)	129	7	302
	Total PAH	540	10	1,975
	ΣTPH	89,832	269	328,161
	Mercury	48	6	124
	Arsenic	2,778	1,110	4,660
	Chromium	12,554	1,420	30,900
	Copper	24,397	623	77,300
	Lead	7,242	817	13,400
	Nickel	7,424	2070	13,300
	Zinc	220,400	71,800	369,000
Halfpenny Bay Reference Site	ΣPAH (16 parent compounds)	1.3	0.4	3.1
	Total PAH	1.9	0.7	3.9
	ΣTPH	291	180	378
	Mercury	4	3	4
	Arsenic	1,548	887	2,530
	Chromium	5,702	3,150	8,010
	Copper	1,808	315	6,730
	Lead	410	410	410
	Nickel	3,226	1,910	4,070
	Zinc	ND	ND	ND

[7] Holmes et al. (2012) or Vincente (2012) do not report which PAHs were included in the sum of detectable PAHs value.

EXHIBIT 7-3. SEDIMENT SAMPLE CONCENTRATIONS COMPARED TO AVAILABLE PAST DATA

SITE LABEL THIS STUDY	LATITUDE (WSG84)	LONGITUDE (WSG84)	SITE LABEL PREVIOUS STUDIES	LATITUDE (WSG84)	LONGITUDE (WSG84)	COMPOUND	CONCENTRATION THIS STUDY (µG/KG)	CONCENTRATION PREVIOUS STUDIES (µG/KG)**
AB1-SA-D	17.707787	-64.771751	AC1-01*	17.707778	-64.771750	Chromium	30,900	38,000
PA1-SA-D	17.694851	-64.756392	PA1-01	17.694806	-64.756389	Chromium	1,420	9,000
AB1-SA-D	17.707787	-64.771751	AC1-01*	17.707778	-64.771750	Copper	36,800	28,000
PA1-SA-D	17.694851	-64.756392	PA1-01	17.694806	-64.756389	Copper	2,040	9,000
AB1-SA-D	17.707787	-64.771751	AC1-01*	17.707778	-64.771750	Lead	7,510	300,000
PA1-SA-D	17.694851	-64.756392	PA1-01	17.694806	-64.756389	Lead	Below detection	14,000
WB1-SA-D	17.700570	-64.750652	WB1-01	17.700556	-64.750639	Lead	13,400	90,000
PA1-SA-D	17.694851	-64.756392	PA1-01	17.694806	-64.756389	Mercury	Below detection	20
WB1-SA-D	17.700570	-64.750652	WB1-01	17.700556	-64.750639	Mercury	124	590
PA1-SA-D	17.694851	-64.756392	PA1-01	17.694806	-64.756389	Sum detectable PAHs	450	Below detection
WB1-SA-D	17.700570	-64.750652	WB1-01	17.700556	-64.750639	Sum detectable PAHs	2,055	22,500
PA1-SA-D	17.694851	-64.756392	PA1-01	17.694806	-64.756389	Nickel	2,070	4,000
WB1-SA-D	17.700570	-64.750652	WB1-01	17.700556	-64.750639	Nickel	13,300	69,000
PA1-SA-D	17.694851	-64.756392	PA1-01	17.694806	-64.756389	Zinc	Below detection	20,000
WB1-SA-D	17.700570	-64.750652	WB1-01	17.700556	-64.750639	Zinc	369,000	428,000

*This site was mislabeled in our study, but has similar GPS coordinates to site AC1-01 not site AB1-01 (see Section 5.4.1).
**Concentrations are approximated from figures in Holmes et al. (2012).

7.2 MANGROVE HABITAT SUMMARY

Based on the metrics collected during this assessment, the mangrove forest on the SCRG property, along the perimeter of the Study Area is healthier than the forest at the Great Pond Reference Site (Exhibit 7-4). Sections of Great Pond where most of the mangroves were dead were excluded from transect habitat analysis. As such, the metrics (i.e., health) for Great Pond are similar to the Study Area mangroves, but may not be reflective of the entire pond.

EXHIBIT 7-4. MANGROVE FOREST HEALTH METRICS FOR THE STUDY AREA AND REFERENCE SITE

METRIC (AVERAGE)	SCRG STUDY AREA	GREAT POND REFERENCE SITE
Adult Tree Height (ft)	16.78	13.24
Diameter at Breast Height (in)	1.83	1.70
Crown Diameter (ft)	11.33	6.40
Health*	2.36	2.47
Number of Stems	2.44	2.84
Seedling/Sapling Density	12.58	6.80
*1-5 scale; 1=excellent, 2=good, 3=average, 4=unhealthy, 5=poor.		

SECTION 8. ADDITIONAL SITE DATA

This section includes a summary of studies that have been previously conducted at the site and may have data relevant for future assessments[8]. A brief discussion of the facilities and operational history at the site is provided in the Work Plan (Section 2.2).

8.1 VICENTE & ASSOCIATES

Vicente & Associates conducted investigations on May 28-30, 2002; June 9, 2003; and January 16-19, 2012. The first effort (May 2002) was in support of a natural resource injury assessment of the environment surrounding Hovensa and the alumina facility (Vicente 2012). This effort focused on characterization of the benthic community (i.e., flora and fauna) at mud bottom sites within the Study Area (Vicente 2012). The second effort, in 2003, is described as a shoreline inspection but we have been unable to locate any data associated with this effort (Vicente 2012). The 2012 effort resulted in the generation of a small amount of sediment contaminant chemistry data and visual observations (Vicente 2012; Holmes et al. 2012; Exhibit 8-1).

8.2 BIOIMPACT

In the early 1990s, contamination of bottom sediments was noted during benthic surveys conducted in support of an Environmental Site Assessment for the construction of a new dock at the Hovensa facility. Hovensa subsequently contracted BioImpact to conduct a benthic survey of the west turning basin at the Hovensa refinery in 1993 (BioImpact 1993). The survey consisted of visual observations and chemical analysis of sediment samples. Sediment contamination with lighter fraction hydrocarbons (i.e., benzene, toluene, and xylene) was confirmed using gas chromatography. Observational data include evaluations of fish and invertebrate health, sediment composition (including observations of material consisting of asphalt, tar, and tar balls), visibility, and algal cover. Geographic locations, but not coordinates, for sampling locations and visual observations are provided below in Exhibit 8-1. BioImpact concluded that oily material observed in sediment was unrecovered No. 6 oil released during Hurricane Hugo in 1989.

[8] These reports are publically available and copies have been provided with the data package.

EXHIBIT 8-1. PREVIOUS ASSESSMENT ACTIVITIES

MATRIX	PARAMETER	GENERAL LOCATION	OBSERVATIONS	SAMPLING DATE	SOURCE
Sediment	Chromium[1]	Alucroix Dock-West	~39 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Chromium	Alucroix Dock- East	~21 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Chromium	Alucroix Bay	~26 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Chromium	West of Port Authority Dock	~9 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Copper	Alucroix Dock-West	~29 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Copper	Alucroix Dock- East	~22 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Copper	Alucroix Bay	~42 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Copper	West of Port Authority Dock	~9 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	Alucroix Dock-West	~300 mg/mg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	Alucroix Dock- East	~15 mg/mg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	Alucroix Bay	~155 mg/mg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	West of Port Authority Dock	~15 mg/mg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Sum of detectable PAHs	West of Port Authority Dock	Non detectable	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Sum of detectable PAHs	West Turning Basin outfall	~23 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Sum of detectable PAHs	West Turning Basin close to outfall	~16 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Sum of detectable PAHs	West Turning Basin Dock #7	~2 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	West of Port Authority Dock	~15 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	West Turning Basin outfall	~88 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	West Turning Basin close to outfall	~120 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Lead	West Turning Basin Dock #7	~148 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Mercury	West of Port Authority Dock	~20 µg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Mercury	West Turning Basin outfall	~580 µg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Mercury	West Turning Basin close to outfall	~1200 µg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Mercury	West Turning Basin Dock #7	~200 µg/kg	January 2012	Vicente 2012; Holmes et al. 2012

MATRIX	PARAMETER	GENERAL LOCATION	OBSERVATIONS	SAMPLING DATE	SOURCE
Sediment	Nickel	West of Port Authority Dock	~5 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Nickel	West Turning Basin outfall	~70 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Nickel	West Turning Basin close to outfall	~122 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Nickel	West turning basin Dock #7	~13 mg/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Zinc	West of Port Authority Dock	~20 ng/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Zinc	West Turning Basin outfall	~430 ng/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Zinc	West Turning Basin close to outfall	~450 ng/kg	January 2012	Vicente 2012; Holmes et al. 2012
Sediment	Zinc	West Turning Basin Dock #7	~100 ng/kg	January 2012	Vicente 2012; Holmes et al. 2012
Mangroves	Health and diversity	Krauss Lagoon Channel	Stunted roots, low biomass, low diversity, and observed seedlings overgrown.	January 2012	Vicente 2012
SAV	SAV health	Krauss Lagoon Channel (Alucroix Channel, Alumina Bay), East Turning Basin, West Turning Basin	Injured propagation and destruction of colonization potential.	January 2012	Vicente 2012
Sediment/ Non-vegetated Bottom	Polychaetes, bivalves, arthropods	Dredged channels	Low abundance of infauna relative to mud bottom on NW coast.	January 2012	Vicente 2012
Water	Eutrophication	Alucroix Channel	Phytoplankton bloom, algal mats, and other abnormal growth of other macro algae.	January 2012	Vicente 2012
Sediment	Benzene, toluene, xylene	West Turning Basin	No detectable benzene, toluene, xylene.	June 1993	BioImpact 1993
Sediment	Unspecified Hydrocarbons	West Turning Basin	Unspecified hydrocarbons are listed as 1-7% of the sediment sample content and did not indicate fresh or light hydrocarbon fractions.	June 1993	BioImpact 1993
Sediment	American Petroleum Institute (API) gravity	West Turning Basin	API gravity was less than 10.	June 1993	BioImpact 1993

MATRIX	PARAMETER	GENERAL LOCATION	OBSERVATIONS	SAMPLING DATE	SOURCE
Sediment/ Non-vegetated Bottom	Oil	West Turning Basin	Thick (4-6 inch) tar layers and large (10 foot diameter) tar balls.	June 1993	BioImpact 1993

[1] List of contaminants reflects those presented in Holmes et al. (2012). Full list of analytical parameters measured by Vicente (2012) is not available.

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ATTACHMENT A. TABLES

EXHIBIT A-1. PREVIOUSLY SAMPLED DREDGE CHANNEL TRANSECTS AND SEDIMENTS WITH CURRENT SITES SAMPLED. TABLE ADAPTED FROM VICENTE ET AL., 2002 AND 2012

LATITUDE* (WGS84)	LONGITUDE (WGS84)	DEPTH (FT)	TRANSECT BEARING	TRANSECT LENGTH	STATION CODE (FROM PRIOR STUDIES)	YEAR SAMPLED	TARGETED SAMPLING SITE	SITES SAMPLED
								TPH, PAH, METALS, MERCURY, BTEX, BIOMARKER
17.694056	-64.760083	5ft - 7ft	90°	20m	SO1-1	2012		
17.696139	-64.757278	19ft-4ft	90°	20m	S01-2	2012		
17.700583	-64.747806	40ft-7ft	shore	20m+	EB01	2012		
17.698167	-64.744639	44ft-3ft	90°	20m+	EB02	2012	X	
17.693583	-64.745806	54ft-3ft	shore	20m+	EB03	2012	X	
17.690750	-64.742306	33ft-3ft	90°	20m+	EB04	2012		
17.700583	-64.748222	7ft-43ft	N,E,W,S	20m++	EBO1 S (EBo1-1)	2012		
17.700500	-64.748472	7ft-43ft	N,E,W,S	20m++	EBO1 S (Ebo1-2)	2012		
17.700250	-64.748389	7ft-43ft	N,E,W,S	20m++	EBO1 S (Ebo1-3)	2012		
17.700556	-64.747500	7ft-43ft	N,E,W,S	20m++	EBO1 S (Ebo1-4)	2012		
17.700806	-64.747472	7ft-43ft	N,E,W,S	20m++	EBO1 S (Ebo1-5)	2012		
17.708639	-64.771222	32.3ft-3ft	90°	20m++	AC1-11	2012	X	
17.688410	-64.741197	26ft-3ft	90°	20m++	EB05	2012	X	X
17.700570	-64.750652	29ft-3ft	90°	20m++	WB1	2012	X	X
17.696083	-64.748583	20ft-3ft	90°	20m++	WB2	2012	X	
17.694851	-64.756392	31ft-10ft	West	30m	PA-1	2012	X	X
17.692806	-64.754222	20ft-13ft	West	30m	PA-2	2012		

LATITUDE* (WGS84)	LONGITUDE (WGS84)	DEPTH (FT)	TRANSECT BEARING	TRANSECT LENGTH	STATION CODE (FROM PRIOR STUDIES)	YEAR SAMPLED	TARGETED SAMPLING SITE	SITES SAMPLED
								TPH, PAH, METALS, MERCURY, BTEX, BIOMARKER
17.689605	-64.753309	31ft-22ft-	West	30m	PA-3	2012	X	X
17.707778	-64.771750	34.6ft-0ft	West	20m++	AC-1	2012	X	
17.707787	-64.771751	34.3ft-3ft	West	10m	AB-1	2012	X	X
17.699917	-64.766817	35ft-3ft	East	20m+10m	AC2	2012		
17.694783	-64.765083	25ft-0ft	West	20m+10m	AC3	2012	X	
17.688167	-64.762194	11ft-12ft	90°	20m	AC4	2012		
17.676528	-64.752028	43ft-43ft	270°	100m	RT1DP	2012		
17.682389	-64.754694	18ft-16ft	90°	100m	RT1-sh	2012		
17.686667	-64.761583	14-ft	N/A	N/A	ST1	2002	X	
17.703833	-64.771194	38-ft	N/A	N/A	MT1	2002	X	
17.691389	-64.759194	12-ft	N/A	N/A	ST2	2002		
17.686917	-64.757611	14-ft	N/A	N/A	ST3	2002		
17.685472	-64.757694	14-ft	N/A	N/A	RT1	2002		
17.688444	-64.752778	7-ft	N/A	N/A	RT2	2002		
17.686611	-64.740167	14-ft	N/A	N/A	RR1	2002		
17.683694	-64.738944	40-ft	N/A	N/A	MR1	2002		

EXHIBIT A-2. TRANSECT AND SEDIMENT SAMPLING IN STUDY AREA AND REFERENCE SITES. THE SITES SAMPLED MAY HAVE DIFFERENT COORDINATES AND TRANSECT BEARINGS THAN LISTED IN THE WORK PLAN DUE TO VARIANCES DURING FIELD WORK.

TRANSECT LOCATION	GENERAL LOCATION	SITE ID #	TRANSECT START (WGS 84 DATUM)		ACTUAL TRANSECT BEARING	GENERAL HABITAT CLASSIFICATION OF CENTROID (NCCOS 2002)	SEDIMENT SAMPLE ANALYSIS		
			LATITUDE	LONGITUDE			COMPOSITE (TPH, PAH, METALS, MERCURY)	BTEX	BIOMARKER
Study Area	Shelf	1	17.667765	-64.768468	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	2	17.667560	-64.764117	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	3	17.668700	-64.758870	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	4	17.670054	-64.754825	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	5	17.673422	-64.769365	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	6	17.673212	-64.764062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	7	17.673212	-64.758062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	8	17.673795	-64.752364	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	9	17.674837	-64.746361	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	10	17.675417	-64.740372	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	11	17.675697	-64.734064	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	12	17.675777	-64.727867	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	13	17.675530	-64.722040	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	14	17.675689	-64.716473	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	15	17.675858	-64.712869	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Fringe Reef	16	17.680749	-64.773524	255	Coral Reef and Colonized Hardbottom	X		
Study Area	Fringe Reef	17	17.679235	-64.770032	288	Submerged Aquatic Vegetation	X	X	
Study Area	Fringe Reef	17*	17.678892	-64.770209	10	Coral Reef and Colonized Hardbottom	X	X	
Study Area	Shelf	18	17.679192	-64.764070	347	Coral Reef and Colonized Hardbottom	X	X	
Study Area	Shelf	19	17.679043	-64.758274	216	Coral Reef and Colonized Hardbottom	X		

TRANSECT LOCATION	GENERAL LOCATION	SITE ID #	TRANSECT START (WGS 84 DATUM)		ACTUAL TRANSECT BEARING	GENERAL HABITAT CLASSIFICATION OF CENTROID (NCCOS 2002)	SEDIMENT SAMPLE ANALYSIS		
			LATITUDE	LONGITUDE			COMPOSITE (TPH, PAH, METALS, MERCURY)	BTEX	BIOMARKER
Study Area	Shelf	20	17.679199	-64.752081	337	Coral Reef and Colonized Hardbottom	X		
Study Area	Shelf	21	17.679212	-64.746062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	22	17.679148	-64.740568	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	23	17.679263	-64.734004	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	24	17.679212	-64.728062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	25	17.679212	-64.722062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	26	17.679041	-64.716389	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	27	17.676495	-64.712971	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Kings Bay	28	17.685600	-64.770034	208	Submerged Aquatic Vegetation	X		X
Study Area	Kings Bay	29	17.685211	-64.770062	340	Submerged Aquatic Vegetation	X		X
Study Area	Ruth Island	30	17.685443	-64.764383	2	Submerged Aquatic Vegetation	X	X	
Study Area	Fringe Reef	31	17.685076	-64.757533	180	Submerged Aquatic Vegetation	X	X	
Study Area	Fringe Reef	32	17.685222	-64.752045	60	Coral Reef and Colonized Hardbottom	X	X	
Study Area	Fringe Reef	33	17.685004	-64.746242	2	Coral Reef and Colonized Hardbottom	X	X	
Study Area	Limetree Bay	34	17.685140	-64.739489	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	35	17.685212	-64.734062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	36	17.685212	-64.728062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	37	17.685212	-64.722062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Shelf	38	17.684929	-64.717320	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Kings Bay	39	17.691421	-64.775314	352	Submerged Aquatic Vegetation	X	X	
Study Area	Kings Bay	40	17.689772	-64.770533	258	Submerged Aquatic Vegetation	X	X	
Study Area	Krause Point	41	17.690198	-64.763845	100	Submerged Aquatic Vegetation	X		X
Study Area	Limetree Bay	42	17.691646	-64.758066	114	Submerged Aquatic Vegetation	X	X	X

TRANSECT LOCATION	GENERAL LOCATION	SITE ID #	TRANSECT START (WGS 84 DATUM)		ACTUAL TRANSECT BEARING	GENERAL HABITAT CLASSIFICATION OF CENTROID (NCCOS 2002)	SEDIMENT SAMPLE ANALYSIS		
			LATITUDE	LONGITUDE			COMPOSITE (TPH, PAH, METALS, MERCURY)	BTEX	BIOMARKER
Study Area	Limetree Bay	43	17.688987	-64.751692	245	Submerged Aquatic Vegetation	X		
Study Area	Fringe Reef	44	17.688679	-64.747849	348	Submerged Aquatic Vegetation	X	X	
Study Area	Canegarden Bay	45	17.691474	-64.739684	182	Submerged Aquatic Vegetation	X	X	
Study Area	Canegarden Bay	46	17.691197	-64.734100	7	Submerged Aquatic Vegetation	X	X	
Study Area	Canegarden Bay	47	17.691212	-64.728062	N/A	Submerged Aquatic Vegetation			
Study Area	Canegarden Bay	48	17.691212	-64.722062	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Canegarden Bay	49	17.690560	-64.718221	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Kings Bay	50	17.694816	-64.777424	160	Coral Reef and Colonized Hardbottom	X	X	
Study Area	Limetree Bay	51	17.691612	-64.754503	92	Submerged Aquatic Vegetation	X		
Study Area	Limetree Bay	52	17.696168	-64.758490	172	Submerged Aquatic Vegetation	X		X
Study Area	Limetree Bay	53	17.694312	-64.755012	276	Non-vegetated Bottom	X		X
Study Area	Canegarden Bay	54	17.696792	-64.739184	205	Submerged Aquatic Vegetation	X	X	
Study Area	Canegarden Bay	55	17.697212	-64.734062	N/A	Submerged Aquatic Vegetation			
Study Area	Canegarden Bay	56	17.697212	-64.728062	N/A	Submerged Aquatic Vegetation			
Study Area	Canegarden Bay	57	17.697068	-64.722300	N/A	Coral Reef and Colonized Hardbottom			
Study Area	Canegarden Bay	58	17.694745	-64.718891	N/A	Submerged Aquatic Vegetation			
Study Area	Canegarden Bay	59	17.701342	-64.738314	169	Submerged Aquatic Vegetation			
Study Area	Canegarden Bay	60	17.702171	-64.734053	339	Non-vegetated Bottom	X		
Study Area	Canegarden Bay	61	17.701928	-64.728342	N/A	Submerged Aquatic Vegetation			
Study Area	Canegarden Bay	62	17.700743	-64.723447	N/A	Submerged Aquatic Vegetation			
Reference Site	Halfpenny Bay	1	17.683774	-64.697535	N/A	Submerged Aquatic Vegetation			
Reference Site	Halfpenny Bay	2	17.681303	-64.694226	N/A	Coral Reef and Colonized Hardbottom			

TRANSECT LOCATION	GENERAL LOCATION	SITE ID #	TRANSECT START (WGS 84 DATUM)		ACTUAL TRANSECT BEARING	GENERAL HABITAT CLASSIFICATION OF CENTROID (NCCOS 2002)	SEDIMENT SAMPLE ANALYSIS		
			LATITUDE	LONGITUDE			COMPOSITE (TPH, PAH, METALS, MERCURY)	BTEX	BIOMARKER
Reference Site	Halfpenny Bay	3	17.681981	-64.688886	N/A	Coral Reef and Colonized Hardbottom			
Reference Site	Halfpenny Bay	4	17.681748	-64.685371	N/A	Coral Reef and Colonized Hardbottom			
Reference Site	Halfpenny Bay	5	17.687791	-64.698125	N/A	Submerged Aquatic Vegetation			
Reference Site	Halfpenny Bay	6	17.686911	-64.694495	N/A	Submerged Aquatic Vegetation			
Reference Site	Halfpenny Bay	7	17.686661	-64.689261	N/A	Submerged Aquatic Vegetation			
Reference Site	Halfpenny Bay	8	17.693269	-64.698902	154	Coral Reef and Colonized Hardbottom	X	X	
Reference Site	Halfpenny Bay	9	17.692859	-64.694540	354	Coral Reef and Colonized Hardbottom	X		
Reference Site	Halfpenny Bay	10	17.692411	-64.690309	N/A	Coral Reef and Colonized Hardbottom			
Reference Site	Halfpenny Bay	11	17.699057	-64.699821	311	Coral Reef and Colonized Hardbottom	X		
Reference Site	Halfpenny Bay	12	17.698815	-64.694620	N/A	Submerged Aquatic Vegetation			
Reference Site	Halfpenny Bay	13	17.696965	-64.691152	177	Coral Reef and Colonized Hardbottom	X	X	X
Reference Site	Halfpenny Bay	14	17.703401	-64.699687	8	Submerged Aquatic Vegetation			
Reference Site	Halfpenny Bay	15	17.703846	-64.695447	309	Submerged Aquatic Vegetation	X		X

*The second site 17 is the additional transect conducted near the *A. palmata* coral discovered while diving in the area.

EXHIBIT A-3. MANGROVE TRANSECT START AND END LOCATIONS IN THE STUDY AREA AND REFERENCE SITES.

TRANSECT LOCATION	SITE	TRANSECT NUMBER	TRANSECT START (WGS 84 DATUM)		TRANSECT END (WGS 84 DATUM)	
			LATITUDE	LONGITUDE	LATITUDE	LONGITUDE
Study Area	SCRG	1	17.70531	-64.7691	17.70562	-64.7689
Study Area	SCRG	2	17.70024	-64.7671	17.7003	-64.7665
Study Area	SCRG	3	17.69716	-64.7672	17.69679	-64.7675
Study Area	SCRG	4	17.69454	-64.7762	17.69478	-64.7759
Study Area	SCRG	5	17.69172	-64.7715	17.69198	-64.7717
Study Area	SCRG	6	17.6907	-64.7648	17.69115	-64.7649
Study Area	SCRG	7	17.69879	-64.7659	17.69882	-64.766
Study Area	SCRG	8	17.70625	-64.7699	17.70643	-64.7697
Study Area	SCRG	9	17.69411	-64.7649	17.69392	-64.7654
Study Area	SCRG	10	17.70256	-64.7724	17.70245	-64.7727
Study Area	SCRG	11	17.70069	-64.7688	17.70053	-64.7693
Study Area	SCRG	12	17.69297	-64.7665	17.69243	-64.7665
Study Area	SCRG	13	17.69768	-64.7653	17.69781	-64.7646
Study Area	SCRG	14	17.69819	-64.7588	17.69858	-64.7589
Study Area	SCRG	15	17.69875	-64.7567	17.69906	-64.7568
Study Area	SCRG	16	17.69786	-64.7602	17.69811	-64.7606
Reference Site	Great Pond	1	17.72307	-64.6525	17.72393	-64.6524
Reference Site	Great Pond	2	17.7265	-64.6546	17.7266	-64.6541
Reference Site	Great Pond	3	17.72332	-64.6554	17.72326	-64.6553
Reference Site	Great Pond	4	17.72347	-64.6549	17.72331	-64.6549
Reference Site	Great Pond	5	17.72511	-64.6529	17.72528	-64.6525

EXHIBIT A-4. TABLE PROVIDED TO BENTHIC FIELD TEAM REGARDING ORDER OF SITES TO VISIT, SAMPLES TO TAKE, AND LOCATION.

PRIORITIZED SITE	FIELD DAY	SITE CELL NUMBER BY AREA (MAP)	CENTROID LATITUDE (WGS84)	CENTROID LONGITUDE (WGS84)	REPLICATE TRANSECT WITHIN GRID CELL	SITE LOCATION	HABITAT	SITE CODE	RANDOMIZED TRANSECT DIRECTIONAL	COMPOSITE (C) AND BTEX (B) SAMPLES
1	1	41	17.690212	-64.763840		Study Area	Submerged Aquatic Vegetation	41-SA-SAV	100	C
2	1	40	17.689766	-64.770552		Study Area	Submerged Aquatic Vegetation	40-SA-SAV	258	C, B
3	1	39	17.691349	-64.775281		Study Area	Submerged Aquatic Vegetation	39-SA-SAV	352	C, B
4	1	50	17.694806	-64.777432	X	Study Area	Coral Reef and Colonized Hardbottom	50-SA-CR	140	C, B
5	2	30	17.685453	-64.764396		Study Area	Submerged Aquatic Vegetation	30-SA-SAV	2	C, B
6	2	28	17.685617	-64.774301		Study Area	Submerged Aquatic Vegetation	28-SA-SAV	208	C
7	2	16	17.680745	-64.773527	X	Study Area	Coral Reef and Colonized Hardbottom	16-SA-CR	255	C
8	2	17	17.679240	-64.770029		Study Area	Submerged Aquatic Vegetation	17-SA-SAV	288	C, B
9	3	31	17.685079	-64.757550		Study Area	Submerged Aquatic Vegetation	31-SA-SAV	250	C, B
10	3	19	17.679050	-64.758245	X	Study Area	Coral Reef and Colonized Hardbottom	19-SA-CR	216	C
11	3	18	17.679212	-64.764062	X	Study Area	Coral Reef and Colonized Hardbottom	18-SA-CR	347	C
12	4	42	17.691638	-64.758041		Study Area	Submerged Aquatic Vegetation	42-SA-SAV	114	C, B
13	4	52	17.696183	-64.758518		Study Area	Submerged Aquatic Vegetation	52-SA-SAV	172	
14	4	43	17.688973	-64.751682		Study Area	Submerged Aquatic Vegetation	43-SA-SAV	245	C
15	4	44	17.688684	-64.747862		Study Area	Submerged Aquatic Vegetation	44-SA-SAV	348	C, B

PRIORITIZED SITE	FIELD DAY	SITE CELL NUMBER BY AREA (MAP)	CENTROID LATITUDE (WGS84)	CENTROID LONGITUDE (WGS84)	REPLICATE TRANSECT WITHIN GRID CELL	SITE LOCATION	HABITAT	SITE CODE	RANDOMIZED TRANSECT DIRECTIONAL	COMPOSITE (C) AND BTEX (B) SAMPLES
16	5	32	17.685212	-64.752062	X	Study Area	Coral Reef and Colonized Hardbottom	32-SA-CR	60	C, B
17	5	33	17.685064	-64.746212	X	Study Area	Coral Reef and Colonized Hardbottom	33-SA-CR	2	C, B
18	5	45	17.691452	-64.739665		Study Area	Submerged Aquatic Vegetation	45-SA-SAV	182	C, B
19	6	46	17.691212	-64.734062		Study Area	Submerged Aquatic Vegetation	46-SA-SAV	7	C, B
20	6	54	17.696817	-64.739151		Study Area	Submerged Aquatic Vegetation	54-SA-SAV	205	C, B
21	6	59	17.701342	-64.738314		Study Area	Submerged Aquatic Vegetation	59-SA-SAV	169	**C**
22	6	60	17.702196	-64.733992		Study Area	Non-vegetated Bottom	60-SA-NVB	339	C
23	7	EB05	17.688417	-64.741194		Study Area	Dredged	EB05-SA-D		C, B
24	7	WB1	17.700556	-64.750639		Study Area	Dredged	WB1-SA-D		C, B
25	7	PA-1	17.694806	-64.756389		Study Area	Dredged	PA1-SA-D		C, B
26	7	PA-3	17.689583	-64.753278		Study Area	Dredged	PA3-SA-D		C, B
27	7	AB-1	17.707778	-64.77175		Study Area	Dredged	AB1-SA-D		C, B
28	8	8	17.693229	-64.698924		Reference Site	Coral Reef and Colonized Hardbottom	8-RS-CR	154	**C, B**
29	8	11	17.699105	-64.699787		Reference Site	Coral Reef and Colonized Hardbottom	11-RS-CR	311	C
30	8	14	17.703401	-64.699687		Reference Site	Submerged Aquatic Vegetation	14-RS-SAV	8	C, B
31	8	15	17.703846	-64.695447		Reference Site	Submerged Aquatic Vegetation	15-RS-SAV	309	C
Alternate		29	17.685212	-64.770062		Study Area	Submerged Aquatic Vegetation	29-SA-SAV	340	**C**
Alternate		53	17.694227	-64.755008		Study Area	Non-vegetated Bottom	53-SA-NVB	276	**C**

PRIORITIZED SITE	FIELD DAY	SITE CELL NUMBER BY AREA (MAP)	CENTROID LATITUDE (WGS84)	CENTROID LONGITUDE (WGS84)	REPLICATE TRANSECT WITHIN GRID CELL	SITE LOCATION	HABITAT	SITE CODE	RANDOMIZED TRANSECT DIRECTIONAL	COMPOSITE (C) AND BTEX (B) SAMPLES
Alternate		51	17.691602	-64.754460		Study Area	Submerged Aquatic Vegetation	51-SA-SAV	92	C
Alternate		20	17.679208	-64.752048	X	Study Area	Coral Reef and Colonized Hardbottom	20-SA-CR	337	C
Alternate		9	17.692911	-64.694495		Reference Site	Coral Reef and Colonized Hardbottom	9-RS-CR	177	C, B
Alternate		13	17.696913	-64.691129		Reference Site	Coral Reef and Colonized Hardbottom	13-RS-CR	354	C

Notes: The site ID is the site number (according to grid cell on map), the acronym for the Study Area (SA) or Reference Site (RS) and the habitat type acronym for coral reef (CR), non-vegetated bottom (NVB), submerged aquatic vegetation (SAV), or dredged channel (D). The dredged channel sampling locations use a slightly different code; instead of a cell number first, they use the site code they were given in prior studies.

EXHIBIT A-5. KEY PROJECT PERSONNEL, CONTACT INFORMATION, AND RESPONSIBILITIES

TITLE	NAME*	COMPANY	TELEPHONE	EMAIL ADDRESS	RESPONSIBILITIES
Program Manager	Robert Unsworth	IEc	617-354-0074	Unsworth@indecon.com	Oversee overall sampling program and project.
Project Manager 1	Ann Jones	IEc	617-354-0074	Ajones@indecon.com	Oversee Work Plan development, contracting, field work, data, and final report. Communication with DPNR.
Project Manager 2	Heather Ballestero	IEc	617-354-0074	Hballestero@indecon.com	Oversee Work Plan development, contracting, field work, data, and final report. Daily communication with field teams.
Quality Assurance Manager (QAM)	Christopher Lewis	IEc	617-354-0074	Clewis@indecon.com	Oversee implementation of quality assurance and quality control measures.
Field Team Leader 1	Hank Tonnemacher	Seven Seas, Ltd.	340-642-7816	Go7seas@gmail.com	Coral, SAV, non-vegetated habitat assessments, fish surveys, sediment sampling. Daily updates to USVI, Pinnacle, and IEc.
Dive Assistant	Richard Berey	CoastWorks	340-773-4909	rwberey@icloud.com	Coral, SAV, non-vegetated habitat assessments, fish surveys, sediment sampling. Daily updates to USVI, Pinnacle, and IEc.
Field Team Leader 2	Brian Daley	Geographic Consulting	340-277-7804	bdaley@geographicconsulting.com	Mangrove Assessment, fish surveys, sediment sampling. Daily updates to SCRG and IEc.
Vessel Manager	Eddy Lavarini	Cruzan Maritime Services, LLC	340-643-4025	cruzanmaritime@gmail.com	Coordinate vessel traffic, transport divers in Study Area.
Analytical Laboratory	Wendy Wong	NewFields/ Alpha Analytical	781-681-5040 x118	wwong@newfields.com	Sediment analysis, data review
Project Reviewer	Norman Williams	USVI DPNR	340-773-1082	norman.williams@dpnr.vi.gov	Project oversight, Work Plan approval, permitting
Project Contact	Carey Guilbeau	Pinnacle	340-626-2521	CGuilbeau@hovensa.com	Project contracting, site access and logistics
Project Contact	Jehangir Zakaria	SCRG	340-643-0404	jzakaria@stxrenaissance.com	Site access to SCRG shorelines for mangrove assessment.