SIRIUS RESORT AND MARINA

CORAL BAY, ST. JOHN, U.S.V.I.

SHEET	SHEET TITLE	2015-06-03 ISSUE	2015-11-02 SUBMITTAL	2016-04-18 SUBMITTAL	2016-06-14 SUBMITTAL		
SHT–01	COVER SHEET AND DRAWING INDEX	■	☒	☒	■		
SHT–02	VICINITY AND LOCATION MAPS	■	☒	■	■		
SHT–03	GENERAL NOTES	■	■	☒	☒		
SHT–04	EXISTING CONDITIONS AND DEMO PLAN	■	■	■	■		
SHT–05	GENERAL ARRANGEMENT PLAN	■	☒	☒	☒		
SHT–06	BOATYARD PLAN	■	☒	☒	■		
SHT–07	MARINA PLAN	■	☒	☒	☒		
SHT–08	DREDGING & BOAT RAMP SECTIONS	■	☒	☒	■		
SHT–09	TYPICAL BULKHEAD SECTION	■	■	☒	■		
SHT–10	TYPICAL DOCK SECTION	■	■	☒	■		
SHT–11	WAVE ATTENUATOR DOCK SECTION	■	☒	☒	■		
SHT–12	TYPICAL DOCK DETAILS		■	■	■		
SHT–13	TYPICAL DOCK DETAILS		■	■	■		
SHT–14	AIDS TO NAVIGATION PLAN	■	■	■	■		

PERMIT SUBMITTAL
14 JUNE 2016
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LEGEND:

■ INDICATES DRAWINGS ISSUED

☒ INDICATES DRAWINGS MODIFIED FROM PREVIOUS SUBMITTAL

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VICINITY MAP
SCALE: NTS

LOCATION MAP
SCALE: NTS

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SHT-02 **VICINITY AND LOCATION MAPS**	DATE: 2016-06-14 moffatt & nichol	**SIRIUS RESORT & MARINA**

GENERAL NOTES
ALL ELEVATIONS SHOWN ON DRAWINGS REFERENCED TO MEAN SEA LEVEL (MSL).

1. THE TOPOGRAPHIC AND BATHYMETRIC INFORMATION DEPICTED REPRESENTS THE SURVEY MADE BY MARVIN BERNING AND ASSOCIATES ON MAY 10, 2007 AND NOVEMBER 2014, AND CAN ONLY INDICATE THE GENERAL CONDITIONS EXISTING ON SAID DATES.

2. TIDAL DATUM RELATIONSHIP AS FOLLOWS:

MEAN HIGHER HIGH WATER	0.46 FEET
MEAN HIGH WATER	0.37 FEET
MEAN SEA LEVEL	0.00 FEET
MEAN LOW WATER	−0.35 FEET
MEAN LOWER LOW WATER	−0.43 FEET

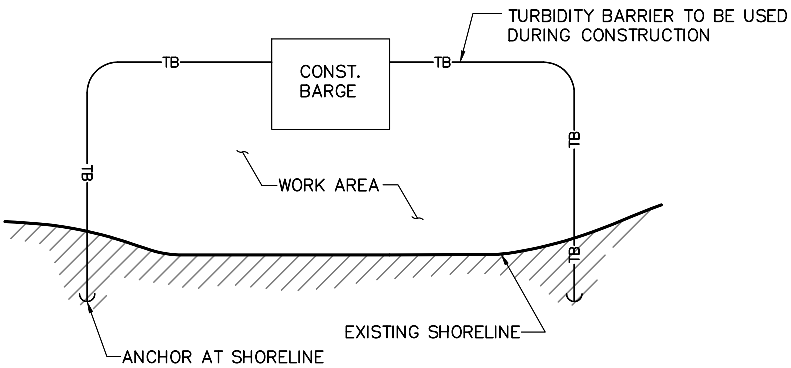
GENERAL CONSTRUCTION – BEST MANAGEMENT PRACTICES
1. ALL WORK WILL ADHERE TO PERFORMANCE REQUIREMENTS OF THE CLEAN WATER ACT, SECTION 404 PERMIT AND SECTION 401 WATER QUALITY CERTIFICATION. NO IN–WATER WORK WILL BEGIN UNTIL AFTER ISSUANCE OF REGULATORY AUTHORIZATIONS.

2. THE CONSTRUCTION CONTRACTOR IS RESPONSIBLE FOR PREPARATION OF AN ENVIRONMENTAL PROTECTION PLAN. THE PLAN WILL BE SUBMITTED AND IMPLEMENTED PRIOR TO THE COMMENCEMENT OF ANY CONSTRUCTION ACTIVITIES. THE PLAN WILL IDENTIFY CONSTRUCTION ELEMENTS AND RECOGNIZE SPILL SOURCES AT THE SITE. THE PLAN WILL OUTLINE BMPS, RESPONSIVE ACTIONS IN THE EVENT OF A SPILL OR RELEASE, AND NOTIFICATION AND REPORTING PROCEDURES. THE PLAN WILL ALSO OUTLINE CONTRACTOR MANAGEMENT ELEMENTS SUCH AS PERSONNEL RESPONSIBILITIES, ACTION AREA SECURITY, SITE INSPECTIONS, AND TRAINING.

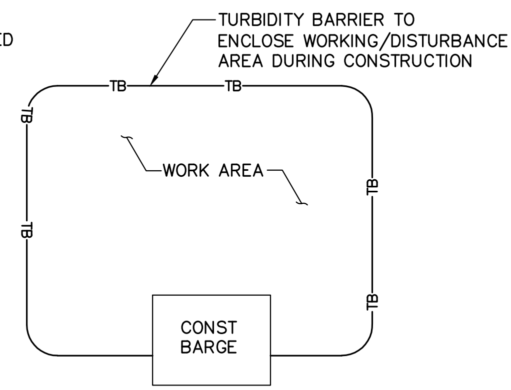
3. BARGE OPERATIONS WILL BE RESTRICTED TO TIDAL ELEVATIONS ADEQUATE TO PREVENT GROUNDING OF A BARGE.

TURBIDITY BARRIER NOTES
1. THE CONTRACTOR SHALL FURNISH, INSTALL AND MAINTAIN TURBIDITY CONTROL BARRIERS AROUND THE WORK AREA AS NECESSARY. THE PURPOSE OF THE BARRIER IS TO AVOID ANY DEBRIS FROM GOING INTO THE MAIN WATERS. THE CONTRACTOR HAS THE OPTION TO ENCLOSE THE ENTIRE WATERSIDE OF THE SITE, WITHIN THE LIMITS OF DISTURBANCE, OR TO INSTALL AND MOVE THE BARRIER IN STAGES. THE CONTRACTOR SHALL MAINTAIN SUCH BARRIERS AT ALL TIMES IN THE AREAS WHERE WORK IS IN PROGRESS.

2. DURING DREDGING, THE CONTRACTOR SHALL MONITOR THE TURBIDITY LEVELS TO ENSURE THAT TERRITORIAL WATER QUALITY STANDARDS ARE MAINTAINED AND CONSTRUCTION METHODS ARE IN ACCORDANCE WITH THE PERMITS.



ALONG SHORE
PLAN



OFF SHORE
PLAN

DETAIL – TURBIDITY CONTROL BARRIER

QUANTITY SUMMARY TABLE	
ITEM	QUANTITY
DREDGING	1,200 CY
DREDGING (ALLOWABLE OVERDREDGE)	260 CY
FILL TO MHWL	340 CY
FILL ABOVE MHWL	2,760 CY
LENGTH OF BULKHEAD	720 LF
FIXED DOCK AREA	13,200 SQ. FT.
FLOATING DOCK AREA	28,290 SQ. FT.
TOTAL DOCK AREA	41,490 SQ. FT.
DOCK AREA OVER HALOPHILA STIPULACE	9,825 SQ. FT.
DOCK AREA OVER HALOPHILA STIPULACE/THALSSIA TESTUDINUM	1,999 SQ. FT.
DOCK AREA OVER H.DICIPIENS/H.STIPULACEA	4,956 SQ. FT.

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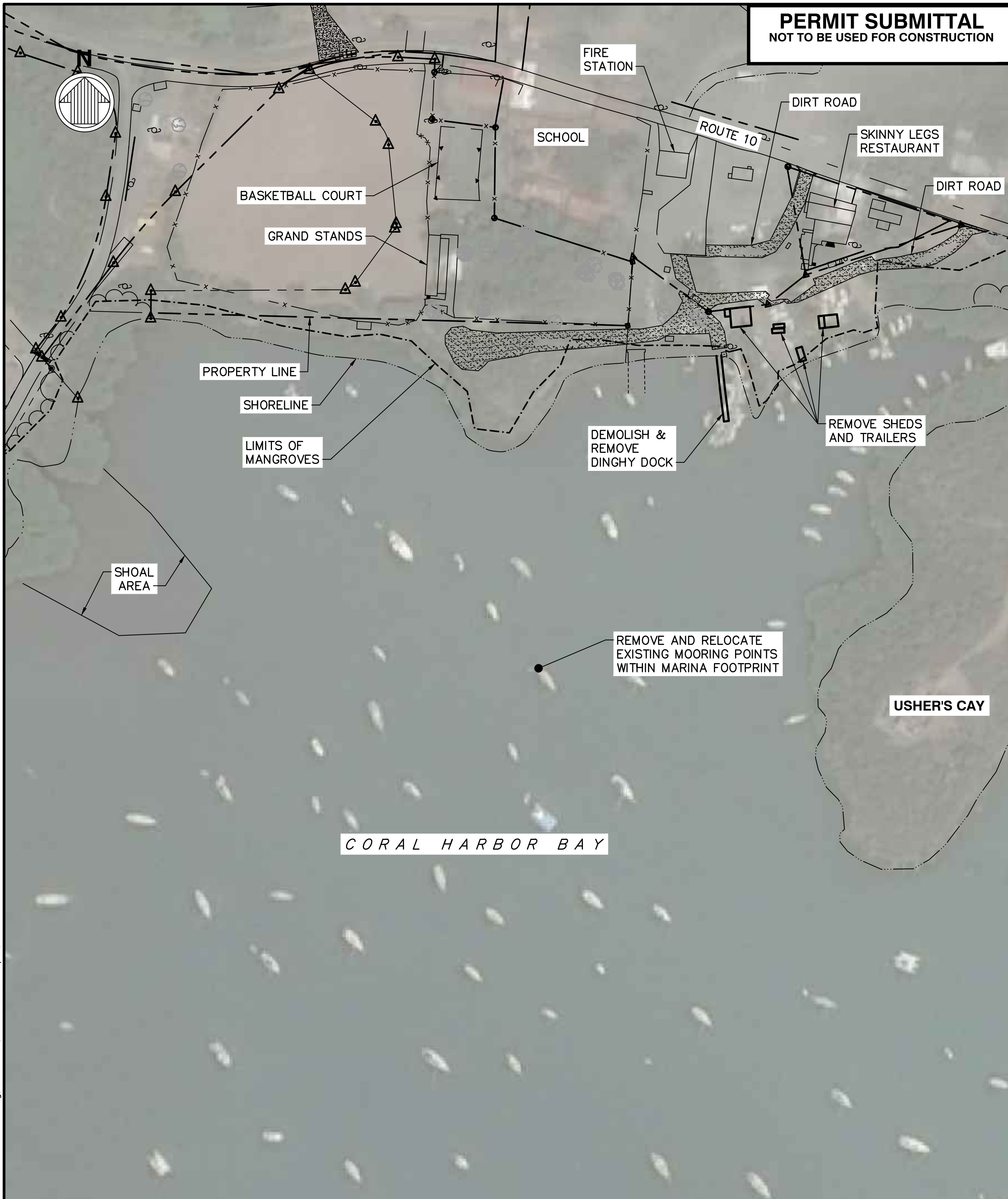

NOTES
1. ALL PRIVATE MOORING SYSTEMS SHALL BE RELOCATED IN ACCORDANCE WITH OWNER.

100' 0' 100' 200'
SCALE: 1"=200'

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SHT-04 **EXISTING CONDITIONS AND DEMO PLAN**	DATE: 2016–06–14 moffatt & nichol	**SIRIUS RESORT & MARINA**

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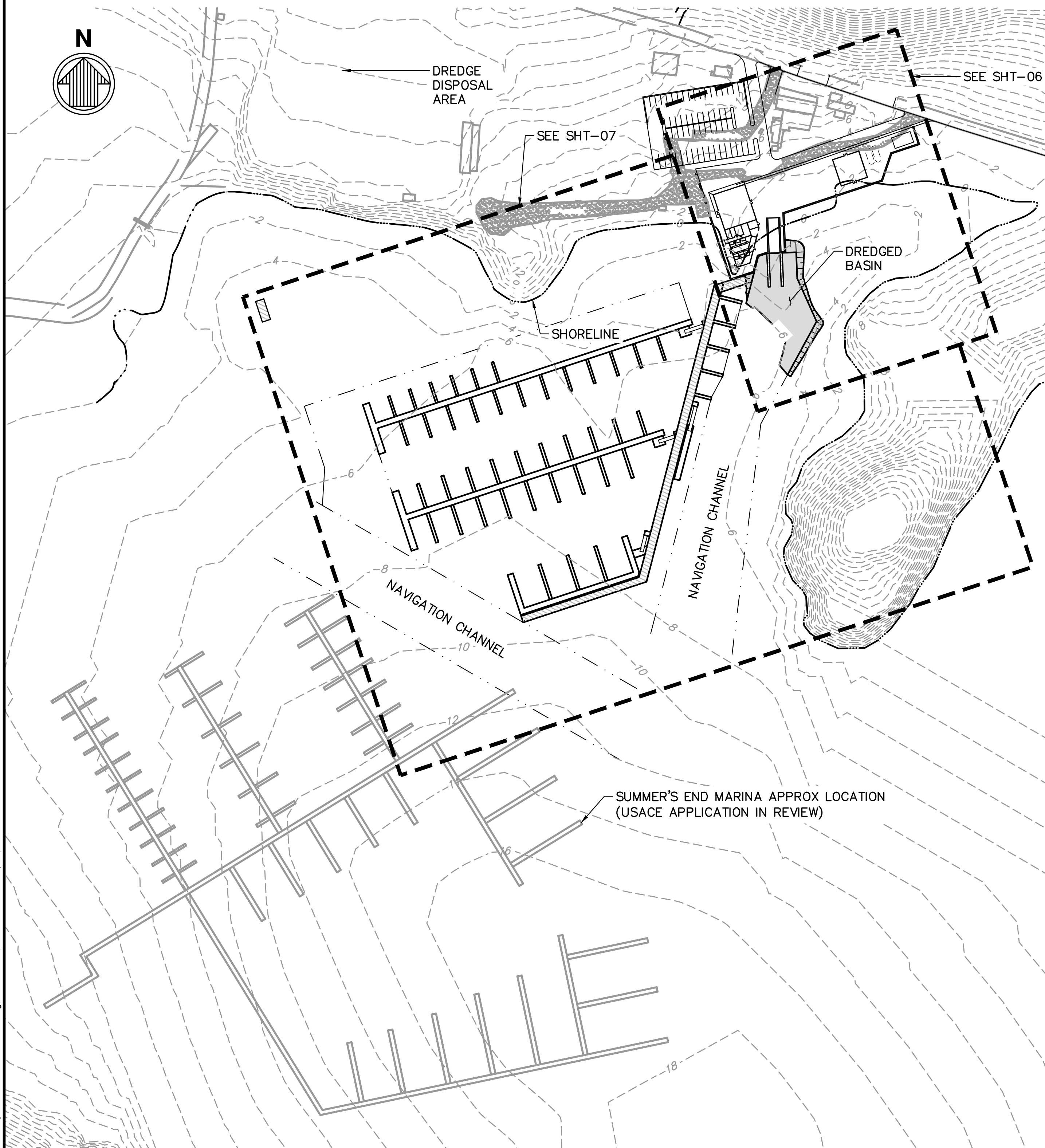

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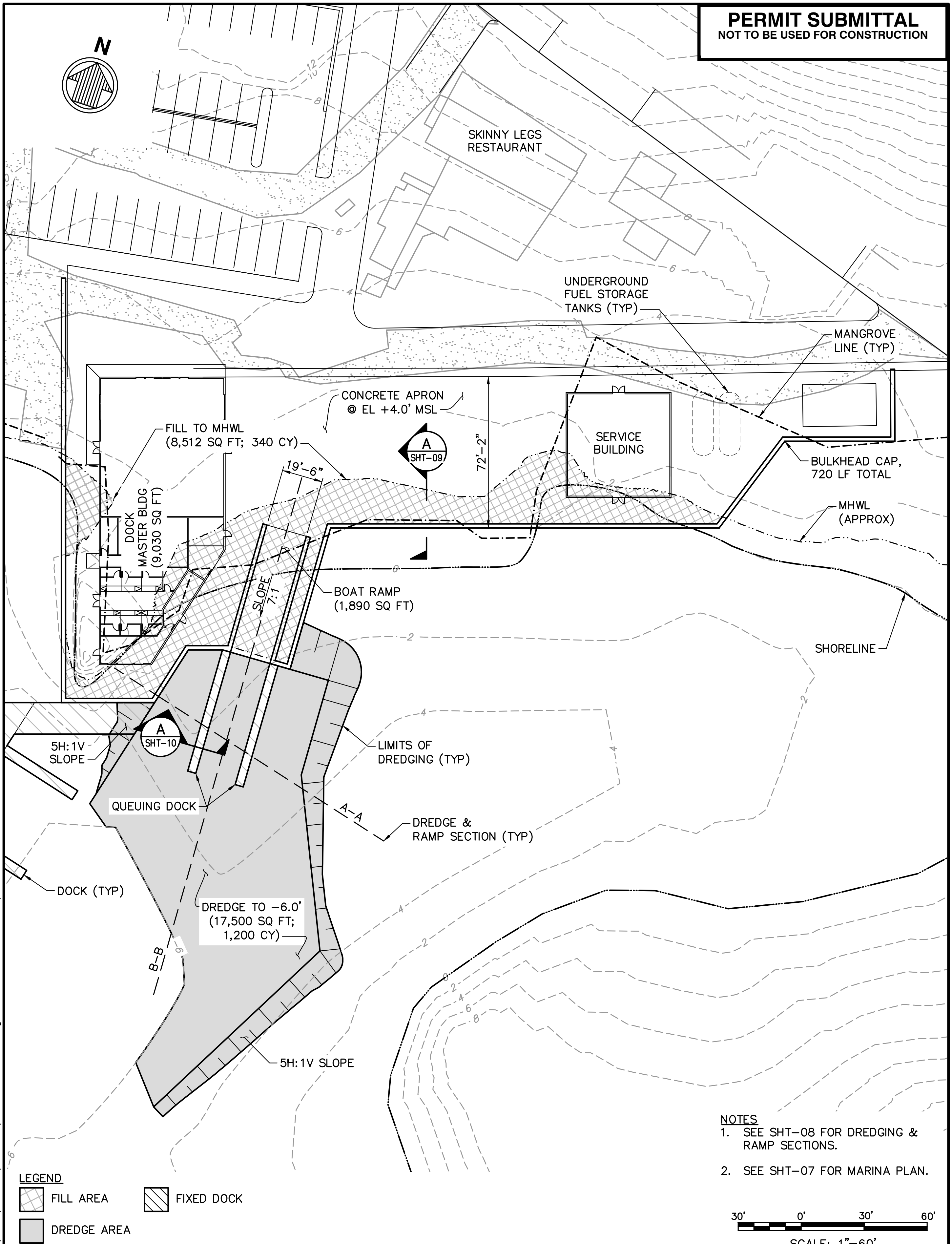
SHT-05 **GENERAL ARRANGEMENT PLAN**	DATE: 2016-06-14 moffatt & nichol	**SIRIUS RESORT & MARINA**



SHT-06
BOATYARD PLAN

DATE: 2016-06-14

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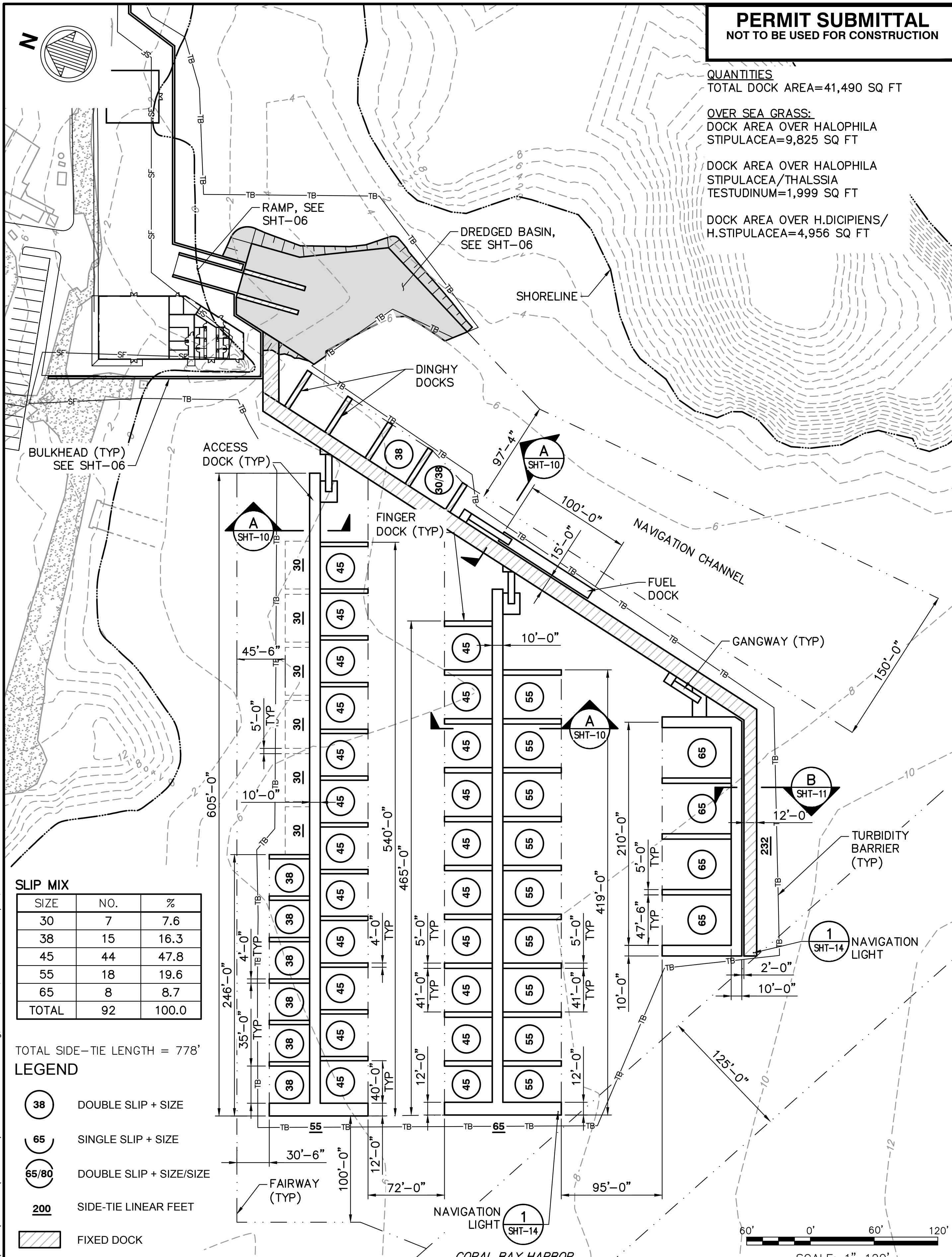

QUANTITIES
TOTAL DOCK AREA=41,490 SQ FT

OVER SEA GRASS:
DOCK AREA OVER HALOPHILA STIPULACEA=9,825 SQ FT

DOCK AREA OVER HALOPHILA STIPULACEA/THALSSIA TESTUDINUM=1,999 SQ FT

DOCK AREA OVER H.DICIPIENS/ H.STIPULACEA=4,956 SQ FT

SLIP MIX

SIZE	NO.	%
30	7	7.6
38	15	16.3
45	44	47.8
55	18	19.6
65	8	8.7
TOTAL	92	100.0

TOTAL SIDE-TIE LENGTH = 778'

LEGEND

- 38 — DOUBLE SLIP + SIZE
- 65 — SINGLE SLIP + SIZE
- 65/80 — DOUBLE SLIP + SIZE/SIZE
- 200 — SIDE-TIE LINEAR FEET
- FIXED DOCK

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SHT-07
MARINA PLAN

DATE: 2016-06-14

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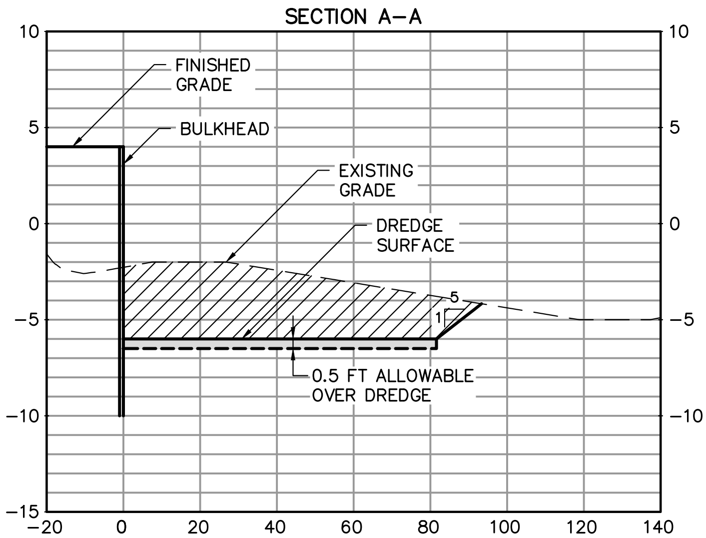

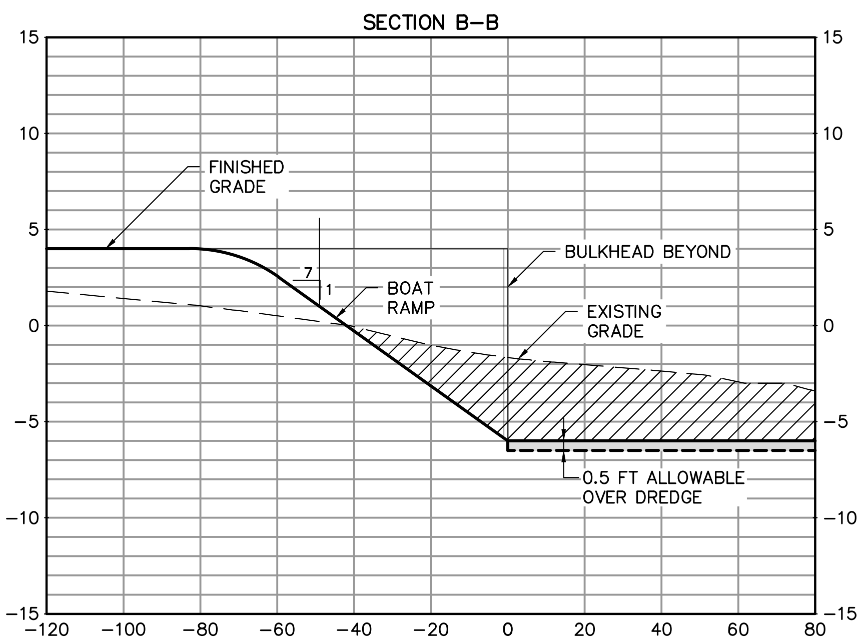

NOTES
1. SEE SHT–06 FOR PLAN.
2. VERTICAL EXAGGERATION 5:1

QUANTITIES
1. DREDGE VOLUME= 1,200 CY
2. OVERDREDGE VOLUME= 260 CY (0.5 FT)

25' 0' 25' 50'
HORIZONTAL SCALE: 1"=50'

SHT-08
DREDGING & BOAT RAMP SECTIONS

DATE: 2016–06–14

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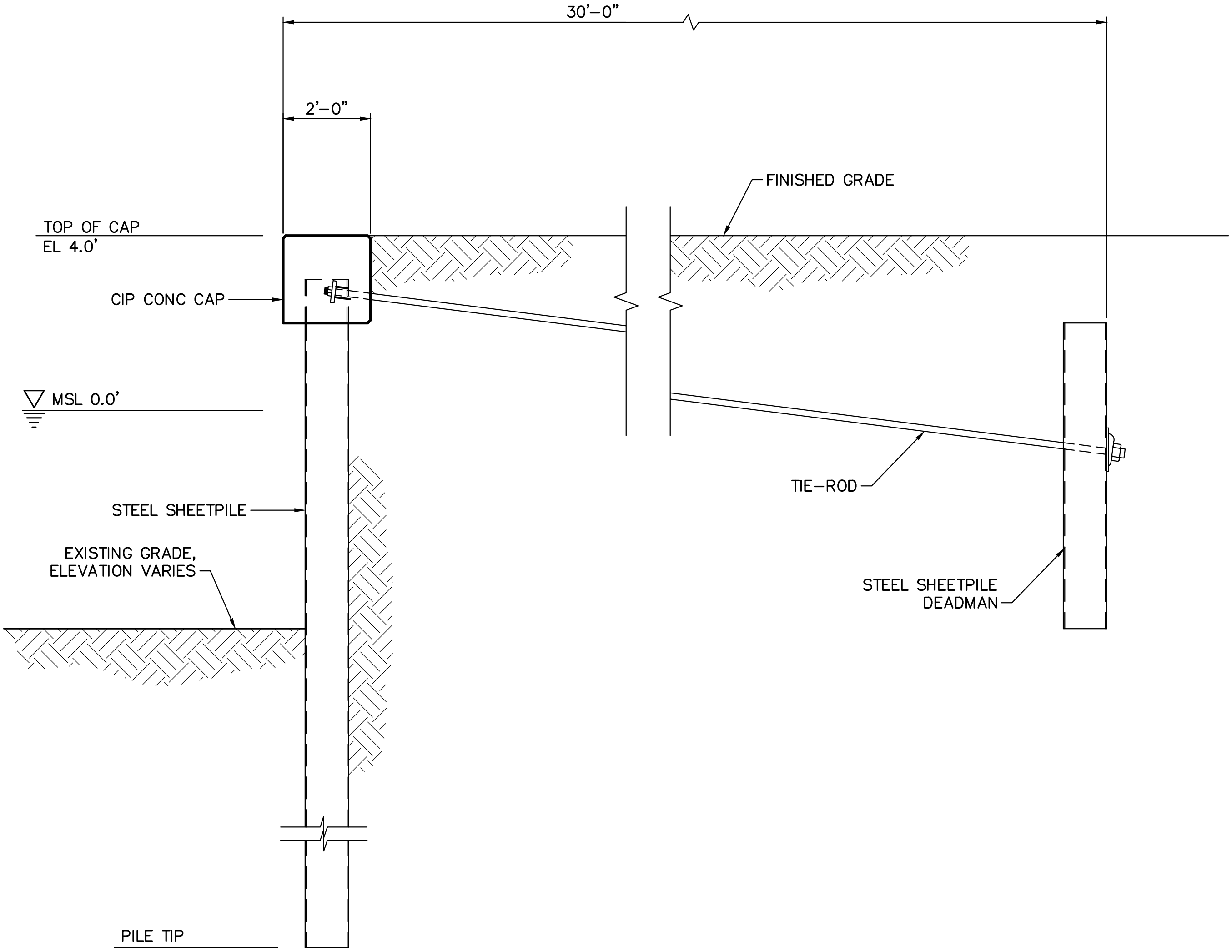

A SHT–06 SECTION
SCALE: 1/4"=1'–0"

2'–0" 0'–0" 2'–0" 4'–0"
SCALE: 1/4"=1'–0"

SHT-09
TYPICAL BULKHEAD SECTION

DATE: 2016–06–14

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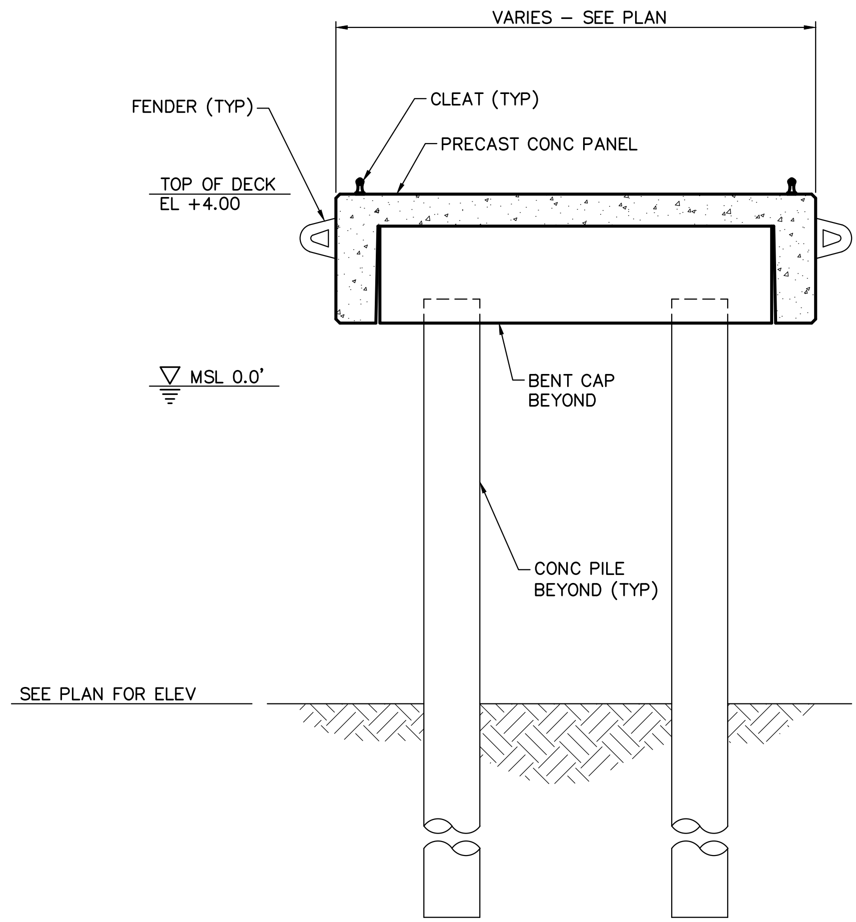

A SHT-07 SECTION
SCALE: 1/4"=1'-0"

2'-0" 0'-0" 2'-0" 4'-0"
SCALE: 1/4"=1'-0"

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SHT-10
TYPICAL DOCK SECTION

DATE: 2016-06-14

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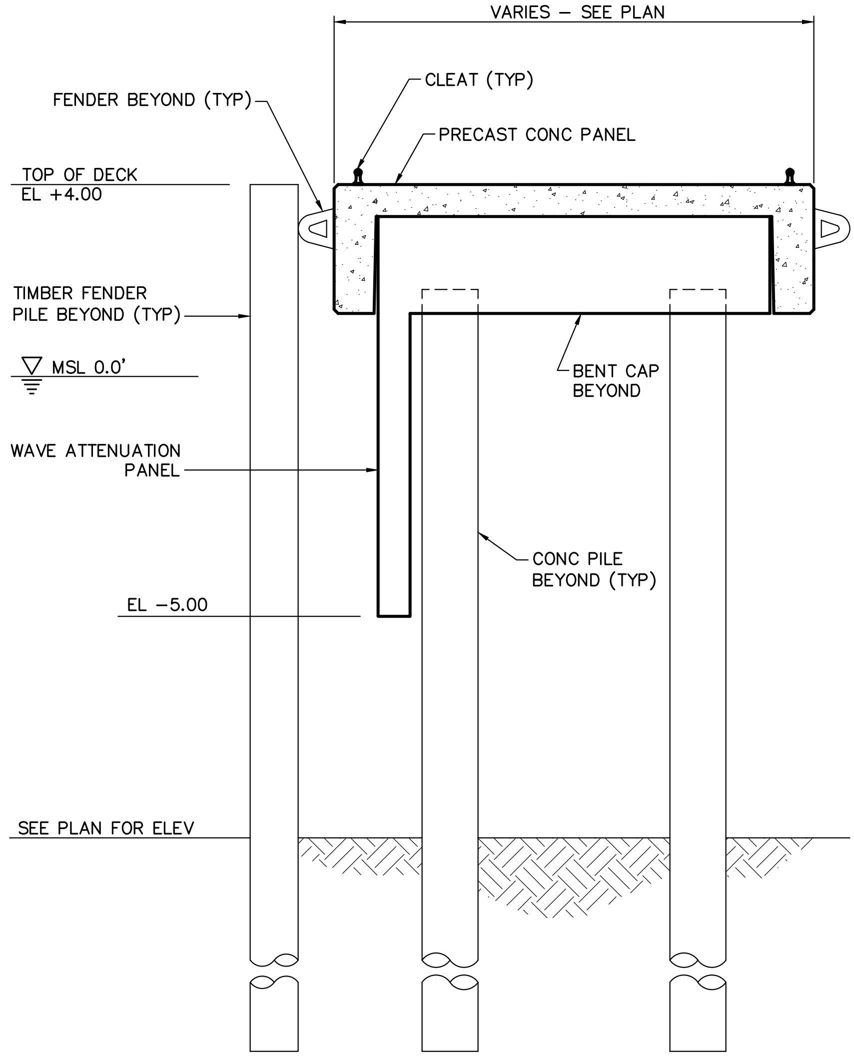

B
SHT-07
SECTION
SCALE: 1/4"=1'-0"

2'-0" 0'-0" 2'-0" 4'-0"
SCALE: 1/4"=1'-0"

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SHT-11
WAVE ATTENUATOR DOCK SECTION

DATE: 2016–06–14

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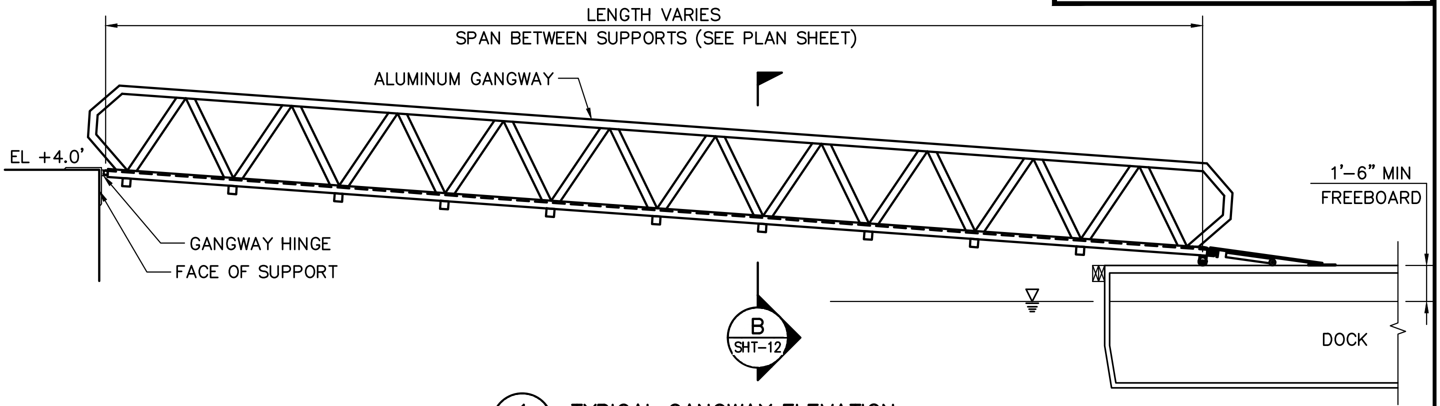
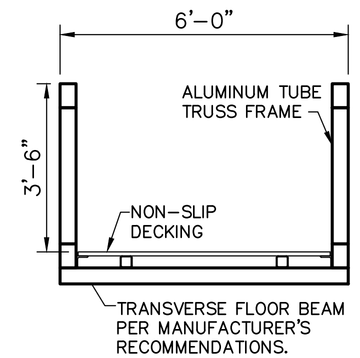
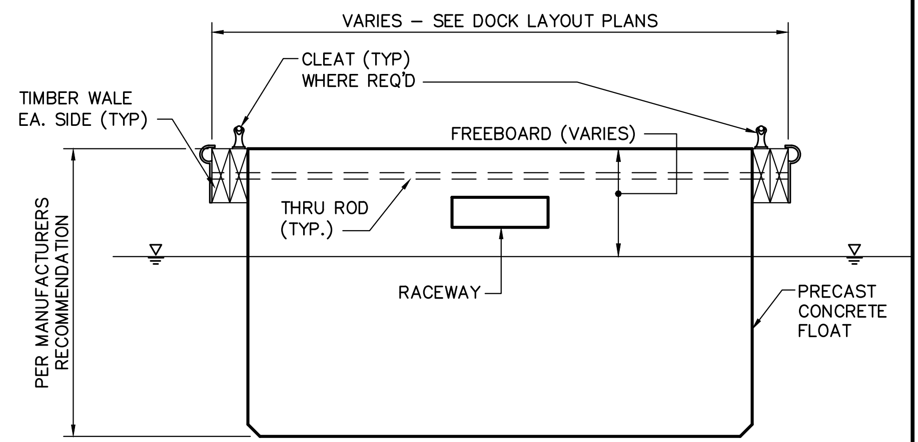


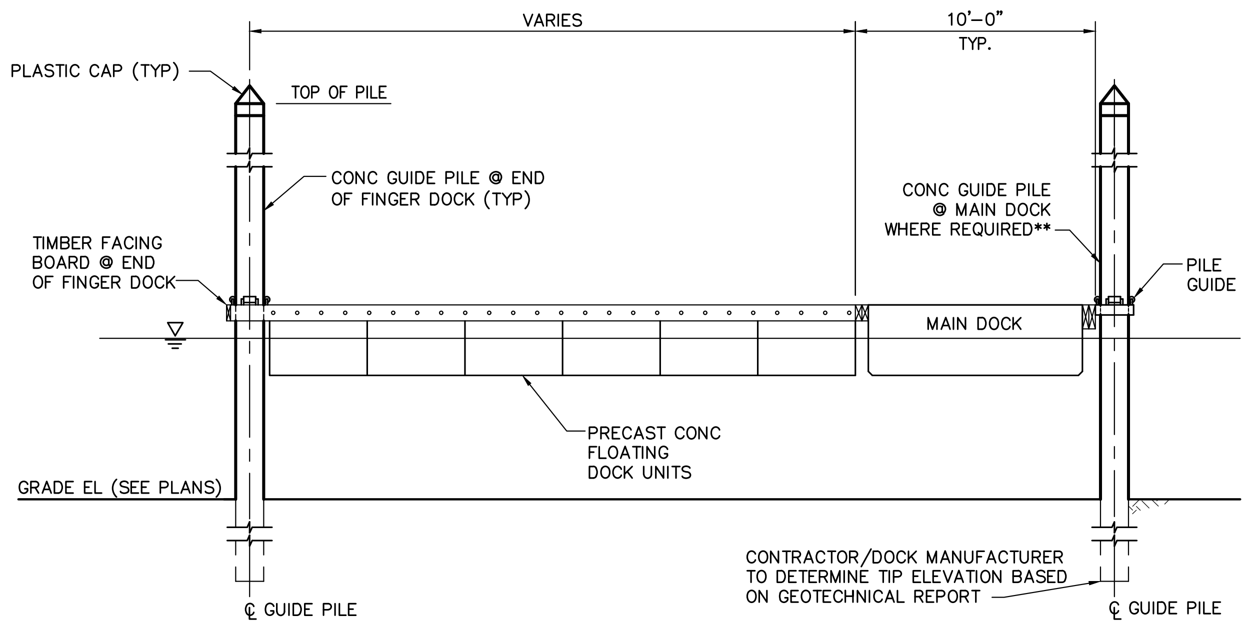
1 SHT–12 TYPICAL GANGWAY ELEVATION
SCALE: 1/8" = 1'–0"



B SHT–12 TYPICAL GANGWAY SECTION
SCALE: 1/4" = 1'–0"



A SHT–12 TYPICAL FLOATING DOCK SECTION
SCALE: 3/8" = 1'–0"



**NOTE:
CONTRACTOR SHALL DETERMINE LOCATIONS OF MAIN PIER GUIDE PILES BASED ON DOCK MANUFACTURER'S RECOMMENDATIONS

2 SHT–12 TYPICAL FINGER PIER ELEVATION
SCALE: 1/8" = 1'–0"

4'–0" 0'–0" 4'–0" 8'–0"
SCALE: 1/8"=1'–0"

2'–0" 0'–0" 2'–0" 4'–0"
SCALE: 1/4"=1'–0"

2'–0" 0'–0" 1'–0" 2'–0"
SCALE: 3/8"=1'–0"

SHT-12
TYPICAL DOCK DETAILS

DATE: 2016–06–14

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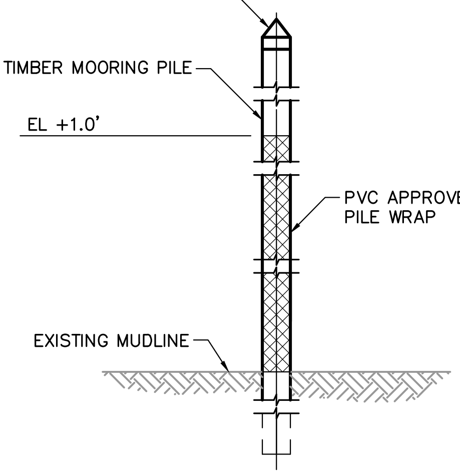
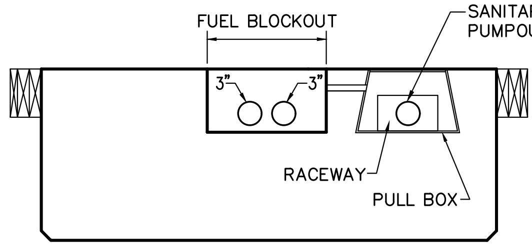


1 SHT-13 TIMBER MOORING PILE DETAIL
SCALE: 1/8" = 1'-0"



A SHT-13 TYPICAL FUEL FLOATING DOCK SECTION
SCALE: 1/2" = 1'-0"

4'-0" 0'-0" 4'-0" 8'-0"
SCALE: 1/8"=1'-0"

1'-0" 0'-0" 1'-0" 2'-0"
SCALE: 1/2"=1'-0"

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SHT-13
TYPICAL DOCK DETAILS

DATE: 2016-06-14

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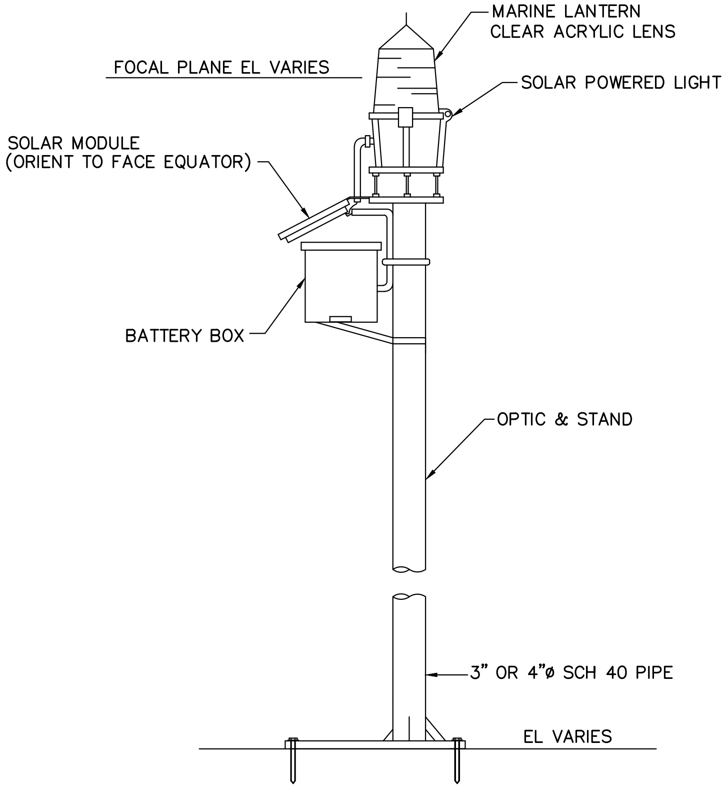

1
SHT-07
DETAIL
SCALE: 1/2"=1'-0"

1'-0" 0'-0" 1'-0" 2'-0"
SCALE: 1/2"=1'-0"

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SHT-14
AIDS TO NAVIGATION PLAN

DATE: 2016-06-14

moffatt & nichol

SIRIUS RESORT & MARINA

Response to EPA Letter to USACE

Comment #1

> This is in reference to Permit Application No. SAJ-1982-05019 (SP-JCM) by Mr. Rory Calhoun for the proposed construction of a private commercial offshore marina and ancillary facilities at Coral Bay, St. John, U.S. Virgin Islands. The Environmental Protection Agency (EPA) has reviewed the public notice for this project and referenced it to available information regarding environmental resources at Coral Bay, as well as to other commercial marina facilities being proposed for this general area. Based on our review, EPA is very concerned that the proposed project will result in significant impacts to the aquatic resources present at Coral Bay. EPA therefore recommends the denial of a Department of the Army permit for this project. This letter is intended to satisfy the requirements of both Part IV 3(a) and 3(b) of the Section 404(q) MOA between our two agencies.

Sirius Marina believes the EPA would have been able to better evaluate the projects and its potential impacts if they would have accessed the actual Environmental Documents prepared for this Permit application. These documents are readily available and a pdf of the EAR is attached.

Using the public notice as a guide for understanding the actual site conditions shows a woeful lack of scholarship and appropriate level of due diligence performed by the EPA in this matter. Furthermore, using information from older, larger failed projects that have been proposed for the greater Coral Bay area – especially those like the Summer's End project that failed to use appropriate measures of ecological analysis or show any avoidance and minimization of project impacts are clearly not useful for comparison with the current project.

Sirius Marina strongly believe that this smaller, carefully designed project strikes a balance between the environment and the various stakeholders and user groups in the region. The current project carefully vetted a number of alternatives and selected the most environmentally friendly project carefully avoiding and minimizing project impacts wherever practicable. They also believe that this project follows in the spirit of protecting the greater Coral Bay ecosystem and when constructed will result in significant environmental benefits to the Bay. Thus, the project will ultimately have a net positive – not negative – impact to the aquatic resources and biotic habitats present at Coral Bay.

Comment #2

> EPA is very concerned that the described work will result in significant impacts to the aquatic resources present at Coral Bay. Coral Bay is an enclosed harbor surrounded by mangroves. The bay serves as a nursery ground and provides habitat for numerous species. It also contains extensive seagrass beds and submerged aquatic vegetation that provide food and foraging habitat to endangered sea turtles and serve as nursery for commercially valuable fish stocks. Numerous coral species are found in the area, and the bay has been documented as a black tip, lemon and nurse shark nursery area. In addition to the seagrass and mangrove habitats at Coral Bay, numerous coral species are found nearby, including *Acropora palmata*, *Acropora cervicornis*, and *Orbicella annularis*, which are listed as threatened under the Endangered Species Act. Despite these valuable resources in the area, the U.S. Virgin Islands

The above comment is rife with numerous errors that precludes the reader from being able to carefully evaluate the resources present and the potential impacts to those resources.

Firstly, Coral Bay has been mostly denuded of its native mangrove vegetation with more 50% of the current shoreline being devoid of mangrove vegetation. Secondly, while part of the Bay contains seagrass, a majority of the Bay bottom within the footprint of the project is devoid of any seagrasses or submergered aquatic vegetation. This is directly associated with the poor water quality associated with the upper, northeastern most reaches of the Bay which is highly turbid and highly polluted. Lastly, the coral species listed are not found in the project area or imediately adjacent to the project. The closest coral resources (which are not ESA listed species) to the project area are located on the far side of the Bay some 0.4 miles away. The closest ESA listed coral species are located slightly more than a half mile to the south-southeast of the project area. No impacts to coral resources are anticipated whatsoever, as a result of this project.

Comment #3

continued intense use of Coral Bay without a formal management plan has resulted in impacts from improper mooring and anchoring of vessels, plus additional impacts associated with improper waste disposal. In addition, developments on the lands surrounding the bay have increased the levels of pollutants and sedimentation that reach the harbor. EPA believes that the construction of the proposed marina has a significant potential to escalate the environmental impairment of Coral Bay.

Sirius Marina believes that it is precisely because this Bay has been developed without a plan, without proper waste disposal – especially human waste via pump-out facilities, illegal mooring by live-aboard boats that have caused irreparable harm to seagrass resources in the Bay, and finally a lack of proper on-land storm water management program – in tandem these factors have all led to the slow but steady degradation to water quality and concomitant degradation to the aquatic resources in the Bay and vicinity. Sirius Marina's marine consultants can attest that while performing the submerged aquatic vegetation studies in the northernmost portion of Coral Bay that this water was among the most polluted, dirty, foul smelling water that they had ever dived and feel lucky to have escaped these surveys without becoming ill.

On the contrary to EPA's belief, this project when implemented will greatly reduce and not escalate impairment of these resources.

Comment #4

Coral Bay was selected as a priority site for a U.S. Coral Reef Task Force Local Action Strategy due to its valuable environmental resources and the significant environmental impacts occurring by human activities in the area. Such designation led to significant investments by the National Oceanic and Atmospheric Administration (NOAA) and EPA in an effort to reduce and reverse environmental impacts at Coral Bay. For example, EPA awarded a Community Action for a Renewed Environment grant to the

As locals to the Coral Bay area, Sirius Marina is a strong supporters of all actions to help restore Coral Bay back to a state much less impaired than it is today. Accordingly, though the project and other community service based missions they stand ready to support all agencies in restoring Coral Bay. A healthier Coral Bay is in everybody's best interest.

Comment #5

With respect to seagrass, the applicant has estimated that the installation of pilings and other structures may result in impacts of 1.236 acre of seagrass, including shading impacts. But a comprehensive benthic survey of seagrass for the complete project area is needed. The survey should include the transit routes that would be used by vessels entering or exiting the marina, as well as any other areas of the bay that

These surveys have been performed and were included in the environmental documents prepared for the initial Environmental Impact Assessment for the proposed project and in the Responses to the ACE Letter of March 8, 2016

Comment #6

for refuge, foraging and spawning. While EPA defers to the expertise and statutory responsibilities of the U.S. Fish and Wildlife Service and the National Marine Fisheries Service regarding sea turtles and corals, the available information suggests that these threatened/endangered species, as they occur within the project area, are likely to be negatively affected by the construction and operation of the proposed marina. Seagrasses, which are aquatic resources of national importance, may also be substantially affected by the potential degradation of water quality that may occur from the construction and operation of the proposed facilities, the potential for fuel and wastewater spills, the increases in runoff from the associated upland development, and the overall increase of human activity in the area.

As noted above sea turtle and coral resources will not be impacted whatsoever by the construction or operation of this proposed marina facility.

Seagrasses have been avoided to the greatest extent practicable with most of the dock and slips of the marina being placed over areas of barren (mud) bottom. The majority of seagrass resources that will be impacted by the proposed project are those of a highly invasive, exotic seagrass species. This is discussed in great detail in our Environmental Impact assessment. The regulatory agencies with purview of these resources have determined that these exotic species are not to be considered in determining overall project impacts or resulting seagrass mitigation for those impacts that are unavoidable.

Again, Sirius Marina believes that the short term duration and ephemeral nature of project impacts during construction will be greatly outweighed by the project benefits, especially water quality when the project is completed.

Comment #7

To compensate for the unavoidable impacts of the project, the applicant proposes to transplant seagrass from the piling installation areas, to plant red mangroves (*Rhizophora mangle*) and to remove trash and derelict, sunken vessels from the sea floor. While these mitigation concepts may adequately compensate for some of the project's impacts, the information available does not adequately quantify the amount of seagrass to be restored, or how much red mangrove habitat would be created within the bay. In addition, detailed plans for the removal of sunken vessels from the bay, and the measures to protect subaquatic vegetation and water quality during the removal process are needed. Given the available information, it

Sirius Marina stands ready to work with – not against -- the permitting agencies in this matter. Accordingly, once they receive conceptual approval of this project they will work aggressively to move from a conceptual mitigation plan to a detailed final mitigation design plan that will then become part of the special conditions of the project permit and one that will be implemented as a requirement of project construction.

Sirius Marina and its support team will coordinate a time to meet with the resource agencies to discuss a final mitigation plan to offset any impacts of the project and they look forward to these discussions. In fact, if EPA's staff has any questions or concerns with any of the details in this matter, Sirius Marina would be more than willing to address them.

Comment #8

As EPA has previously stated for other projects proposed in this area, whatever the outcome of this proposed permit, EPA would like to work with the government of the U.S. Virgin Islands, other federal agencies and the interested public, on a strategy to remove all sunken, derelict vessels in Coral Bay and to improve waste management practices in this area. That work should continue, regardless of the outcome of the marina proposals.

Sirius Marina strongly agrees and believes that this project and its proposed mitigation options such as providing pump-out facilities, will help expedite this process.

Comment #9

> EPA is also concerned about in-water and shoreline construction measures to control sedimentation and turbidity. The proposed upland components of the project (parking, restaurant, marina offices, and others) would likely involve land clearing, grading and excavation as well as major construction activity within the Coral Bay watershed. These activities may result in contaminated water and sediments reaching Coral Bay, as well as in the development of additional impervious surfaces and increased runoff flows that increase the risk of pollutants entering the water column. According to the information furnished by the applicant, these potential impacts would be minimized and abated through the implementation of a sediment and erosion control and storm water management plans. The project will require a permit under the Territorial Pollutant Discharge Elimination System (TPDES) program administered by VIDPNR for the discharge of storm water runoff from the proposed construction activities. The establishment of sediment controls and the diversion of storm water flows to control water velocity and the transport of sediments will be important factors in reducing the potential impacts from sedimentation in the bay. EPA reiterates the need to prepare a Storm Water Pollution Prevention Plan addressing all storm water and sedimentation issues pursuant to the requirements of the TPDES General Permit. The development and establishment of controls prior to the start of any earth movement activities is highly important, since they are critical to ensure adequate management of storm water erosion and sedimentation.

Sirius Marina is fully aware that it will need to apply for a Storm Water Pollution Prevention Plan (SWPPP) prior to start of any earthwork and we expect this to be a condition of both Permits. A SWPPP will be prepared and submitted after the CZM and ACE Permits are received. The land side of the Marina has a moderate slope with elevations from 14' to sea level. The site slopes south to the bay. Very little storm water enters the site as the Public Road, Route 10, to the north, intercepts all the upland runoff and directs it to the east, by-passing the site. With the Route 10 intercepting upland runoff, storm water runoff will be limited to what falls on the site.

Sirius Marina is aware that the CBCC has developed proposed mitigation measures and preliminary design features to reduce sediment from the Johnny Horn Gut. They have been in contact with the CBCC and will work with them in the final design of the proposed Johnny Horn Gut watershed improvements to reduce sediment runoff. Sirius Marina will work closely with the Moravian Church and adjacent landowners to define and obtain the necessary easements to provide the necessary check dams, sedimentation basins and emergency spillways. It is in our interest to improve the water quality in the Bay.

Comment #10

> Given the significant direct and indirect impacts that the proposed project would have on the seagrass beds at Coral Bay, the relative large scale of the project, as well as its potential impacts on water quality and endangered species, EPA believes that the construction of this marina will have a substantial and unacceptable impact on aquatic resources of national importance. This is based on the potential infrastructure needs of the project, its potential for significant water quality degradation, its effects on aquatic resources of national importance (seagrasses and corals), its indirect impacts on endangered/threatened species and the consideration of the values and functions of the special aquatic

Sirius Marina strongly disagree with the conclusions drawn by the EPA in this matter. Failure on their part to understand the actual locations of corals, seagrasses and mangroves relative to the project footprint warrants harsh criticism. This lack of science-based management, and one based on an overall ideology that uses anecdote from previous failed projects does not lend to sound stewardship of the resources that everyone is working so diligently to preserve, protect and enhance for future generations to use and enjoy.

Sirius Marina also believe that our Responses to the ACE March 8, 2016 letter and changes to the overall Marina design further reduces negative impacts to the Marine Environment.

COASTAL ENGINEERING ASSESSMENT
SIRIUS MARINA

Prepared for:

T-Rex St. John, LLC

45 Maple Street

Garden City, New York 11530

Prepared by:

MOFFATT & NICHOL

1509 West Swann Avenue, Suite 225

Tampa, Florida 33606

July 2014

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1. INTRODUCTION

1.1 GENERAL

The proposed Sirius Marina will lie along the north shore of Coral Harbor, a small embayment of Coral Bay on the east side of St. John, U.S. Virgin Islands. Figure 1-1 shows the location of the marina within Coral Harbor and its relationship to Coral Bay and the bays of Round Bay and Hurricane Hole. A significant number of boats use Coral Harbor as a permanent or temporary anchorage because the harbor is sheltered from the prevailing wind, waves, and currents.

A full service marina does not presently exist on St. Johns; the proposed marina is conceived to capture boat owners who live on or visit St. John on a frequent basis.

An understanding of the oceanographic and meteorological conditions within Coral Harbor is an important aspect of marina planning and design. This report provides a coastal engineering assessment of the wind and wave conditions, tides, currents, and water depth related to the marina development.

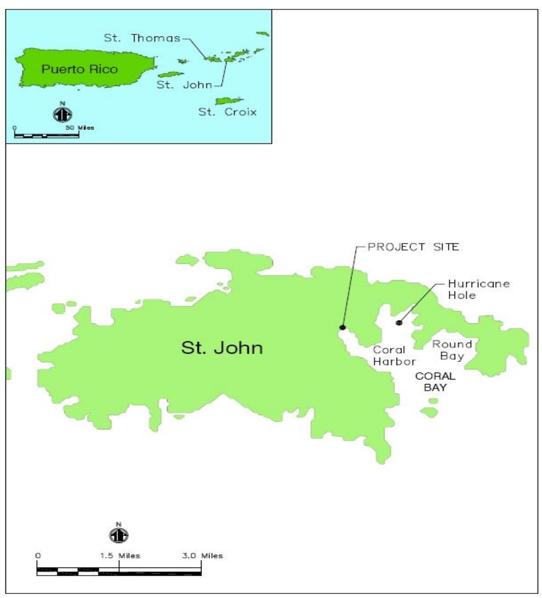

Figure 1-1 Coral Bay, St. John

1.2 PROPOSED SITE

The proposed marina site will lie within a footprint tentatively defined by the property shoreline to the north, the seaward extension of the property line to the west, the shoreline of Usher Cay on the east side, and to the south, a line from the south tip of Usher Cay to the west property boundary as shown in Figure 1-2. This footprint accommodates approximately 90 slips ranging from 20 feet to 100 feet in length. Water depths within the marina footprint range from 2 feet below mean sea level (MSL) on the northeast side to 12 feet on the south side.

The shoreline of the property is characterized by a mixture of mangroves, rock outcrops, and sand beaches. A rock outcrop forms a natural divide of the east and west sides of the property. Mangroves line the shoreline to the west of the rock outcrop and at the northeast corner. A sand beach is found in the vicinity of the existing boat repair yard and the public boat ramp and pier.

Figure 1-2 Project Site

1.3 DATA SOURCES

The following sections describe the field investigations, literature review, and other miscellaneous data sources used in the preparation of this report.

1.3.1 Bathymetric Data

A bathymetric survey of the site was conducted in May 2007 and November 2014 by Marvin Berning and Associates which encompasses the proposed marina footprint and an 800-foot by

2000-foot area that includes the main entrance channel into Coral Harbor. The bathymetric survey was supplemented by navigation charts developed by the National Oceanographic and Atmospheric Administration (NOAA).

1.3.2 Water Levels

Water level data were obtained from the NOAA Center for Operational Oceanographic Products and Services (CO-OPS) website (NOAA-CO-OPS, 2007) for Lameshur Bay station in St. John and Charlotte Amalie Station (Station ID #9751639, 18˚ 20' N, 64˚ 56' W) in St. Thomas. Tidal benchmark information established by NOAA at Coral Bay was used to define the tidal datum relationship.

1.3.3 Wind Statistics

Wind statistics are prepared and analyzed under two general categories, short term and long term statistics. Short term statistics define so-called "Prevailing Conditions" or day-to-day operational conditions. Long term statistics describe extreme storm events associated with specific return period intervals. Long term statistics are used to assist in the design of marine structures

Available data for the area of interest were obtained from the following sources:

- Global Hindcast Model (GHM)
- Caribbean Disaster Mitigation Project (CDMP)
- FEMA
- NOAA

Wind and wave statistics were obtained from a Global Hindcast Model (GHM). Grid point #5032 of the global model is located approximately 15 miles southeast of the project site (18.25˚ N and 64.5˚ W) as shown in Figure 1-3, in water depth of 338 m. Wind statistics reported for station #5032 were based on hindcast studies for15-years of continuous prevailing and 99-years of storm event satistics.

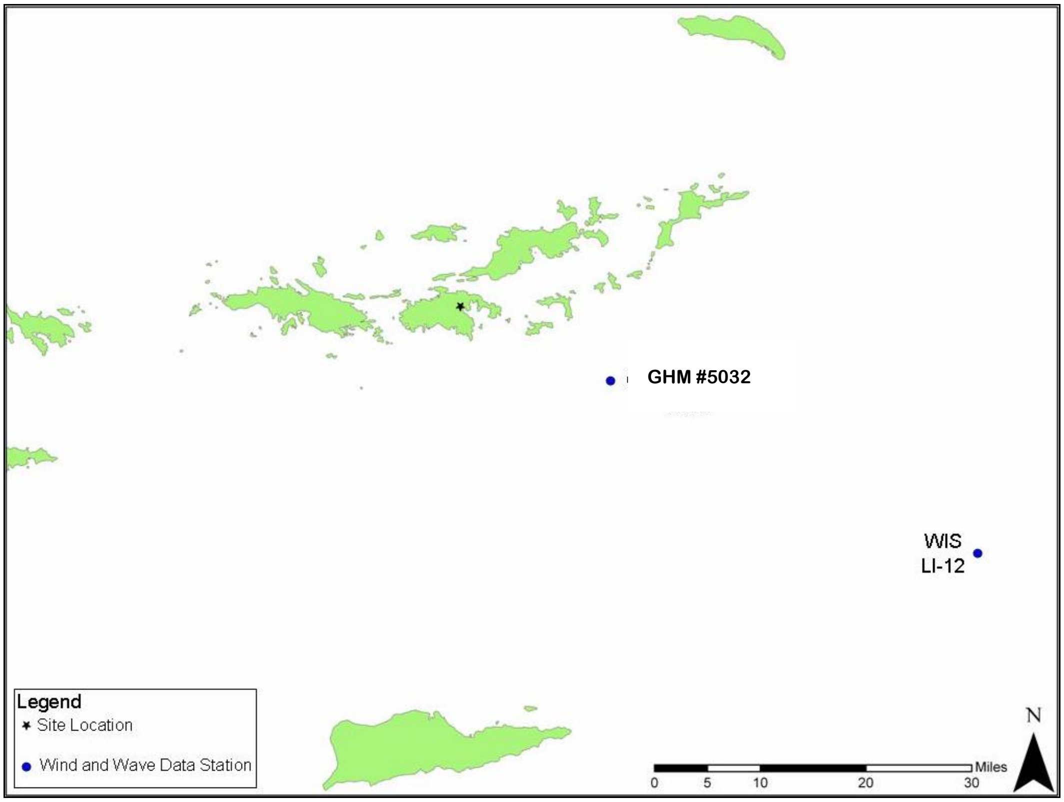

Figure 1-3 Wind and Wave Station Locations

Additional data from the Caribbean Disaster Mitigation Project (CDMP) data was used to supplement the wind statistics obtained from GHM Grid #5032 to assess the extreme wind conditions at the proposed marina site. The CDMP was conducted under the auspices of the Organizations of American States (OAS) to effectively mitigate the effects of storm hazards (surge, high winds and wave action) in the Caribbean basin. CDMP data provides maximum estimates for surge, wave height and wind speeds in select regions of the Caribbean basin for 10- 25-, 50- and 100-year return periods.

NOAA's National Hurricane Center database was also consulted to determine historical tropical storm tracks passing within 100 mile radius of St. John. The 100 nautical mile radius is commonly used to establish wind effects associated with tropical storms.

1.3.4 Wave Statistics

Wave statistics were available for the GHM hindcast station #5032 of the same duration for prevailing and storm events discussed in Section 1.3.3. The CDMP study also provides wave height data for extreme storm events associated with select return periods.

2. SITE CONDITIONS

This section details general oceanographic conditions at the site including tides, currents, hurricanes, winds, and local bathymetry.

2.1 WATER LEVELS

Water level fluctuations at Coral Harbor are due to astronomical tides and meteorological events. Astronomical tides are the rising and falling of the water that results from the gravitational attraction of the Moon, Sun and other astronomical bodies acting upon the Earth as it rotates.

The NOAA collects water level data for stations throughout the United States and the U.S. Territories including the U.S. Virgin Islands. The tide station closet to the proposed marina site is Lameshur Bay (Station #9751381), on the south coast of St. John. Time series data of tidal oscillations is available from October 2006 to June 2007. A 7-day time history of the measured tidal oscillation is shown in Figure 2-1. Analysis of the water level data at the Lameshur Bay station shows one predominate diurnal phase. The average maximum excursion between high and low tides is less than 1 foot. NOAA has a long term tide station in Charlotte Amalie Harbor; the tidal magnitude and phase are similar to Lameshur Bay.

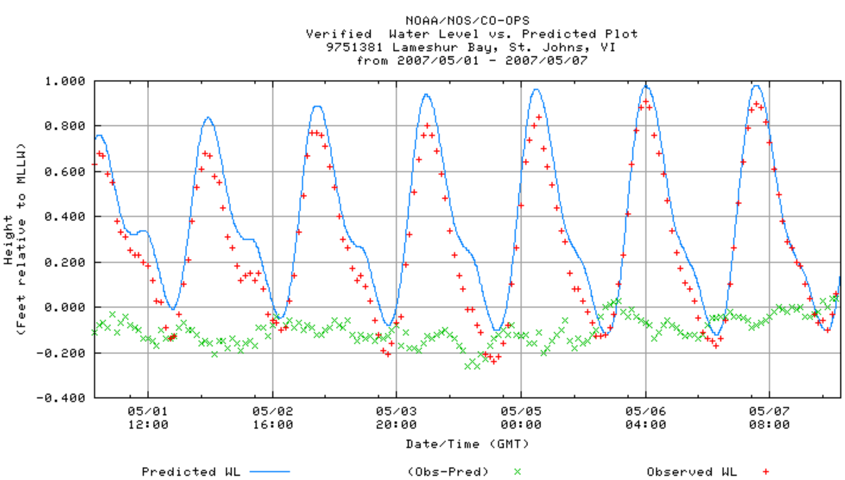

Figure 2-1 Measured Tide Oscillations for Lameshur Bay, 5/1/2007 to 5/07/2007

NOAA established a tidal datum relationship at Coral Harbor based on 3 months of tide measurements. Table 2-1 Tidal Datum Relationship at Coral Harborshows the datum relationship, reference to mean lower low water (MLLW).

Table 2-1 Tidal Datum Relationship at Coral Harbor

(NOAA Station ID: 9751373)

Datum	Elevation (ft)
Mean Higher High Water (MHHW)	0.9
Mean High Water (MHW)	0.8
Mean Sea Level (MSL)	0.4
Mean Low Water (MLW)	0.1
Mean Lower Low Water (MLLW)	0.0

2.2 BATHYMETRY

Water depths at the entrance of the Coral Bay vary from 50 to 80 feet. Outside of the bay, a shallow shelf extends approximately 5.5 miles in the southerly direction with water depth fluctuating between 65 to 115 feet. Beyond this shelf, the water depth increases sharply to more than 500 feet. Water depths in Coral Bay are greater than 30 feet into Hurricane Hole. The shallowest water lies within Coral Harbor, water depths range from 20 feet at the entrance to less than 2 feet in the cove formed by Ushers Cay as shown in Figure 2-2.

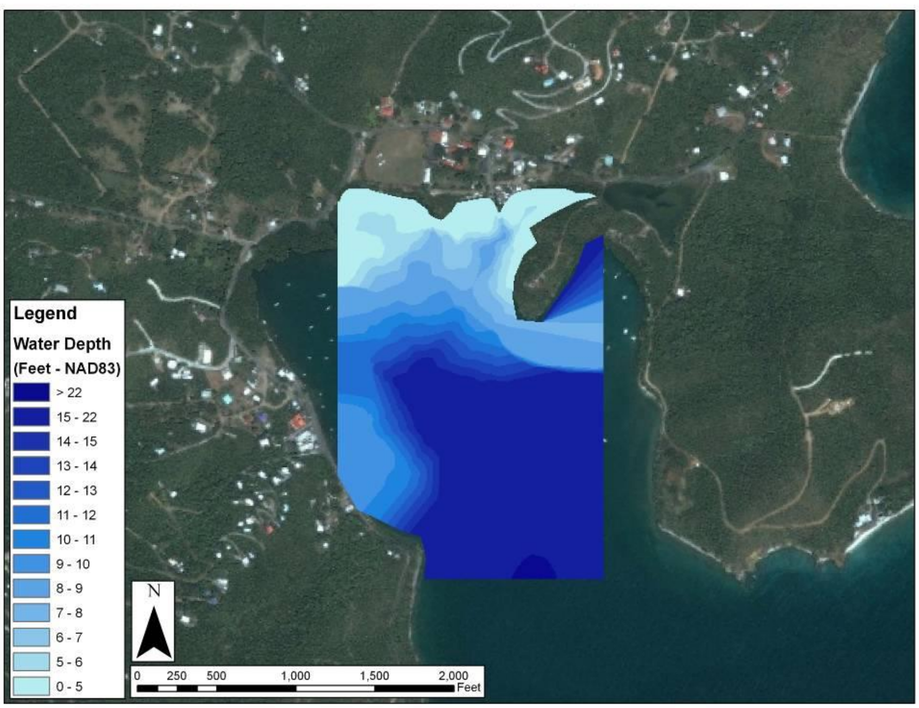

Figure 2-2 Water Depths in Coral Harbor

2.3 WINDS

The study area is influenced by the Caribbean trade winds which typically extend from 10˚ to 20˚ north latitude. These trade winds are predominantly from the easterly directions and vary with the seasons; northeast during the winter months and southeast during the summer. Wind speeds average from 10 to 20 knots. The "Christmas Winds" of up to 30 knot typically occur in December but also extend for limited durations during the remainder of the remainder season. Localized shifts in wind speed and direction within Coral Bay can occur year round due to the effects of radiant cooling and surrounding topography.

Local wind data was not available but a statistical analysis of wind data from GHM grid #5032 was performed, resulting in the wind rose shown in Figure 2-3. Approximately 46.4% of the winds occur from the east, with the east northeast direction accounting for approximately 24% occurrence and the south southeast direction constituting a 16.5% occurrence.

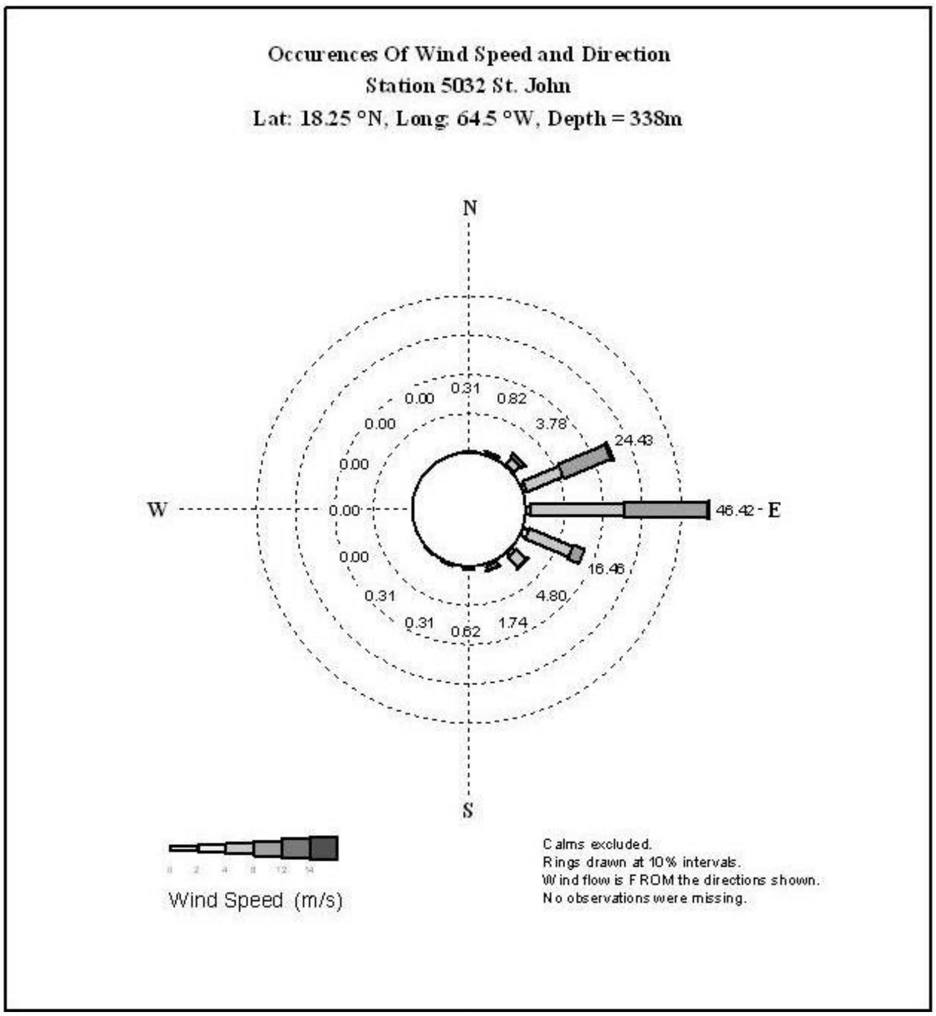

Figure 2-3 Wind Speed and Direction for the GHM #5032

2.4 OFFSHORE WAVES

There are no local wave measurements available to quantify the normal (operational) or storm wave conditions offshore of the site. Wave statistics for GHM #5032 were utilized to determine the offshore wave conditions. A numerical model was then utilized to transform the offshore waves to the projects site to determine the nearshore wave climate. A discussion of the wave transformation process and the wave environment within Coral Harbor is presented in Section 3.

Figure 2-4 shows the wave rose for the grid point #5032 illustrating occurrence of significant wave height (H_s) from all cardinal directions. Significant wave height is defined as the average of the highest one-third of the waves in a wave record. As Figure 2.4 indicates, the predominant wave directions at these stations are from the E-NE to E-SE with the highest probability from the east at 54.2%, followed by E-NE (25.2%) and E-SE (12.3%). The data reveals that almost 48 % of the wave occurrence is 2.5 and 7.5 feet, approaching from east. The data also indicates that the most probable wave period is between 6 and 7 seconds.

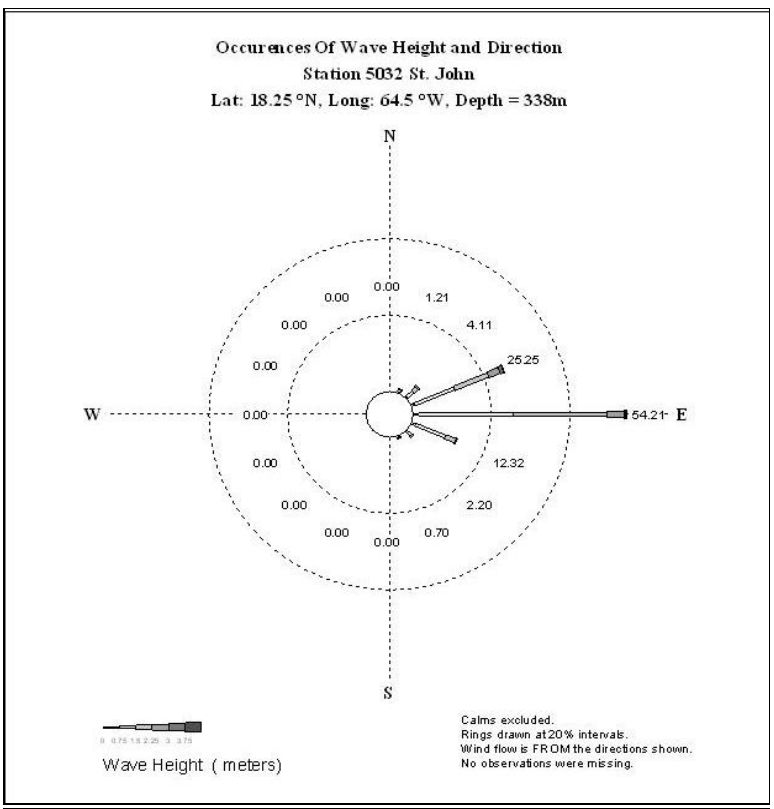

Figure 2-4 Wave Height and Direction for the GHM #5032

2.5 TROPICAL STORM SYSTEMS

The island of St. John lies in a region that experiences elevated occurrences of tropical storms and hurricanes. The island lies along a track where storms generally cross into the Atlantic Ocean from the Caribbean Sea or continue on their westward track to the United States or the Gulf of Mexico. Passing storms can cause elevated water levels and wave heights that may lead to extensive damage to coastal infrastructure and structures.

Since 1851, NOAA has documented forty-five hurricanes and tropical storms that have passed within 100 miles of St. John shown Figure 2-5. Table 2-2 Hurricane Tracks within 100 Nautical Miles of St. John from 1950-2005 shows a partial list of storms from 1950 and their respective wind speeds and category rating (note - tropical storms impacting St. John are too numerous to list). St. John was severely affected by Hurricanes Hugo in 1989 and Marilyn in 1995. Hurricanes Bertha and Lenny in 1996 and 1999, respectively, also caused damage on St. John.

Table 2-2 Hurricane Tracks within 100 Nautical Miles of St. John from 1950-2005

Year	Name	Max Wind Speed (Knots)	Category
1950	Dog	160	H4
1954	Alice	70	H1
1955	Connie	125	H4
1956	Betsy	105	H1
1960	Donna	140	H4
1966	Faith	110	H1
1974	Klaus	80	H1
1989	Hugo	140	H4
1995	Marilyn	100	H2
1995	Luis	120	H4
1996	Bertha	100	H1
1998	Georges	135	H3
1999	Jose	85	H1
1999	Lenny	135	H4
2000	Debby	75	H1

Anecdotal information from local resident indicates that Coral Bay experienced sustained wind speeds of 80 knots during Hurricanes Hugo and Marilyn. Coral Bay also experience elevated water levels and waves during these two storms. More than 15 boats were lost as mooring lines were snapped by the high winds, storm surge, and waves in Coral Harbor and Hurricane Hole during Hurricanes Hugo and Marilyn.

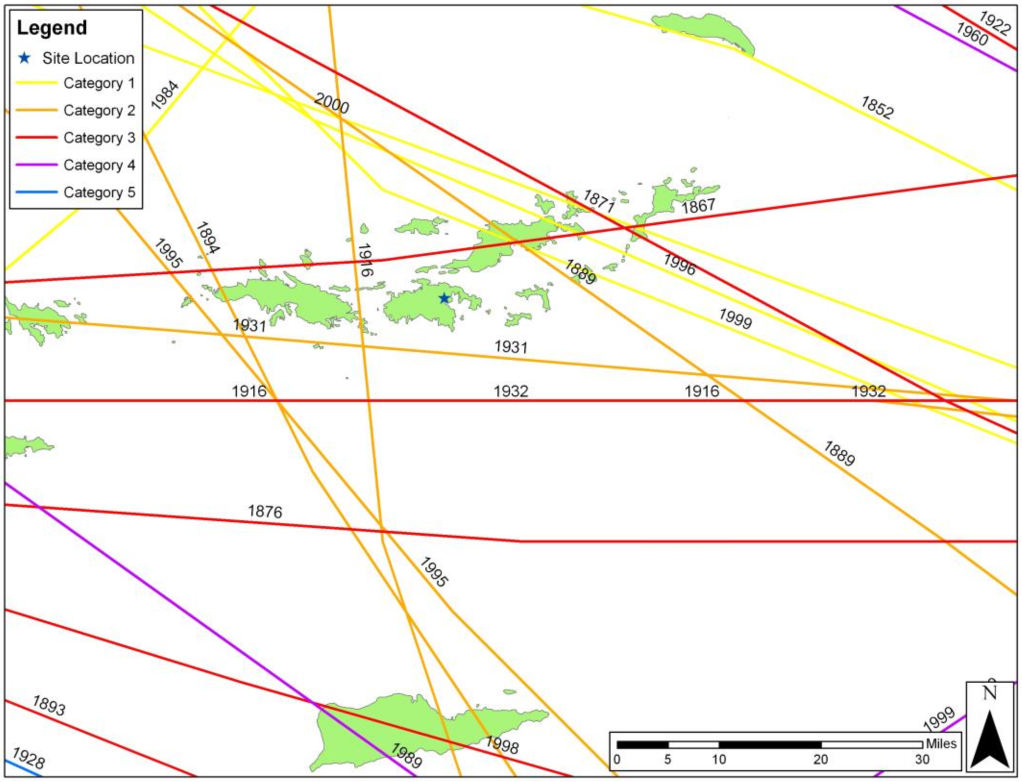

Figure 2-5 Historical Hurricane Tracks from 1851-2005 (NHC)

2.5.1 Storm Surge

Wind and atmospheric pressure gradients associated with the frontal passage, cause setup of the water surface. This setup of the water surface is commonly referred to as storm surge. Storm surge, coupled with waves, may cause significant damage to coastal areas. Storm surge magnitude is directly dependent upon the track of the storm, storm intensity, and the local bathymetry. Storm surge levels in Coral Bay have not been recorded. The CDMP study developed predicted storm surge levels associated with specific return period storm events for Coral Bay as shown in Table 2-3 Maximum Predicted Storm Surge at Coral Bay.

Table 2-3 Maximum Predicted Storm Surge at Coral Bay

Return Period (years)	CDMP Study Storm Surge (MLLW, feet)	FEMA Storm Surge (MLLW, feet)
10	1.0	3.9
25	2.0	5.6
50	3.0	6.4
100	3.9	8.1

The Federal Emergency Management Agency (FEMA) completed an update to the flood insurance study for St. John in April 2007. The restudy was initiated to include storm surge levels recorded during recent hurricane events such as Hurricanes Marilyn and Lenny. The study indicates that the storm surge elevation associated with the 100-year flood event is approximately 8.1 feet MLLW; a level considerably higher than predicted by the CDMP. The discrepancy between the two storm surge values may be attributed to the lack of an astronomical tide component in the storm surge values developed by the CDMP study, statistical redistribution of extreme values due to the inclusion of additional storms, or a change in resolution or modeling parameters.

2.5.2 Extreme Wind Conditions

The National Hurricane Center maintains maximum recorded wind speeds at Cyril E. King Airport in St. Thomas and Henry E. Rohlsen in St. Croix. The maximum recorded wind speed at both airports was during Hurricane Marilyn, 104 mph in St. Thomas and 98 mph in St. Croix. The NHC also lists private anemometer readings at different locations throughout the islands. During Hurricane Lenny, a gust of 92 mph was recorded at Coral Bay.

The limited amount of recorded data has prompted federal and international organizations to develop design wind speeds based on a statistical analysis of recorded and predicted wind speeds for select recurrence intervals. The CDMP study lists wind speeds for storm events associated with the 25-year, 50-year and 100-year return intervals. The wind speed values developed by the CDMP study in Table 2-4 Wind Speed Extremesare based on a one minute averaged wind speed.

Table 2-4 Wind Speed Extremes

Return Period	Wind Speed (mph)
10-year	N/A
25-year	92
50-year	107
100-year	123

2.5.3 Extreme Offshore Waves

Permanent wave buoys are not deployed along the south or east coast of St. John; therefore recorded time series of wave heights during hurricane events is not available. Similar to the development of the extreme values associated with storm surge and extreme wind speeds, design offshore wave conditions were determined through statistical analysis of predicted wave heights. Statistics on extreme wave heights were obtained from the GHM and CDMP studies. Table 2-5 summarizes the expected significant wave heights and peak periods for different return intervals for each study. A comparison of the two data sets indicates that predicted wave heights based on the CDMP study are less than the GHM study. The discrepancies between the values may also be attributed to those issues discussed in Section 2.5.2. Section 3 discusses the wave transformation of the extreme wave conditions to the project site.

Table 2-5 Extreme Offshore Wave Conditions

	GHM #5032		CDMP	
Return Period (years)	**Sig. Wave Height (ft)**	**Peak Period (sec)**	**Sig. Wave Height (ft)**	**Peak Period (sec)**
5	N/A	N/A	N/A	N/A
25	25.5	11.9	18.0	N/A
50	31.8	12.9	19.7	N/A
100	38.0	13.8	23.0	N/A

3. WAVE TRANSFORMATION

Waves affecting the project site are a combination of locally generated wind waves and swells generated by distant storms. Swell conditions at the site during prevailing and extreme conditions were determined by the transformation of offshore wave conditions discussed in Section 2.0. Local seas conditions during prevailing and extreme conditions were based on wave generation using the wind speeds recorded at St. Thomas or extreme values outlined in Section 2.5.2.

3.1 NUMERICAL MODEL DESCRIPTION

The Near Shore Spectral Wave (NSW) module of the MIKE21 commercial software package developed by Danish Hydraulics Institute (DHI) was used to generate and/or transform the waves. MIKE21 NSW describes the propagation, growth, and decay of short-period and short-crested waves generated by the frictional forces of wind blowing over an unimpeded fetch length. Effects of refraction and shoaling due to varying depth, local wind generation, wave-current interaction, and energy dissipation due to bottom friction and wave breaking can be simulated. The domain of interest is discretized into rectangular grids and the governing equations are solved numerically. Output from the model consists of predicted significant wave height, mean wave period, and mean wave direction.

3.2 WAVE MODEL CONFIGURATION

Figure 3-1 shows the extent of the numerical model comprised of 12 x 50 foot grids. The offshore boundary condition lies at the 500 foot water depth contour, where waves are not influenced by the ocean bottom. Since wave period and locally bathymetry are the most influential factors in the wave refraction and transformation process, a unit wave height approach was employed to transform the offshore waves to the project site. A refraction/shoaling coefficient was defined as part of the transformation process. This coefficient was then applied to different offshore wave height conditions having similar wave periods to determine the wave climate at the project site.

Incident wave directions were varied between 90-180 degrees with respect to north (i.e. 90 corresponds to waves approaching from east). For each combination, a shorter period (T_m=5 seconds) and a longer period wave spectrum (T_m=8 sec) were considered. Wave periods of 5 to

8 seconds constitute the majority of swells propagating into Coral Harbor during prevailing conditions.

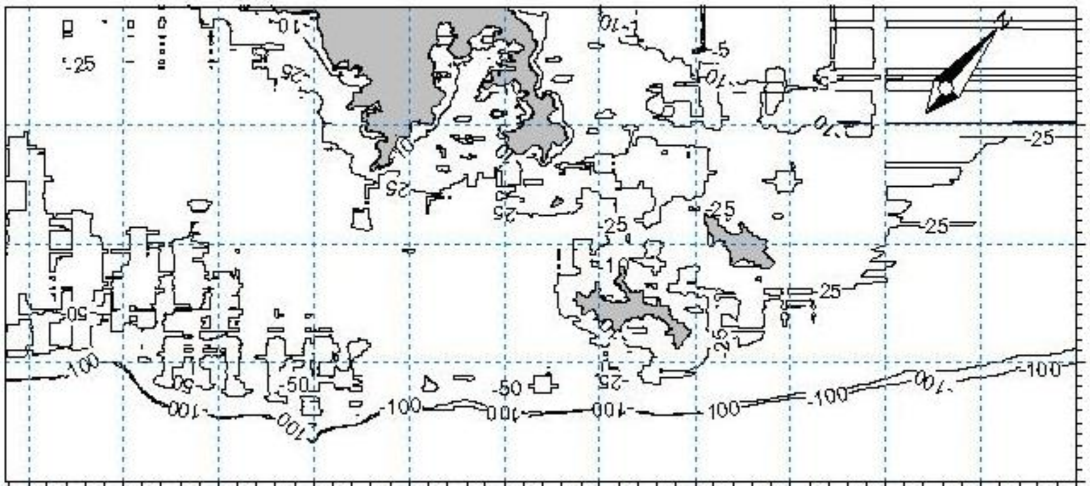

Figure 3-1 Model Extents

3.3 WAVE MODEL RESULTS

Figures 3-2, 3-3, and 3-4 show the results of the wave transformation and shoaling process corresponding to a mean wave period (T_m) of 5 seconds for three directions (east, southeast, and south). The project site is sheltered from swells entering Coral Harbor from all directions, with wave heights less than 10% to 20% of the corresponding offshore wave heights. Wave heights at the project site are predicted to be less than 1.5 feet from the short period swells. The west side of the project site is more exposed than the central or east side. The project site is most affected by waves propagating from the southeast direction.

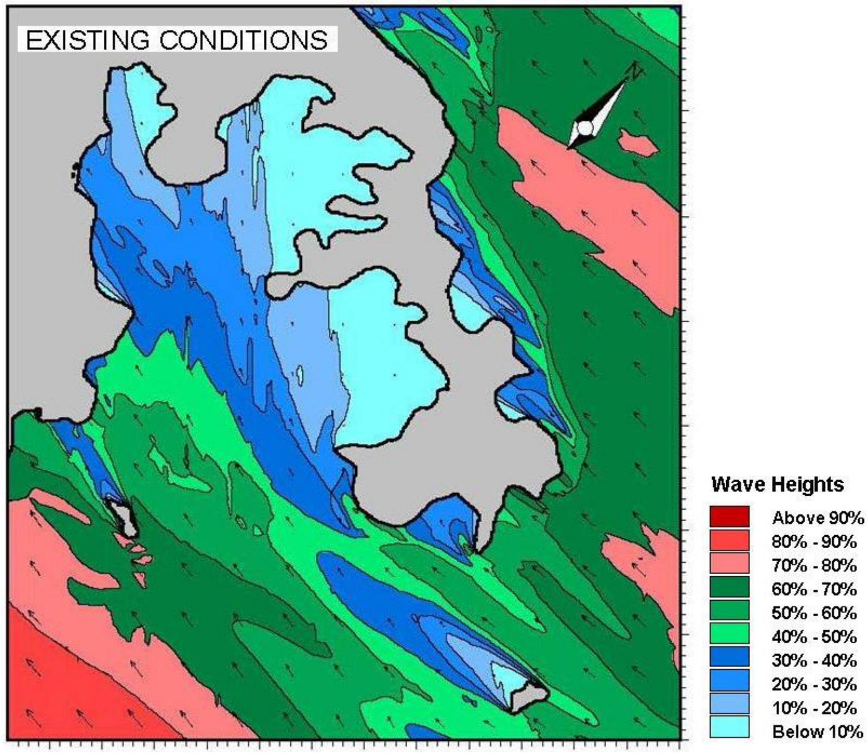

Figure 3-2 Offshore Wave Penetration from East

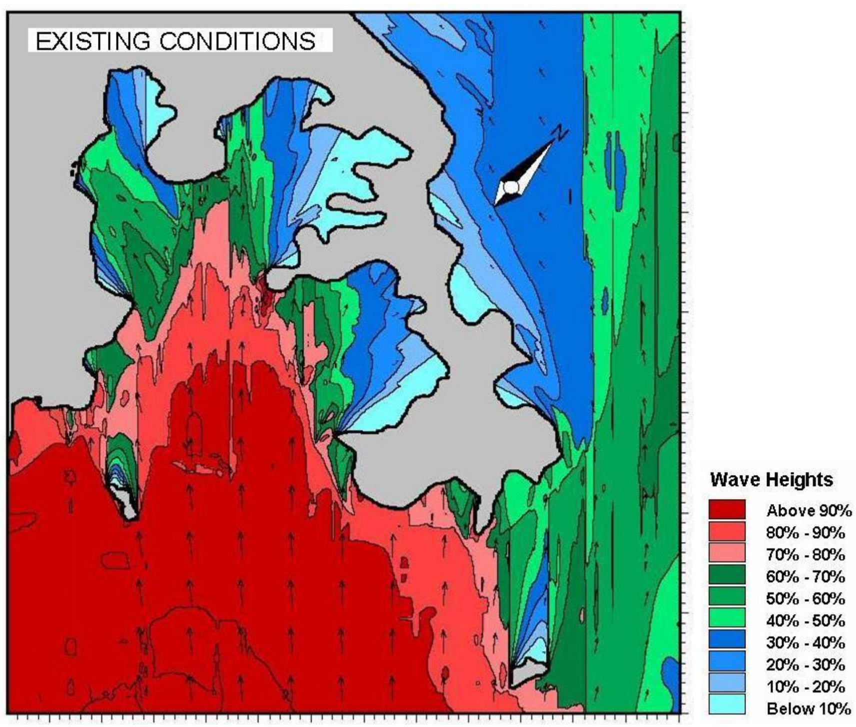

Figure 3-3 Deep Water Wave Penetration from South-East

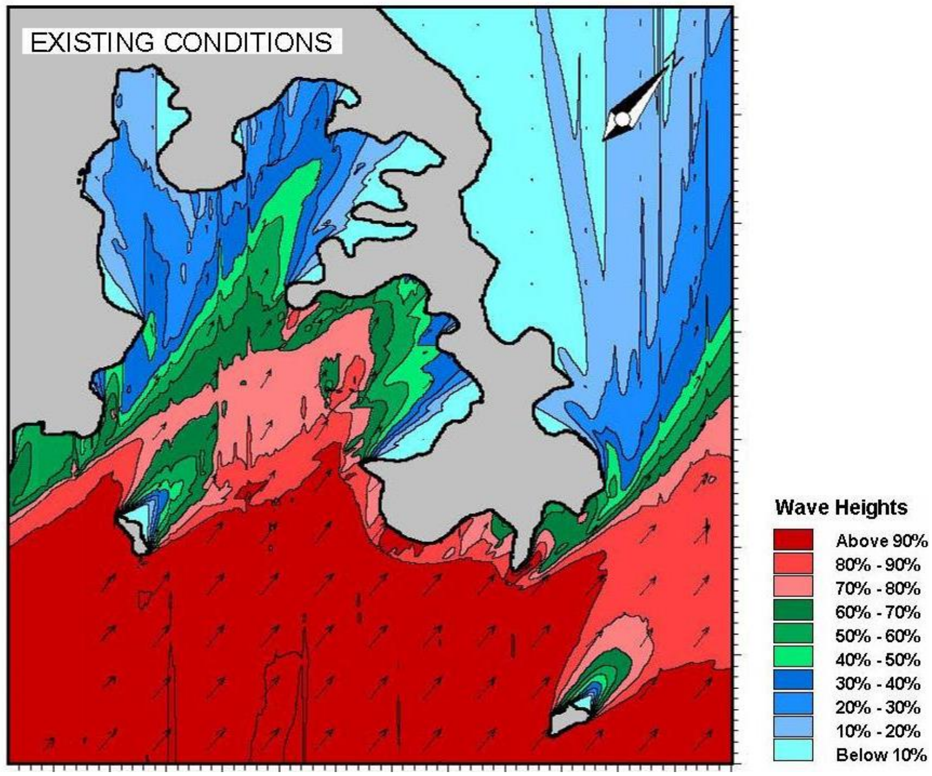

Figure 3-4 Offshore Wave Penetration from South

The model results for the longer period waves are similar to the 5 second period waves. Results shown in Figure 3-4 and Figure 3-5 indicate that the offshore waves dissipate down to 10 to 20 % levels as the waves propagate into the Coral Harbor. The longer period swells propagating into project site are predicted to be less than 1.5 feet during prevailing conditions.

During hurricane events, the wave refraction patterns and the percent change in wave height was similar for longer wave periods associated with tropical or hurricane events. Water depths at the entrance to Coral Bay and Coral Harbor limit the height of the approaching waves. The model results suggest that wave heights in Coral Bay would range from 2.5 to 6 feet during these events.

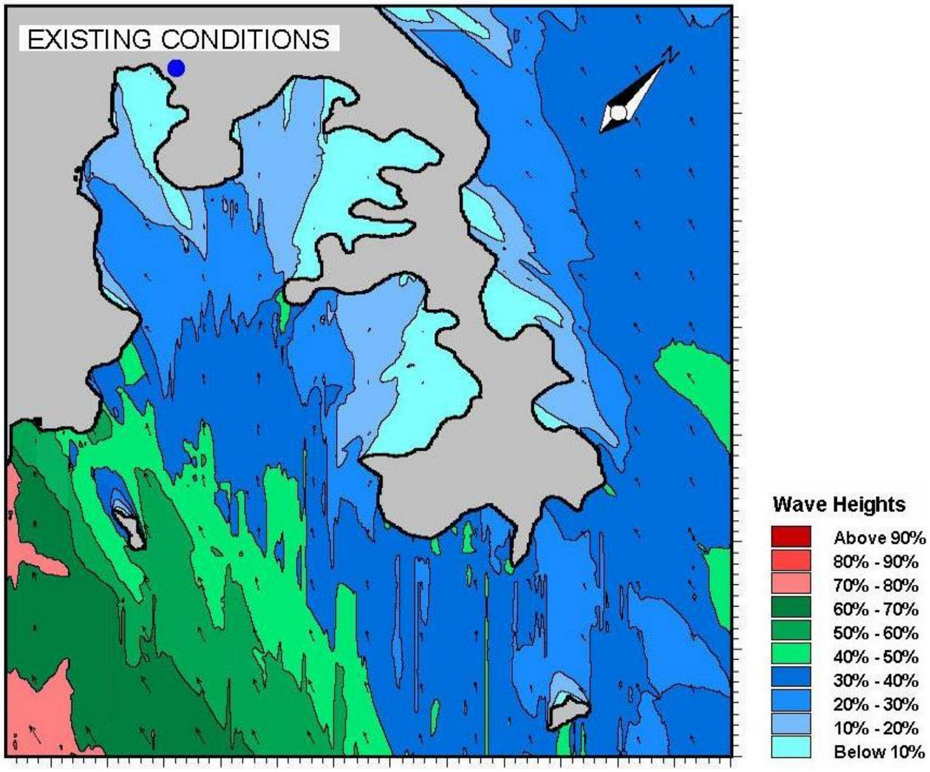

Figure 3-5 Deep Water Wave Penetration from East

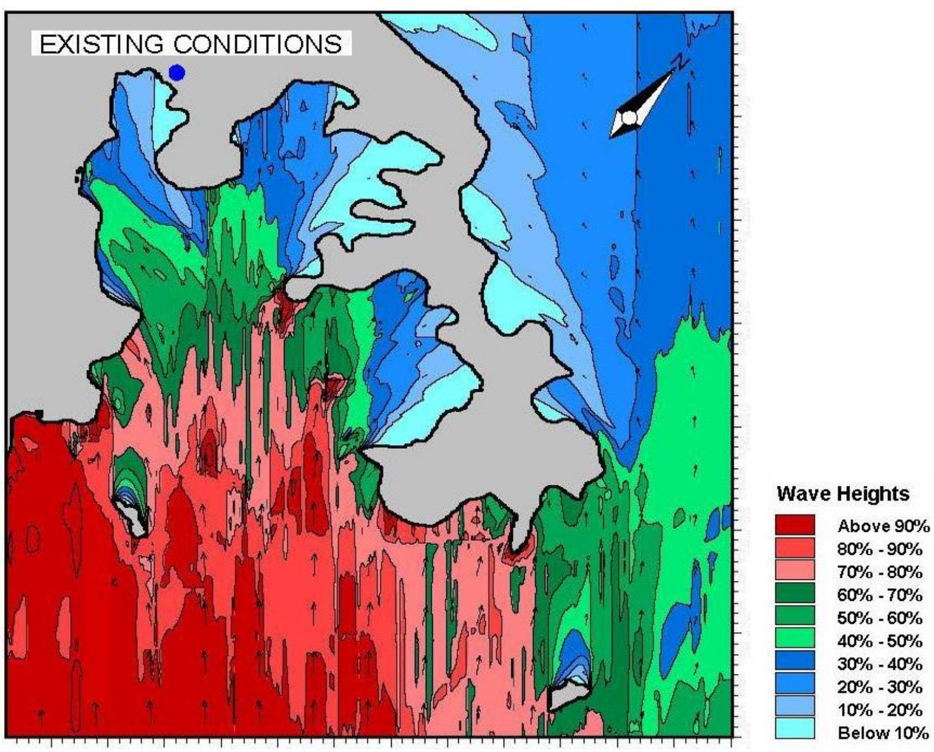

Figure 3-6 Deep Water Wave Penetration from South-East

The wave environment in Coral Harbor during prevailing and storm conditions is heavily influenced by local wind generated waves (seas). There is approximately a 1.2 mile long unobstructed surface of water (fetch) between the project site and Lagoon Point, corresponding to waves from the southeast direction. The wave height and corresponding wave period at the project site associated with sea conditions were estimated based on empirical hindcast formulas incorporated into the NSW model.

Table 3-1 Local Sea Conditions – Southeast Direction

U(mph)	Hs (ft)	Tp (sec)
15	0.5	1.5
25	0.9	1.8
50	2.5	2.4
75	4.0	2.9
90	4.9	3.1

Wave heights were computed for several wind speeds. The results are shown in Table 3-1. Figure 3-7 shows corresponding wave heights for prevailing wind speed of 15 mph. Wave heights are less than 1.5 foot except during tropical storms or hurricanes, where wave height can approach 5 feet. The magnitude of seas and swells are similar during the large storm events. Because the wave periods are not in phase, the two wave heights are not added together. However, wave heights may be higher or lower in localized areas as a portion of the sea and swell wave spectrum fall in and out of phase.

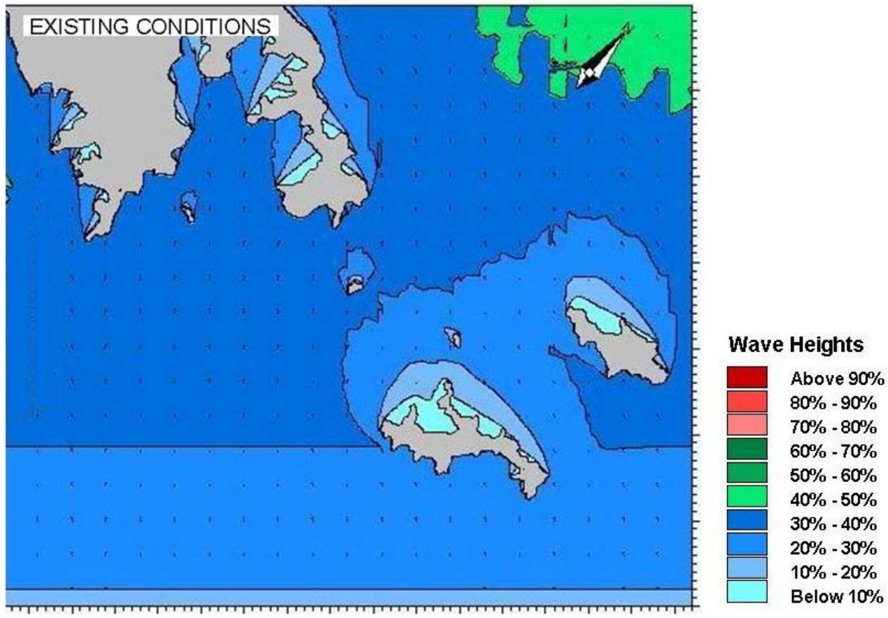

Figure 3-7 Locally Generated Wind Waves from SE

4. MARINA FLUSHING ANALYSIS

4.1 FLUSHING STANDARDS

Marina flushing is defined as the length of time required to exchange a volume of water equivalent to the marina basin volume with the ambient body of water. A well flushed marina typically signifies good water quality. Federal and USVI regulatory agencies offer guidelines for well flushed marinas. The U.S. Army Corps of Engineers Coastal Engineering Manual (USACE-CEM) provides marina flushing guidelines and examples which suggest that a flushing time of 2-4 days is acceptable, 4-10 days is marginal, and greater than 10 days is unacceptable. The flushing time is computed by modeling a conservative tracer placed throughout the marina basin until the concentration reaches 37% of the initial concentration (1/e, e= 2.71828) at which point the basin is considered "flushed". The Florida Department of Environmental Protection (FDEP) applies a more restrictive guideline that requires the residual concentration of a conservative tracer to reach 10% of the initial concentration in 4 days (96 hours). Coastal Zone Management guidelines prepared by the U.S.V.I Department of Planning and Natural Resource (DPNR) states that the residual concentration of a conservative tracer should be 10% of the initial concentration after 24 hours though DPNR has not applied this guideline to previous marina developments in the U.S.V.I.

The flushing time of the proposed marina facility was analyzed using the hydrodynamic module (HD) of MIKE21 suite of computer models. The tidal currents represent the primary hydrodynamic forces. Wind and wave induced currents, which may enhance mixing and improve flushing, were excluded from the model setup to present a more conservative flushing estimate. The output of the hydrodynamic model was used with the coupled MIKE21 Advection/Dispersion module (AD) to evaluate the flushing time for the basin.

4.2 MODEL DOMAIN

The model setup uses existing land and water surveys of the project site and tides generated based on available tidal harmonics for NOAA's Charlotte Amalie tide station. An average tide during a four day period was applied to the flushing model. These conditions represent a typical tidal prism and current velocities in the bay. A uniform concentration of a conservative (non-decaying) tracer was placed in a 20-acre water body to represent the marina footprint. Areas outside of the basin were initiated with a concentration of zero. The tracer concentration is monitored as it disperses under the influence of tidal oscillations.

4.3 FLUSHING MODEL RESULTS

The model results indicate that the average residual constituent concentration is less than 37% after 24 hours, and falls below 10% level after 96 hours, as shown in Figure 4-1. The proposed marina site meets the flushing criteria established by USACE and FDEP.

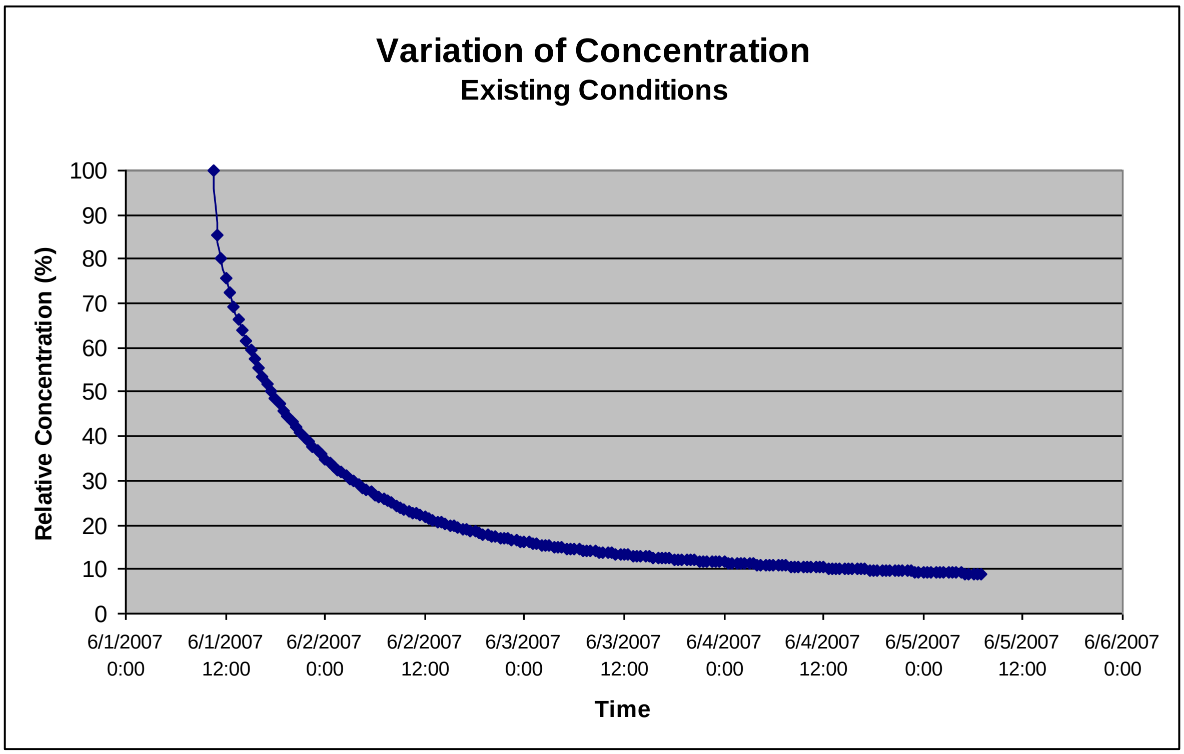

Figure 4-1 Coral Harbor Marina Flushing Curve

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CORAL BAY — ST. JOHN
U.S. VIRGIN ISLANDS

TERRESTRIAL REPORT

Prepared For

Schwab, Twitty & Hanser Architects

Prepared By

EcoScience Corporation
1101 Haynes Street, Suite 101
Raleigh, NC 27604

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CORAL BAY — ST. JOHN
U.S. VIRGIN ISLANDS

TERRESTRIAL REPORT

1.0 SUMMARY

EcoScience Corporation (ESC) has been retained to undertake terrestrial resource surveys of a 3.7-acre tract of land at Coral Bay (Site 1), located in the East End of St. John, U.S. Virgin Islands (Figure 1). An additional tract of 2.4 acres at Coral Bay (Site 2) was also surveyed. Both of the Sites, with the immediate surrounding area, are collectively referred to herein as the study area. In July 2007, a team from ESC□□ undertook field surveys that focused primarily on:

a) flora and vegetation communities;
b) fauna (amphibians, reptiles, birds, mammals and invertebrates);
c) identification of suitable habitat for federally protected species;
d) identification and location of all trees over 6 inches diameter at breast height (dbh);
e) identification and general location of Section 404 jurisdictional streams and wetlands; and
f) identification of waters (guts) under the jurisdiction of the U.S. Virgin Islands Department of Planning and Natural Resources (DPNR).

The study area is located in the Coral Bay quarter, Estate Carolina, at the community of Coral Bay near the Emmaus Moravian Church. Site 1 is located at the intersection of Highway 10 and Highway 107, in the southwest quadrant of the intersection. This Site maintains a forested cover. Site 2 is east of Highway 107 and south of Highway 10, and is occupied by a school, fire station, police station, a restaurant, and scattered residential lots. The study area is located on a flat coastal area fronting Coral Harbor and Coral Bay.

No Section 404 jurisdictional surface waters or wetlands were located on either Site. The USGS topographic quadrangle (Western St. John, VI 7.5-minute quadrangle [1982]) depicts one intermittent blue-line stream that is depicted as flowing through a portion of Site 1 (Figure 1). However, ESC delineations resulted in a determination that this feature is located approximately 30 to 40 feet outside of the western boundary of Site 1 and drains to Coral Harbor approximately 750 feet south of Site 1.

The diversity of flora is moderately rich in the forested Site 1. Of seven general vegetation community types found on the island, two (Dry Forest and Mixed Dry Shrubland) are located on Site 1. In addition to climate, historic impacts by grazing and agriculture use have likely played a role in diminishing Site diversity. A total of 43 plant species in 24 families were recorded. At Site 2, 19 species of plants in 13 families were recorded. Clearing and disturbance have resulted in a poorly diversified flora in this area.

A total of 17 species of birds were observed within and adjacent to the study area. Of the 18 species of mammals recorded for the Virgin Islands, two species were confirmed to occur at the study area. These consisted of feral goats and donkeys. Two species of reptiles and two amphibians were recorded.

2.0 PHYSICAL RESOURCES

The study area consists of two parcels of land totaling approximately 6.0 acres (Sites 1 and 2, Figure 1) near the eastern edge of St. John in the U.S. Virgin Islands. Site 1 consists of approximately 3.7 acres and lies in the southwest quadrant of the intersection of Route 10 (Centerline Road) and Route 107 (Salt Pond Road, Figure 1). Site 1 is bounded to the northwest and southwest by private residential developments, to the west by undeveloped, naturally vegetated land, and to the north and east by the impervious surfaces of Routes 10 and 107. Site 2 consists of approximately 2.3 acres and lies on the south side of Route 10 approximately 500 feet east of the Route 107 intersection (Figure 1). Site 2 is bounded to the north by Route 10, to the south by private development and shrubby undeveloped areas, to the west by a church-owned baseball field and basketball court, and to the east and southeast by an unpaved access road to development along the north shore of Coral Harbor. The area surrounding the study area may generally be characterized as low-density residential and business development, and contains residential buildings and outbuildings, restaurant and business development, a church and surrounding grounds, and areas of natural vegetation.

Site 1 consists of natural vegetation which may generally be characterized as moderate-aged secondary growth and the Site appears to have historically been used as agricultural or pastoral land approximately 10 to 15 years ago. Vegetation consists primarily of large saplings and small trees which maintain a closed canopy over an understory consisting of a moderately dense vine layer, few shrubs except along woodland edges, and a sparse to absent herb layer. The southern and western boundaries are demarcated by a collapsed rock wall. A fallen power line runs east-west through the approximate center of Site 1 and a relict fence runs generally north-south through the approximate Site center.

Site 2 consists predominantly of residential, business, and restaurant development along with school and fire station buildings and grounds. The majority of the ground surface within this area is covered by the surfaces of buildings and parking lots. Vegetated areas are generally well-maintained and consist of ornamental shrubs, small grassy lawns, and occasional canopy trees.

2.1 Climate

The climate of the Coral Bay area is typical of the southeast side of St. John and receives an average of 30-35 inches of rainfall—less that the mountainous northern and western sides of the island which average 50 inches of rain per year (USGS 2005). Easterly trade winds affect the island and the study area during the summer. Low-pressure systems and fronts influence the local climate during the winter.

Temperature varies little throughout the year, with daytime temperatures falling within the range of 75 -88° F, and usually drops 10° F at night. Due to year-round high temperatures and nearly constant winds, the evapotranspiration rate is generally high (STX EID 2006).

2.2 Geology, Topography, and Soils

St. John, St. Thomas, Puerto Rico, and the British Virgin Islands are topographic highs on the Puerto Rico Bank, a submerged platform generally defined by the 600-foot depth contour (Rogers and Teytaud 1988). During the Pleistocene Epoch, a continuous landmass extended eastward from Puerto Rico across the British Virgin Islands, including the area of St. John. Deep water and steep slopes surround the Puerto Rico Bank. The Puerto Rico Trench, with water depths greater than 27,000 feet, lies to the north; the Virgin Islands Basin, with water depths commonly in excess of approximately 8200 feet (NOAA Chart 25641, 1983), separates St. John from St. Croix to the south; the Pillsbury Sound with depths of up to 105 feet separates St. John from St. Thomas to the west; and the Flanagan Passage with depths of up to 156 feet lies within the Caribbean Sea immediately to the east (U.S. Geological Survey [USGS] Western St. John, VI 7.5-minute quadrangle [1982]).

St. John is irregularly shaped, with an area of approximately 19 square miles. The landscape of St. John is generally mountainous, with slopes in excess of 30 percent covering more than 80 percent of the island (Rankin 1998). The land mass of St. John originated in underwater volcanic eruptions and movements of the Caribbean tectonic plate near the transition between the Early and Late Cretaceous Period (Rankin 1998). Over millions of years, weathering, the action of ocean waves, and the growth of coral formations produced the landscape of St. John seen today.

On small portions of the island, such as Coral Bay where the study area is located, the landscape is dominated by alluvial and beach sediments and low, relatively flat topography that forms what may best be described as a coastal plain. Site 1 is located in the floodplain of an intermittent drainage that collects flow from Ajax Peak, Mamey Peak, and Bordeaux Mountain. Site 2 is located at the bottom of Base Hill near the inland extent of the Coral Harbor coastal plain. Both sites have fairly gentle slopes, generally ranging from 0 to 2 percent. Elevations within Site 1 ranges from a low of approximately 8 feet above mean sea level (MSL) in the southwest corner of the site to a high of approximately 34 feet above MSL along Route 10 in the northern portion of the site. Elevations within Site 2 range from a low of approximately 8 feet above MSL in the southeast corner of the site to a high of approximately 32 feet above MSL in the northwest corner of the site (2004 Light Detection and Ranging [LIDAR] elevation data).

The study area is underlain by five soil series: Cinnamon Bay loam (*Typic Haplustolls*), Sandy Point and Sugar Beach soils (*Tropic Fluvaquents* and *Fluvaquentic Troposaprists*), Solitude gravelly fine sandy loam, (*Aeric Tropaquepts*), Victory-Southgate complex (*Typic Ustropepts*), and *Ustorthents*. The Cinnamon Bay, Sandy Point and Sugar Beach, and Solitude series (all located on Site 1) are considered hydric by the Natural Resource Conservation Service (NRCS) (NRCS 1998). However, no hydric soils were found in the study area during field investigations. Sedimentation and overwash from the highway and uphill development may have changed the character of the soils over time to eliminate their hydric characteristics. In addition, drainage patterns have apparently changed, as evidenced by the relocation of an intermittent stream to the west Site 1 (see Section 1.0 and Section 2.3). Changes in drainage likely prevent the occurrence of long-term standing water on Site 1. Soils within the study area are depicted on Figure 2.

Within Site 1, Cinnamon Bay loam occurs under the northwest corner, Sandy Point and Sugar Beach soils occur under a small portion of the southern corner, Solitude gravelly fine sandy loam occurs within the majority of the interior, Victory-Southgate complex occurs generally along Route 10, and Ustorthents occur generally along Route 107 (Figure 2). Site 2 is underlain entirely by Victory-Southgate complex (Figure 2).

The Cinnamon Bay series (Cinnamon Bay loam, 0 to 5 percent slopes, occasionally flooded) consists of very deep, well-drained soils on alluvial fans and terraces. They formed in alluvium derived from adjacent volcanic uplands. The seasonal high water table is more than 6 feet deep, and depth to bedrock is more than 60 inches. Permeability is moderate and the hazard of erosion is moderate.

The Sandy Point and Sugar Beach series (Sandy Point and Sugar Beach soils, 0 to 2 percent slopes, frequently flooded) consists of very deep, very poorly-drained soils in saline marshes and flats adjoining the sea. These soils formed in marine sediments that overlie herbaceous plant remains. The seasonal high water table ranges from approximately 1 foot above the surface to a depth of 0.5 foot from April to December, when flooding is frequent for brief periods. The depth to bedrock is more than 60 inches. Permeability is slow and the hazard of erosion is slight.

The Solitude series (Solitude gravelly fine sandy loam, 0 to 2 percent slopes, frequently flooded) consists of very deep, somewhat poorly drained soils in areas adjacent to saline marshes, flats, and ponds. They formed in marine sediments at the mouths of guts. Seasonal high water table is at a depth of 1.0 to 2.5 feet from April to December, when flooding is frequent for brief periods. Depth to bedrock is more than 60 inches. Permeability is slow and the hazard of erosion is low.

The Victory-Southgate series (Victory-Southgate complex, 2 to 12 percent slopes, very stony) consists of moderately deep, well-drained soils on summits and side slopes of volcanic hills and mountains. These soils formed in material weathered from extrusive igneous bedrock. The seasonal high water table is more than 6 feet deep, and depth to bedrock ranges from 20 to 40 inches. Permeability is moderate and the hazard of erosion is moderate.

The Ustorthent series (Ustorthents) consists of areas that have been altered from their natural state by humans. Generally, these areas are associated with cutting and filling activities associated with construction of airports, roads, shopping centers, buildings, storm drains, housing developments, recreational areas, and similar projects. The properties and characteristics of the Ustorthents vary so considerably that an onsite investigation is needed to determine the suitability for most uses.

2.3 Water Resources and Hydrology

No jurisdictional streams or guts were located within the boundaries of either Site 1 or Site 2. The study area is located within part of the St. Thomas-St. John watershed (USGS Hydrologic Unit [HU] 21020001) of the Caribbean Region. The Site falls within the Southeast St. John sub-watershed (USGS HU 21020001010020) of the St. John watershed (USGS HU 21020001020) (VIDPNR 2006a). In addition, within each watershed, the Virgin Islands Division of Environmental Protection (DEP), Department of Planning and Natural Resources (VIDPNR) has defined waterbody Assessment Units (AUs), which correspond to coastal elements of each watershed. The Site is encompassed by one AU: VI-STJ-12 (Coral Harbor) (VIDPNR 2006a). No water quality monitoring stations are located within this AU.

Classes have been assigned to waters of St. John based upon the existing or contemplated best usage of coastal waters to which surface waters within individual watersheds drain. A best usage classification of **B** has been assigned to all coastal waters receiving surface water runoff from the Site. Class **B** waters are suitable for the propagation of desirable species of marine life and for primary contact recreation (swimming, water skiing, etc.) (VIDPNR 2006a).

The VIDPNR-DEP has initiated a whole-basin approach to water quality management for the three St. John watersheds. Water quality for the study area is summarized in the 2006 Integrated Water Quality Monitoring and Assessment Report for the United States Virgin Islands. AU VI-STJ-13 (Coral Harbor) is listed as having **Insufficient Information** as to its support of its designated uses (VIDPNR 2006a).

The VIDPNR-DEP has assembled a list of impaired waterbodies according to the Clean Water Act Section 303(d) and 40 CFR 130.7, hereafter referred to as the VIDPNR 2006 Section 303(d) list. The list is a comprehensive public accounting of all impaired waterbodies. An impaired waterbody is one for which technology-based pollution controls are not stringent enough to attain or maintain compliance with applicable State and Territory water quality standards as defined in 40 CFR 131. The standards violation may be due to an individual pollutant, multiple pollutants, or an unknown cause of impairment. The impairment could be from point sources, non-point sources, and/or atmospheric deposition. AU VI-STJ-13 is not listed anywhere on the VIDPNR 2006 Section 303(d) list (VIDPNR 2006b).

The USGS topographic quadrangle (Western St. John, VI 7.5-minute quadrangle [1982]) depicts one intermittent blue-line stream flowing through a portion of Site 1 (Figure 1). However, ESC delineations resulted in a determination that this feature is located approximately 30 to 40 feet outside of the western boundary of Site 1 and drains to Coral Harbor approximately 750 feet south of Site 1. The system appears to be an intermittent or ephemeral storm drainage. Changes in drainage patterns have apparently occurred within the area that may have relocated this drainage from the position depicted on the USGS topographic quadrangle. An influx of sediment from higher elevations might have a significant effect on drainage within this level area. Furthermore, changes must have occurred decades ago or earlier, as a crumbling rock wall noted on the western boundary of Site 1 separates this drainage from the Site. No Section 404 jurisdictional surface waters or Section 404 jurisdictional wetlands are located within the study area.

2.4 Methodology

Prior to traveling to the study area, ESC reviewed existing literature, aerial imagery and baseline information relevant to the project. Sources of relevant information included documentation available from USGS topographic mapping (Western St. John 7.5-minute quadrangle [1982]), U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory mapping, Natural Resources Conservation Service (NRCS) soils mapping (NRCS 1998), and recent aerial photography (2004 and 2005) obtained from the U.S. Department of Agriculture.

Advanced 15-meter horizontal Light Detection and Ranging (LIDAR) elevation data with vertical accuracy of several centimeters were employed to determine elevations within the study area. The LIDAR data were produced by the U.S. Army Corps of Engineers (USACE) in 2004, and were used to create a high resolution digital elevation model and isoplethic contour lines.

The most current USFWS list of federally protected species with ranges extending into the U.S. Virgin Islands was consulted prior to field surveys. Species listed by the VI DPNR were also reviewed. Indigenous species are also protected under the U.S. Virgin Islands Indigenous and Endangered Species Act of 1990. Field surveys for protected species focused on identification of suitable habitat, as well as likely presence during survey periods.

2.4.1 Section 404 Jurisdictional Area Delineation

Vegetated wetlands are defined by the presence of three primary criteria: hydric soils, hydrophytic vegetation, and evidence of hydrology at or near the surface for a portion (12.5 percent) of the growing season (Environmental Laboratory 1987). Jurisdictional areas were evaluated using the three-parameter approach following U.S. Army Corps of Engineers (USACE) delineation guidelines (Environmental Laboratory 1987). Surface waters within the Site are subject to jurisdictional consideration under Section 404 of the Clean Water Act as waters of the United States (33 CFR Section 328.3). The project study area was walked and visually surveyed for significant features, including surface waters, vegetated wetlands, or guts. Any depressions or other areas likely to retain water were examined by digging soil cores. Any occurrence of possible hydric vegetation was also closely examined for hydric soils or drainage patterns.

2.4.2 Vegetation Communities

Plant community descriptions are based on the U.S. Virgin Islands Vegetation Classification System (Gibney et al. 2000). Plant names follow nomenclature in Aceveco-Rodríguez (1996). Plant names were also obtained from Little and Wadsworth (1964) and Little et al. (1974). The vegetation communities were assessed using the vegetation classes developed by the Virgin Islands Conservation Data Center (CDC, which is based within the Eastern Caribbean Center of the University of the Virgin Islands), The Nature Conservancy (TNC), and Island Resources Foundation (IRF) in 1998 (Gibney et al. 2000).

Plant community species compositions were assessed using transects, visual identification, and sampling. Survey transects and locations were devised to cover all distinct habitats within the Sites. Special attention was given to possible occurrences of locally and federally listed rare, endangered, and threatened species.

Trees with a dbh of 6 inches or greater were flagged and located using Trimble GeoXT Differential Global Positioning System (dGPS) data that were post processed using the San Juan, Puerto Rico CORS base station data. The equipment, settings, and methods used for the mapping are based on protocols that are reported to result in sub-meter accuracy.

2.4.3 Fauna

Wildlife and aquatic life distribution and habitat were determined through field observations and available supportive documentation (Bond 1985, Evans 1990, Raffaele 1989, and Raffaele et al. 2003). Study area fauna were surveyed and assessed on an opportunistic basis. Surveys were conducted on July 9, July 11, and July 12, 2007. Birds and herptiles were identified both by sight and by voice during daily observations. Avifaunal surveys were conducted in the early morning, early evening, and throughout the day to ensure observation of usage patterns by resident and transient species. No particular attempt was made to survey bats, since the timeframe for the assessment did not allow the extensive techniques needed to determine the species present, resources being used and areas of possible roost. Determinations of habitat suitability were augmented by literature reviews.

3.0 OBSERVATIONS OF CORAL BAY FLORA

3.1 Overview

The vegetation of St. John is considered sub-tropical, a result of the unique conditions created by climate, soil, wind, elevation, aspect, and the influence of the surrounding ocean. The classification of the island's plant communities is complex because of the blending of types across environmental gradients, leading to subtle changes in species composition and abundance. Past land use activities and fluctuation in the natural environment contribute to this complexity. The dry tropical climate, geography, geology, and historical land use practices have helped to determine the current vegetation patterns. However, cutting, clearing, agriculture and the introduction of non-indigenous plants have left only remnants of the original plant associations.

Seven general vegetation community types are found on St. John: Moist Forest, Dry Forest, Woodlands, Shrublands, Herbaceous, Wetlands, and Sparse Vegetation (Gibney et al. 2000). Plant communities identified in the study area are shown in Figure 3. Site 1 is composed primarily of Dry Forest, of the Semi-Deciduous Forest Subtype, with a patch of Mixed Dry Shrubland along the southeastern boundary. Mixed Dry Shrubland also occurs to the east, south of Site 2 fringing Coral Harbor. Site 2 is in a significantly developed area, and supports mainly cultivated specimens of native and introduced floral species. Historically, this area was also likely composed of Dry Forest grading into Mixed Dry Shrubland. An additional plant community type near the study area is Mangrove Forest, which fringes Coral Harbor south of the study area and east of Highway 107 (Figure 3).

3.2 Vegetation of the Study Area

Species lists obtained during the field visits represent a snapshot of vegetation at the study area that was identified by flowers, fruit, foliage, or other distinguishing characteristics. The lists are not intended to be exhaustive inventories of plant species, but to characterize the general nature of vegetation at the various types of communities present. Some species are highly seasonal, actively growing only during the rainy season or after heavy rains, while some flourish during drier periods of the year. Species that may have been dormant during the July field visits, or cryptic for other reasons, may not be represented.

A total of 42 species in 24 families were recorded in Site 1 (Appendix B). Of these, 32 are trees or shrubs, eight are vines, and three are herbs. Ten of the species are non-native, introduced to St. John (Acevedo-Rodríguez 1996). These introduced species include aggressive vines and species that have been introduced for ornamental or culinary purposes. At Site 2, 19 species of trees or shrubs were recorded (Appendix B). Twelve of these are introduced, as might be expected of a disturbed area with many cultivated specimens.

In the Mixed Dry Shrublands near the study area, five species were noted. The Mangrove Forest area fringing Coral Harbor contained eleven identified species, including trees, shrubs, and vines, some of which only occurred along the disturbed roadside edge (Figure 3 and Appendix B).

3.3 Description of Vegetation Communities

The physiognomic structure (the physical characteristics) and species composition of study area community types are strongly influenced by a number of factors, including prevailing wind patterns, wind velocity, length of the dry season or number of months with less than 2 inches of rainfall, aspect and slope, and land use. The rainfall distribution for the area is 30-45 inches per year. The position of the study area on the southeast side of St. John can be predicted to affect vegetation communities by exposure to drying winds. The southern coasts and mountain slopes of the island are on average drier and more exposed than the northern slopes and shores. Salt spray may be another factor that likely reduces floral diversity.

3.3.1 Dry Forest

This plant community is described in Gibney et al. (2000) as type I.C.1.N.a. Lowland tropical/subtropical semi-deciduous forest. According to Gibney et al. (2000), this type of community is dominant over the Virgin Islands and occupies over 50 percent of St. John. Thomas and Devine (2005) note that this community typically has two layers. At Site 1, the canopy layer is nearly closed and emergent trees reach approximately 60 feet in height. The shrub layer occurs sporadically throughout the forest, forming thickets in many areas. An herb layer is generally absent except on sunny edges. Forest floor leaf litter is absent to abundant, depending on canopy species in the vicinity.

At Site 1, this community occupies 3.5 acres, comprising most of the parcel west of Highway 107. Most trees in the parcel appear to be less than a decade old. However, a band of larger trees occurs through the middle of the parcel, running from northeast to southwest (see Figure 3). This band corresponds to the footprint of an old power line that extends through the parcel. Other large trees occur around the edges of the parcel. From these site characteristics, it appears that grazing or some other agricultural activity apparently occurred in the past, and that vegetation has succeeded to forest only recently. The remains of an old stone wall along the southern boundary suggest that disturbance in this area has been ongoing for many years.

Large trees (those over 6 inches dbh) totaled 34 stems. Figure 3 depicts the location and species of all identified trees with a dbh of greater than 6 inches within the study area. These trees are listed in Table 1:

Table 1: Large Trees Identified at Site 1 (see Figure 3 for locations)

Scientific Name	Common Name	Family	Origin	Diameter (Inches)
Citharexylum fruticosum	fiddlewood, old woman bitter	Verbenaceae	Native	9
Cordia collococca	manjack, red manjack	Boraginaceae	Native	7
Cordia collococca	manjack, red manjack	Boraginaceae	Native	6
Cordia collococca	manjack, red manjack	Boraginaceae	Native	6
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	7
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	10
Guaiacum officinale	lignum vitae, liki wiki	Zygophyllaceae	Native	8
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	8
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	8
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	10
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	7
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	6
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	7
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	11
Parkinsonia aculeata	horse bean, Jerusalem thorn	Fabaceae (Caesalpinioideae)	Introduced	8
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	10
Pilosocereus royenii	dacta dul dul, didledoo	Cactaceae	Native	6
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	9
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	18
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	8
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	7
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	7
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	10
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	11
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	18
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	10
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	7
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	11
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	10
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	19
Tabebuia heterophylla	black cedar, pink cedar	Bignoniaceae	Native	14
Tamarindus indica	tamarind	Fabaceae (Caesalpinioideae)	Introduced	9
Unknown	Unknown			9
Unknown	Unknown			6

Nomenclature and common names are taken from Acevedo-Rodríguez (1996)

Additional plant species identified at Site 1 are listed in Table 2:

Table 2: Additional Plant Species Identified at Site 1

Stratum	Scientific Name	Common Name	Family	Origin
vine	*Abrus precatorius*	crab's eye, jumbie bead	Fabaceae (Faboideae)	Introduced
vine	*Acacia retusa*	catch and keep, white police	Fabaceae (Mimosoideae)	Native
shrub	*Acacia tortuosa*	casha	Fabaceae (Mimosoideae)	Native
shrub	*Bontia daphnoides*	white alling	Myoporaceae	Native
herb	*Bromelia pinguin*	ping wing	Bromeliaceae	Introduced
vine	*Capparis flexuosa*	bottle will, dog caper	Capparaceae	Native
tree	*Capparis indica*	linguam	Capparaceae	Native
vine	*Cissus trifoliata*	sorrel vine	Vitaceae	Native
vine	*Cissus verticillata*	pudding vine	Vitaceae	Native
shrub	*Clerodendrum aculeatum*	chuc chuc	Verbenaceae	Native
tree	*Coccoloba venosa*	cherry grape, chiggery grape	Polygonaceae	Native
shrub	*Colubrina elliptica*	maubi, snakeroot	Rhamnaceae	Native
shrub	*Cordia alliodora*	copper	Boraginaceae	Native
tree	*Crescentia cujete*	calabash tree, gobi	Bignoniaceae	Introduced
shrub	*Croton astroites*	marang, white marang	Euphorbiaceae	Native
shrub	*Croton flavens* var. *rigidus*	marang, yellow marang	Euphorbiaceae	Native
vine	*Cryptostegia grandiflora*	purple allamanda, rubber vine	Asclepiadaceae	Introduced
vine	*Cuscuta americana*	love, love bush, love vine	Cuscutaceae	Native
shrub	*Eugenia bilfora*	black rodwood	Myrtaceae	Native
shrub	*Eugenia rhombea*	crumberry	Myrtaceae	Native
shrub	*Ginoria rohrii*	prickle wood, sugar ant	Lythraceae	Native
herb	*Jatropha gossypifolia*	belly ache bush, body catta	Euphorbiaceae	Native
shrub	*Leucanea leucocephala*	tan tan, tanty	Fabaceae (Mimosoideae)	Introduced
shrub	*Pithecellobium unguis-cati*	blackbead, bread and cheese	Fabaceae (Mimosoideae)	Native
shrub	*Randia aculeata*	Christmas tree, ink berry	Rubiaceae	Native
vine	*Serjania polyphylla*	basket wiss, basket wood	Sapindaceae	Native
shrub	*Solanum racemosum*	cankerberry	Solanaceae	Native
shrub	*Spermacoce confusa*	[none]	Rubiaceae	Native
tree	*Spondias mombin*	hog plum	Anacardiaceae	Native
shrub	*Triphasia trifolia*	sweet lime	Rutaceae	Introduced
tree	*Zanthoxyllum monophyllum*	yellow prickle	Rutaceae	Native

Nomenclature and common names are taken from Acevedo-Rodríguez (1996)

Common tree species at Site 1 are *Samanea saman*, *Guazuma ulmifolia*, and *Cordia sebestena*. Dominant shrubs include *Randia aculeata* and various *Eugenia* species. The vines *Cissus verticillata* and *Cryptostegia grandifolia* were abundant and aggressive, especially in gaps and on forest edges.

3.3.2 Disturbed Land

This plant community is represented by a school, fire station, and residential and commercial establishments of the community of Coral Bay. The entire area of Site 2 is characterized by disturbed land. Much of the surrounding area is also disturbed, and cleared land extends to the shores of Coral Harbor south of the eastern end of Site 2. Most vegetative elements are cultivated fruit trees or ornamentals, or weedy volunteers. Therefore, a large component of introduced species is present. In the absence of human disturbance, Site 2 would likely be comprised of Dry Forest. Its level topography reduces runoff and exposure to wind and salt spray, producing habitat conditions similar to those at Site 1. Many specimen trees on the school grounds are larger than 6 inches dbh. A total of 33 large trees were located within Site 2, and are listed in Table 3.

Table 3: Large Trees Identified at Site 2 (see Figure 3 for locations)

Scientific Name	Common Name	Family	Origin	Diameter (Inches)
Bucida buceras	gree gree tree, gregery	Combretaceae	Native	19
Bucida buceras	gree gree tree, gregery	Combretaceae	Native	39
Bucida buceras	gree gree tree, gregery	Combretaceae	Native	36
Bucida buceras	gree gree tree, gregery	Combretaceae	Native	48
Bucida buceras	gree gree tree, gregery	Combretaceae	Native	36
Bucida buceras	gree gree tree, gregery	Combretaceae	Native	36
Bucida buceras	gree gree tree, gregery	Combretaceae	Native	36
Carica papaya	papaya	Caricaceae	Introduced	8
Cocos nucifera	coconut palm	Arecaceae	Introduced	8
Cocos nucifera	coconut palm	Arecaceae	Introduced	8
Cocos nucifera	coconut palm	Arecaceae	Introduced	8
Cocos nucifera	coconut palm	Arecaceae	Introduced	10
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	10
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	30
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	22
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	20
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	11
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	14
Cordia sebestena	bay almond, geiger	Boraginaceae	Native	14
Delonix regia	flamboyant tree, poinciana	Fabaceae (Caesalpinioideae)	Introduced	24
Ficus benjamina	ficus	Moraceae	Introduced	36
Ficus benjamina	ficus	Moraceae	Introduced	8
Ficus benjamina	ficus	Moraceae	Introduced	7
Guazuma ulmifolia	bastard cedar, jackass calalu	Sterculiaceae	Native	12
Meliococcus bujugatus	genip, kenep	Sapindaceae	Introduced	9
Meliococcus bujugatus	genip, kenep	Sapindaceae	Introduced	40
Musa acuminata	banana	Musaceae	Introduced	6
Roystonea borinquena	cabbage palm, mountain cabbage	Arecaceae	Native	6
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	36
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	42
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	36
Samanea saman	licorice, rain tree	Fabaceae (Mimosoideae)	Introduced	18
Unknown	Unknown			13

Nomenclature and common names are taken from Acevedo-Rodríguez (1996)

Additional species within Site 2 and the disturbed portion of the study area are listed in Table 4.

Table 4: Additional Plant Species Identified at Site 2

Stratum	Scientific	Common	Family	Origin
tree	*Andira inermis*	bastard mahogany, dog almond	Fabaceae (Faboideae)	Native
tree	*Annona muricata*	soursop, susake	Annonaceae	Introduced
tree	*Annona squamosa*	sugar apple	Annonaceae	Native
vine	*Cryptostegia grandiflora*	purple allamanda, rubber vine	Asclepiadaceae	Introduced
tree	*Gliricidia sepium*	pea tree, quick stick	Fabaceae (Faboideae)	Introduced
tree	*Melia azedarach*	chinaberry, hagbush	Meliaceae	Introduced
tree	*Plumeria alba*	frangipani, klang hout	Apocynaceae	Native
tree	*Tamarindus indica*	tamarind	Fabaceae (Caesalpinioideae)	Introduced

Nomenclature and common names are taken from Acevedo-Rodríguez (1996)

3.3.3 Mixed Dry Shrubland

This community is characterized by Gibney et al (2000) as Mixed Dry Shrubland, although further categorization is difficult. Species compositions and vegetative strata are dependent on aspect, exposure, salt spray, wind, and disturbance. At the study area, thin rocky soils also contribute to the formation of drought-dependent communities near the shores of Coral Harbor, and human disturbance contributes to low species diversity. Mixed Dry Shrubland intrudes into the Dry Forest community at Site 1 near Highway 107 (Figure 3). Ground disturbance or vegetative clearing may have degraded the forest cover in this area, leading to the transition to shrubland. However, nearby areas, such as a strip of land south of Site 2 on Coral Harbor, represent well-developed examples of this plant community. Mixed Dry Shrubland is a common plant community type in the East End of St. John. Therefore, site conditions may favor the establishment of this drought-adapted community even without the influences of human disturbance.

This community contains some of the same species as the adjoining Dry Forest community. However, large trees are absent and only one specimen of 6 inches dbh or greater was identified: *Pilosocereus royenii* (see Figure 3 for location). Species characteristic of this community, exclusive of adjacent Dry Forest species, are listed in Table 5.

Table 5: Characteristic Species of the Mixed Dry Shrub Community

Stratum	Scientific	Common	Family	Origin
shrub	*Agave missionum*	century plant, karata	Agavaceae	Native
herb	*Bryophyllum pinnatum*	clapper bush, green love	Crassulaceae	Introduced
tree	*Crescentia cujete*	calabash tree, gobi	Bignoniaceae	Introduced
vine	*Hylocereus trigonus*	chickenet, chigger apple	Cactaceae	Native
tree	*Pilosocereus royenii*	dacta dul dul, didledoo	Cactaceae	Native
herb	*Sanseviera trifasciata*	guana tail, lizard tail	Dracaenaceae	Introduced
shrub	*Croton flavens* var. *rigidus*	marang, yellow marang	Euphorbiaceae	Native

Nomenclature and common names are taken from Acevedo-Rodríguez (1996)

3.3.4 Mangrove Forest

Mangrove Forest does not occur in either Site 1 or Site 2, but forms a fringe along Coral Bay, south-southwest of the study area. The fringe is from 60 to 200 feet wide, and is sharply defined by Highway 107 to the west and the Coral Bay to the east. This community is apparently seasonally flooded. The dominant species is *Rhizopora mangle* (red mangrove), but *Avicennia germinans* (black mangrove) and *Laguncularia racemosa* (white mangrove) also occur. Additional species are sparse and include a few that are more characteristic of the nearby Dry Forest.

Table 6: Characteristic Species of the Mangrove Forest Community

Stratum	Scientific	Common	Family	Origin
shrub	*Acacia tortuosa*	casha	Fabaceae (Mimosoideae)	Native
tree	*Avicenna germinans*	black mangrove	Verbenaceae	Native
vine	*Capparis flexuosa*	bottle will, dog caper	Capparaceae	Native
shrub	*Cassine xylocarpa*	nothing nut, nut muscat	Celastraceae	Native
tree	*Citharexylum fruticosum*	fiddlewood, old woman bitter	Verbenaceae	Native
shrub	*Conocarpus erectus*	button mangrove, button wood	Combretaceae	Native
tree	*Hippomane mancinella*	death apple, manchineel	Euphorbiaceae	Native
tree	*Laguncularia racemosa*	white mangrove	Combretaceae	Native
tree	*Rhizophora mangle*	mangelboom, red mangrove	Rhizophoraceae	Native
shrub	*Solanum racemosum*	cankerberry	Solanaceae	Native
tree	*Thespesia populnea*	seaside mahoe	Malvaceae	Native

Nomenclature and common names are taken from Acevedo-Rodríguez (1996)

4.0 OBSERVATIONS OF CORAL BAY FAUNA

4.1 Overview

The present fauna of St. John represents the result of natural processes punctuated by habitat changes by Amerindians, and the more recent arrival of Europeans and associated more intensive land use changes. The island's fauna likely remained relatively stable until European settlement in the 1600s, which began a period of species decline. The wholesale clearing of land for plantation agriculture (production of sugar, cotton, and indigo), introduction of diseases, overhunting, and the introduction of non-native species (goat [*Capra hircus*], pig [*Sus javanicus*], dog [*Canis domesticus*], cat [*Felis domesticus*], horse [*Equus caballus*], donkey [*Equus asinus*], black and brown rats [*Rattus rattus* and *R. norvegicus*], house mouse [*Mus muscalus*], small Indian mongoose [*Herpestes javanicus*], and several frogs) have all had a dramatic impact on the floral and faunal composition of the Virgin Islands.

Development and vegetation maintenance (such as mowing by man and grazing by cattle and goats) result in fragmentation of habitats available to support island fauna. Though some species receive local and federal legal protection, their habitats continue to disappear. The most significant threat to the island's native fauna is urbanization and loss of suitable habitat.

Wildlife observations were made during field visits on July 9, 11, and 12, 2007. Observations occurred while walking transects through or adjacent to all habitats using the property roads, survey cuts, trails, and coastline as our primary means of access for observations. We also regularly traversed through habitats to obtain identifications of species present. Transects involved slowly walking while recording sightings and activities within each habitat. This was usually done in combination with gathering other information such as plants and other wildlife. It is important to note that the number of species identified reflects the short time frame of the study. More frequent observations would be expected to potentially yield a greater number of species.

4.2 Bird Observations

Four habitats are considered within the Site for the purposes of the bird survey: Dry Forest, disturbed land, Mixed Dry Shrubland, and Mangrove Forest. Table 7 lists birds observed during field investigations. Birds are listed with the most apparent associated habitat.

The Guide to the Birds of Puerto Rico and the Virgin Islands (Raffaele 1989) lists 210 species of birds as occurring in the Virgin Islands. A total of 17 species were observed at Coral Bay during the survey. All species listed were identified visually or vocally at least once, and subsequent identifications were made either visually or by call. The habitat supporting the greatest number of observed species during this survey was disturbed land. Although the habitat in disturbed areas is degraded, the acreage is large and correspondingly more habitat exists. In addition, some bird species are more adapted to open or edge habitats. Disturbed land also offered relatively unobstructed views of species utilizing the habitat; while the Dry Forest community was characterized by dense cover.

Table 7: Bird Species by Habitat

Species	**Dry Forest**	**Disturbed**	**Mixed Dry Shrubland**	**Mangrove Forest**
American Kestrel (*Falco sparverius*)		X		
Bananaquit (*Coereba flaveola*)	X	X	X	
Cattle Egret (*Bubulcus ibis*)		X		
Common Ground-dove (*Columbina passerina*)	X	X		
Gray Kingbird (*Tyrannus dominicensis*)	X	X	X	
Great Egret (*Casmerodius albus*)				X
Green-throated Carib (*Eulampis holosericeus*)	X			
House Sparrow (*Passer domesticus*)		X		
Laughing Gull (*Larus atricilla*)				
Lesser Antillean Bullfinch (*Loxigilla noctis*)	X	X	X	
Mangrove Cuckoo (*Coccyzus minor*)	X			X
Northern Mockingbird (*Mimus polyglottos*)		X		
Pearly-eyed Thrasher (*Margarops fuscatus*)	X	X		
Puerto Rican Flycatcher (*Myiarchus antillarum*)	X	X		
Yellow Warbler (*Dendroica petechia*)	X			
Yellow-crowned Night-heron (*Nyctanassa violacea*)				X
Zenaida Dove (*Zenaida aurita*)	X	X		

Species	Dry Forest	Disturbed	Mixed Dry Shrubland	Mangrove Forest
Total	**10**	**11**	**2**	**3**

Gray kingbirds and bananaquits were commonly observed in multiple habitats. Other common species including the Lesser Antillean bullfinch, yellow warbler, and Zenaida dove were also highly visible. Other species such as the yellow-crowned night-heron were quiet, reserved, and more specialized in their habitat preferences. The cattle egret was only seen in the company of a herd of feral goats that frequents the area.

The only raptor observed in the study area was American kestrel. The kestrel was seen perched atop trees, shrubs, and posts while watching for prey (most likely small birds, grasshoppers, and lizards).

Other bird species may be expected to occur within study area habitats (species observed elsewhere on the island are indicated with an asterisk). Dry Forest may be expected to regularly support scaly-naped pigeon (*Patagioenas squamosa*), bridled quail-dove* (*Geotrygon mystacea*), green-throated carib (*Eulampis holosericeus*), Caribbean elaenia (*Elaenia martinica*), pearly-eyed thrasher* (*Margarops fuscatus*), and migratory warblers such as red-eyed vireo (*Vireo olivaceus*), ovenbird (*Seiurus aurocapilla*) and Kentucky warbler (*Oporornis formosus*). Shrublands often support red-tailed hawk (*Buteo jamaicensis*), Antillean nighthawk (*Chordeiles gundlachii*), troupial (*Icterus incterus*), and black-faced grassquit* (*Tiaris bicolor*). Mangrove Forests would harbor many species of seabirds, shorebirds, and wading birds at their seaward edges, including greater yellowlegs* (*Tringa melanoleuca*), brown pelican* (*Pelecanus occidentalis*), little blue heron* (*Egretta caerulea*), and black-necked stilt* (*Himantopus mexicanus*). A greater component of forest bird species can be anticipated under the mangrove canopy. Disturbed land might host edge species such as white-winged dove (*Zenaida asiatica*), or grassland species such as smooth-billed ani* (*Crotophaga ani*), or species adapted to disturbance such as Caribbean martin (*Porgne dominicensis*) or rock dove (*Columba livia*).

4.3 Mammals

According to information provided by the St. Croix Environmental Information Depository (STX EID 2006), 18 species of mammals are recorded for the Virgin Islands: five bats, 11 non-native species that have established feral populations, and two of which are listed as extinct or probably extinct—the Antillean hutia (*Isolobodon portoricensis*) and Puerto Rican nesophontes, a shrew-like insectivore (*Nesophontes edithae*).

No bats were identified during Site investigations. Bats which may potentially occur within the study area include the insectivorous velvety free-tailed bat (*Molossos molossos*) and the piscivorous greater bulldog (fisherman) bat (*Noctilio leporinus*). The study area provides suitable habitat for both bats since the former species may roost in buildings (such as buildings in the developed portion of Coral Bay), and the latter species roosts generally in coastal maritime habitats.

The only species of non-native mammals recorded during field surveys were domestic goat, of which a herd of 15-20 animals was often seen frequenting the area, and donkey, a few individuals of which were seen in the forest of Site 1. Other mammals that likely occur within the study area include small Indian mongoose (*Herpestes javanicus*), domestic cat (*Felis domesticus*), roof rat (*Rattus rattus*), Norway rat (*R. norvegicus*), and house mouse (*Mus musculus*).

4.4 Reptiles and Amphibians

Two species of reptiles and two amphibians were observed within the study area during this investigation. An additional 11 species of reptiles and three species of amphibians may possibly occur within the study area at some point during the year.

4.4.1 Reptiles

Of the 18 terrestrial reptiles that occur in the Virgin Islands, four are snakes, 12 are lizards, and two are turtles. The most common reptile observed during the field investigation is the crested anole (*Anolis cristatellus*) which was ubiquitous both on the ground and on vegetation in all study area communities. Another reptile occasionally observed was the green iguana (*Iguana iguana*) which seen climbing woody vegetation in the Dry Forest community.

A number of species were not encountered during the survey, but likely occur in the study area. The common dwarf gecko (*Sphaerodactylus macrolepis*) is often found in leaf litter and may occur in the Dry Forest of Site 1. The grass anole (*Anolis pulchellus*) may occur in Site 2, as it favors exposed grassy areas. Mixed Dry Shrubland within the study area may contain common ground lizard (*Ameiva exsul*), which specializes in xeric open areas. The terrestrial red-footed tortoise (*Geochelone carbonaria*) is an exotic species from tropical South America which may be expected in almost any habitat.

4.4.2 Sea Turtles

Five species of sea turtles occur in Virgin Islands coastal waters. These include the leatherback (*Dermochelys coriacea*), green (*Chelonia mydas*), loggerhead (*Caretta caretta*), Kemps ridley (*Lepidochelys olivacea*), and hawksbill (*Eretmochelys imbricata*). None of the five species of sea turtles have been reported nesting at Coral Bay. Coral Bay beaches are likely not suitable for nesting turtles due to their narrow and steep character.

4.4.3 Amphibians

The dry character of study area habitats likely limits the local frog population diversity. However, two species were identified by call: the Antillean frog (*Eleutherodactylus antillensis*) and the white-lipped frog (*Leptodactylus albilabris*). The Antillean frog is a woodland specialist, whereas the white-lipped frog is often found in ditches and other temporary or permanent water bodies.

Two other species that might be expected to occur in the study area include Cuban treefrog (*Osteopilus septentrionalis*) and cane toad (*Bufo marinus*). These are exotic, invasive species that find shelter in surface debris and forest vegetation.

4.5 Invertebrates

No formal attempts were made to survey study area invertebrates, given the timeframe, the resources available, and the expertise needed. In addition, little is known about the status of most terrestrial invertebrates of the Virgin Islands.

During our survey, we observed several species of spiders within the woodland community. The spiny-bodied spider (*Gasteracantha tetracantha*) was commonly found within denser portions of the woodland community where it constructed webs among tree branches. The zebra longwing butterfly (*Heliconius charithonius*) was seen foraging for nectar at the flowers of pudding vine. Tracks and holes of the great land crab (*Cardisoma guanhumi*) were common occurrences both in the Dry Forest community at Site 1 and in Mangrove Forest near Coral Harbor.

5.0 ENDANGERED SPECIES

Species with the federal classification of Endangered (E), Threatened (T), or officially Proposed (P) for such listing are protected under the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq.*). The term "Endangered Species" is defined as "any species which is in danger of extinction throughout all or a significant portion of its range," and the term "Threatened Species" is defined as "any species which is likely to become an Endangered species within the foreseeable future throughout all or a significant portion of its range" (16 U.S.C. 1532).

There are 13 federally listed threatened and endangered species for the U.S Virgin Islands. These include nine animals and four plants. The list from the U.S. Fish and Wildlife Service (USFWS 2007) provided below gives the species and the status:

Table 8: Federally listed species whose ranges extend into the U.S. Virgin Islands (USFWS 2007)

Status	Listing
Animals -- 9	
E	Lizard, St. John ground (*Ameiva polops*)
T	Sea turtle, green except where endangered (*Chelonia mydas*)
E	Sea turtle, hawksbill (*Eretmochelys imbricata*)
E	Sea turtle, leatherback (*Dermochelys coriacea*)
T	Sea turtle, loggerhead (*Caretta caretta*)
E	Seal, Caribbean monk (*Monachus tropicalis*)
T	Tern, roseate Western Hemisphere except NE U.S. (*Sterna dougallii dougallii*)
E	Whale, finback (*Balaenoptera physalus*)
E	Whale, sperm (*Physeter catodon* (= *macrocephalus*))
Plants -- 4	
E	Boxwood, Vahl's (*Buxus vahlii*)
E	*Calyptranthes thomasiana* (No common name)
E	*Catesbaea melanocarpa* (No common name)
E	Prickly-ash, St. Thomas (*Zanthoxylum thomasianum*)

None of these species was observed during field surveys. Suitable habitat likely exists for *Catesbaea melanocarpa* and *Zanthoxylum thomasianum* in Dry Forest and/or Mixed Dry

Shrubland habitat. *Zanthoxylum thomasianum* is only known to occur on St. Thomas, U. S. Virgin Islands. Detailed surveys of the study area failed to disclose any occurrences of either species, and it is concluded that they do not occur in the study area.

The VI DPNR (VI DPNR 2006b) lists two additional federal species, the Virgin Islands tree boa (*Epicrates monensis granti*) and the brown pelican (*Pelecanus occidentalis*). Suitable habitat for the brown pelican exists along local shorelines, but not at the study area. However, the Virgin Islands tree boa is not believed to occur on St. John.

In addition to federally listed species, there are 77 locally threatened and endangered species are listed by the VI DPNR (VI DPNR 2006b). These species are listed below, along with an indication of whether suitable habit for each species exists on either Site 1 or Site 2. Species that were recorded in the study area are indicated with an asterisk (*).

Great egret was recorded at the Mangrove Forest portion of the study area. Lignum vitae was found near a driveway and residential lot, suggesting that this occurrence is a cultivated specimen.

Table 9: Locally threatened and endangered species listed by the VI DPNR (VI DPNR 2006b)

Scientific Name	Common Name	Suitable On-Site Habitat
	Animal	
order Antipatharia	Black coral	No
Anas bahamensis	Bahama duck (white-cheeked pintail)	No
Anthracothorax dominicus	Antillean mango (hummingbird)	Yes
Aratinga pertinax	Brown-throated parakeet	Yes
Ardea herodias	Great blue heron	No
Brachyphylla cavernarum	Cave bat	No
*Casmerodius albus**	Great (common) egret	No
Catoptrophorus semipalmatus	Willet	No
Charadrius alexandrinus	Snowy plover	No
Chordeiles gundlachii	West Indian nighthawk	Yes
Columba leucocephala	White-crowned pigeon	Yes
Egretta thula	Snowy egret	No
Epinephelus itajara	Jewfish	No
Fulica caribea	Caribbean coot	No
Geotrygon mystacea	Bridled quail dove	Yes
Ixobrychus exilis	Least bittern	No
Mabuya mabouia	Slipperyback skink	Yes
Myiarchus stolidus	Stolid flycatcher	Yes
Noctilio leporinus	Fisherman bat	No
Nycticorax nycticorax	Black-crowned night-heron	No
Otus nudipes newtoni	Virgin Islands screech owl	Yes
Oxyura jamaicensis	Ruddy duck	No

Scientific Name	**Common Name**	**Suitable On-Site Habitat**
Phaethon lepturus	White-tailed tropicbird	No
Podiceps dominicus	Least grebe	No
Puffinus iherminieri	Audubon shearwater	No
Rallus longirostris	Clapper rail	No
Stenoderma rufum	Red fruit bat	Yes
Sterna antillarum	Least tern	No
Plant		
Agave eggersiana	Egger's agave	Yes
Brassavola cuccullata		Yes
Brysonima sp.		--
Callicarpa ampla	Capa rosa	Yes
Calyptranthes thomasiana	St. Thomas lidflower	No
Catesbaea melanocarpa		Yes
Coccoloba rugosa		Yes
Croton fishlockii		Yes
Cypselia humifusa		No
Epidendrum bifidum (Phychilis macconnelliea)	Sandy point orchid	Yes
Epidendrum ciliare	Cruzan Christmas orchid	No
Epidendrum cochleatum		No
Erythrina eggersii	Egger's cockspur	No
Eugenia sp.		--
Galactia eggersii	Egger's galactia	Yes
*Guaiacum officinale**	Lignum vitae	Yes
Habenaria alata		No
Ilex sideroxyloides	Central American oak	No
Ilex urbanii	Urban's holly	No
Machaonia woodburyana		Yes
Malpighia infestissima	Stinging bush	Yes
Malpighia linearis		Yes
Malpighia sp.		--
Malpighia woodburyana	Cowage cherry	Yes
Mammilaria nivosa	Wooly nipple	No
Manilkara bidentata	Bulletwood	No
Maytenus cymosa		Yes
Nashia inaguensis		Yes
Oncidium prionochilum	Yellow dancing lady orchid	Yes
Oncidium variegatum	White dancing lady orchid	Yes
Operculina triquetra		Yes
Opuntia triacantha		Yes
Peperomia myrtifolia	Myrtle-leaved pepermonia	No
Pilea richardii	Richard's clearwood	No

Scientific Name	Common Name	Suitable On-Site Habitat
Polystachya concreta		No
Ponthieva racemosa		No
Prescottia oligantha		No
Prescottia stachyoides		No
Psidium amplexicaule	Mountain guava	No
Psidium sp.		--
Schoepfia schreberi		Yes
Sida eggersi		Yes
Solanum conocarpum		Yes
Solanum mucronatum		Unknown
Spiranthes elata		No
Tetramicra canaliculata		Yes
Tetramicra canaliculata alba		Yes
Tillandsia lineatispica	Pinon	Yes
Vanilla barbellata	Vanilla orchid	Yes

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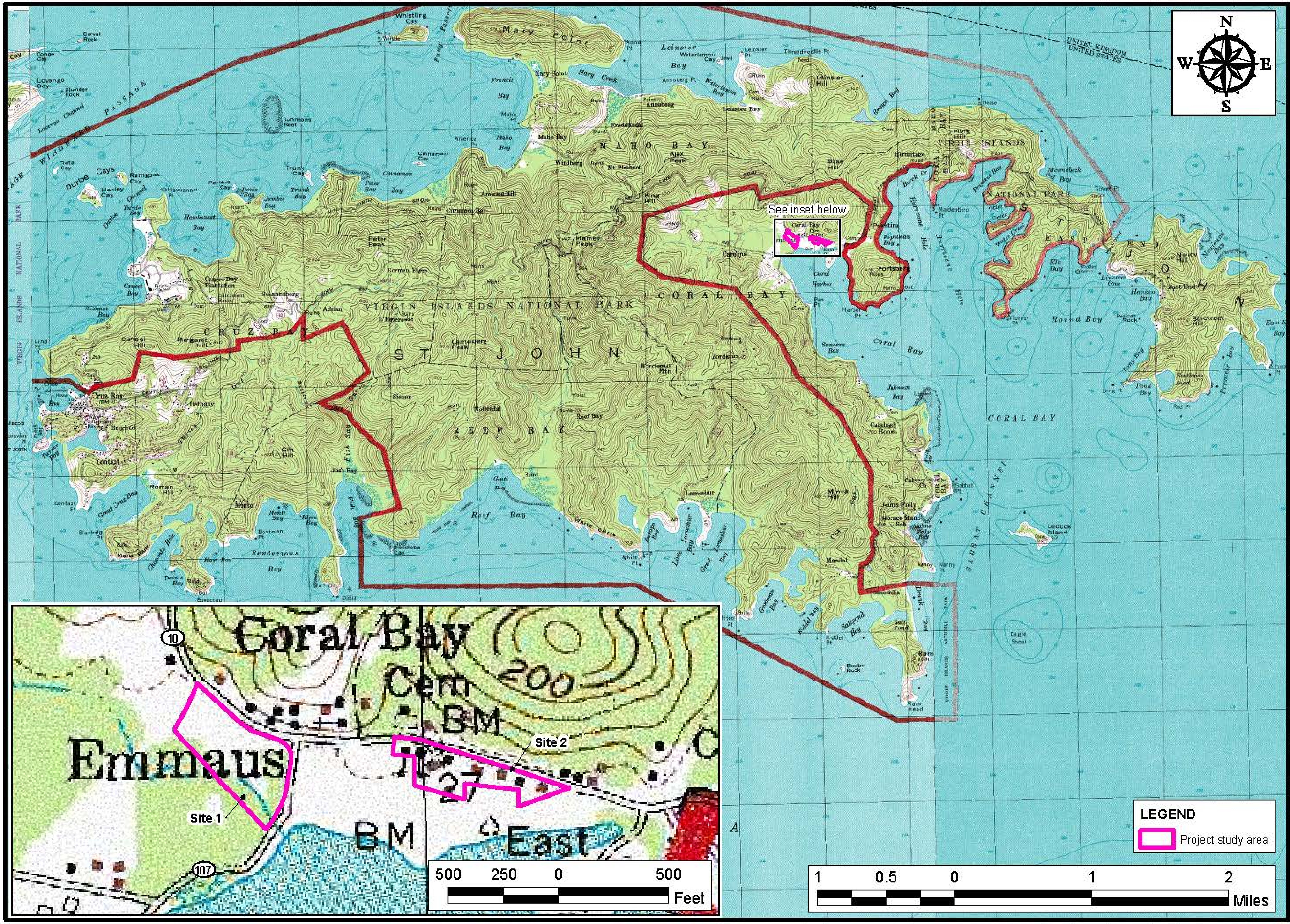
APPENDIX A
Figures



EcoScience Corporation
Raleigh, North Carolina

Client:

Schwab, Twitty & Hanser Architects

Project:

CORAL BAY, ST. JOHN STUDIES

Estate Carolina, St. John
U.S. Virgin Islands

Title:

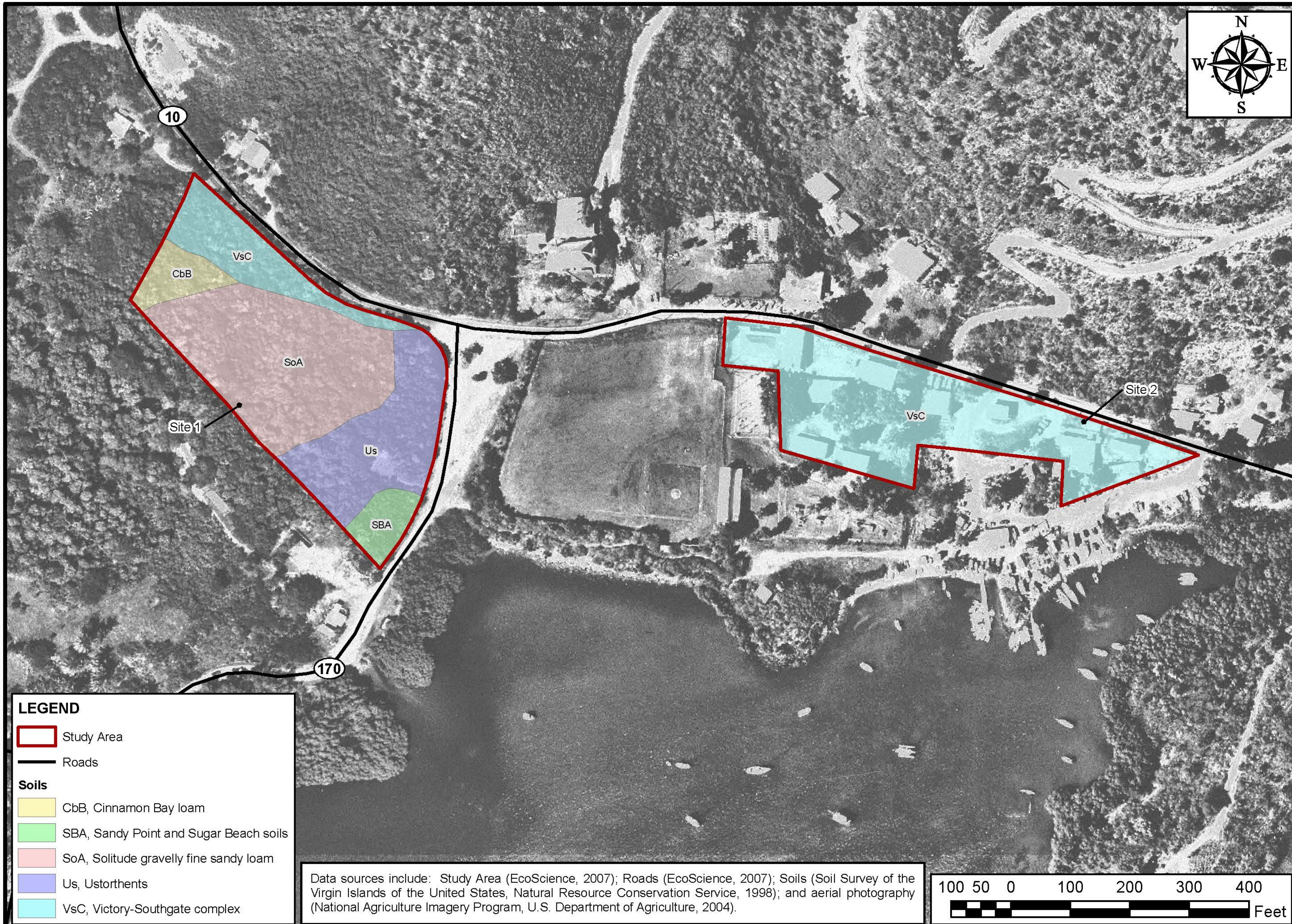
Project Location

Dwn By:	Ckd By:
SGD	ES
Date:	Scale:
JUL 07	As Shown

ESC Project No.: 07-358

FIGURE

1



EcoScience Corporation
Raleigh, North Carolina

Client:

Schwab,
Twitty
& Hanser
Architects

Project:

CORAL BAY, ST. JOHN STUDIES

Estate Carolina, St. John
U.S. Virgin Islands

Title:

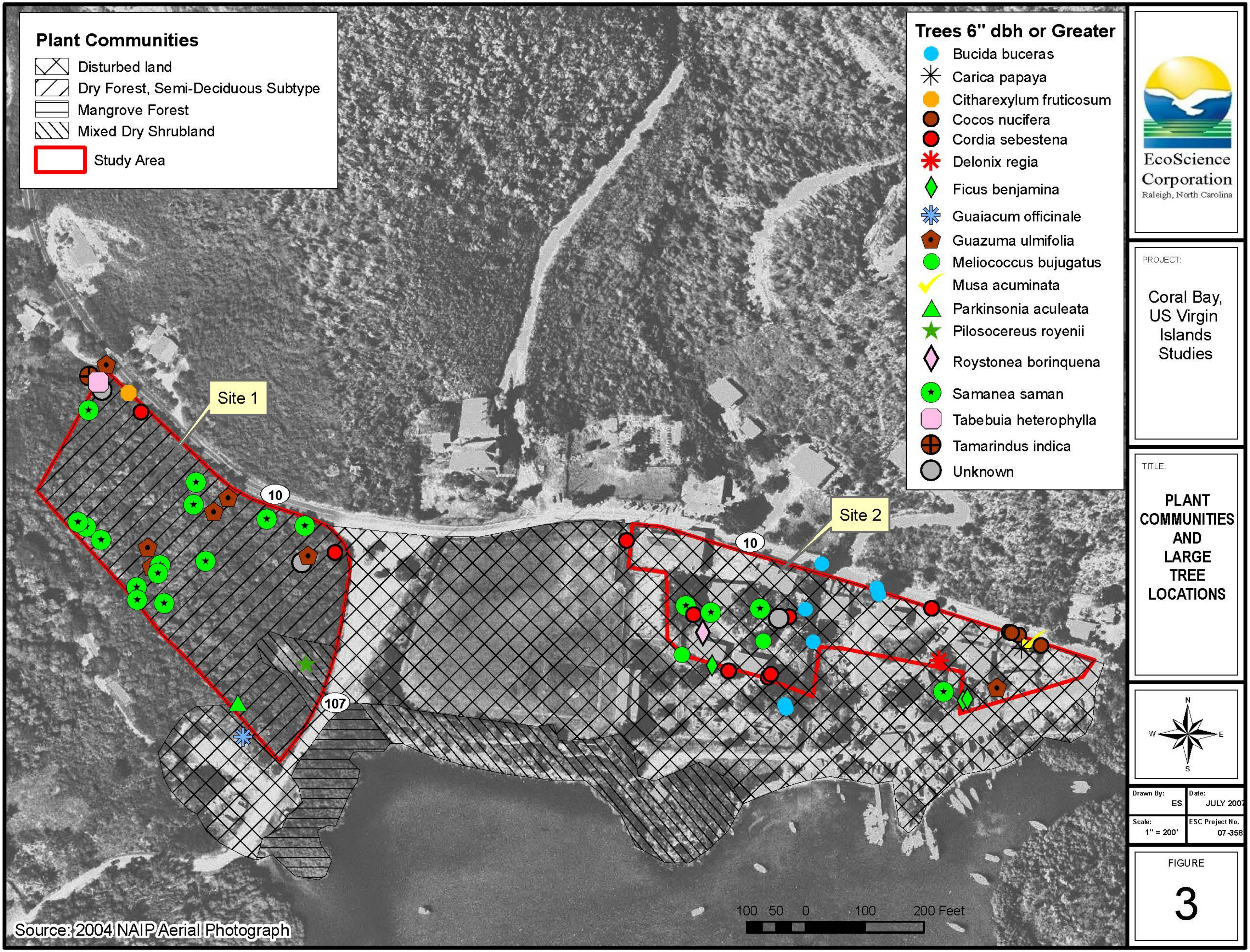
Existing Conditions and Study Area Soils

Dwn By:	Ckd By:
SGD	ES
Date: JUL 07	Scale: 1:1800

ESC Project No.: 07-358

FIGURE

2


Plant Communities
Disturbed land
Dry Forest, Semi-Deciduous Subtype
Mangrove Forest
Mixed Dry Shrubland
Study Area
Trees 6" dbh or Greater
Bucida buceras
Carica papaya
Citharexylum fruticosum
Cocos nucifera
Cordia sebestena
Delonix regia
Ficus benjamina
Guaiacum officinale
Guazuma ulmifolia
Meliococcus bujugatus
Musa acuminata
Parkinsonia aculeata
Pilosocereus royenii
Roystonea borinquena
Samanea saman
Tabebuia heterophylla
Tamarindus indica
Unknown
Site 1
Site 2
10
10
107
100 50 0 100 200 Feet
Source: 2004 NAIP Aerial Photograph
EcoScience Corporation
Raleigh, North Carolina
PROJECT:
Coral Bay, US Virgin Islands Studies
TITLE:
PLANT COMMUNITIES AND LARGE TREE LOCATIONS
N
W
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S
Drawn By: ES
Date: JULY 2007
Scale: 1" = 200'
ESC Project No. 07-358
FIGURE
3

APPENDIX B
Floral and Faunal Species Lists

Vegetation in Dry Forest Sites

Nomenclature and common names are taken from Acevedo-Rodríguez 1996

Anacardiaceae		
Spondias mombin	hog plum	tree
Asclepiadaceae		
Cryptostegia grandiflora	purple allamanda, rubber vine	vine
Bignoniaceae		
Crescentia cujete	calabash tree, gobi, gobi tree	tree-shrub
Tabebuia heterophylla	black cedar, pink cedar, pink manjack toshee, white cedar	tree
Boraginaceae		
Cordia alliodora	copper	shrub
Cordia collococca	manjack, red manjack	tree
Cordia sebestena	bay almond, geiger, scarlet cordia, trumpet tree	tree
Bromeliaceae		
Bromelia pinguin	ping wing	herb
Cactaceae		
Pilosocereus royenii	*organ pipe cactus*	*cactus*
Capparaceae		
Capparis flexuosa	bottle will, dog caper, limber caper	scrambling shrub
Capparis indica	linguam	tree
Crassulaceae		
Bryophyllum pinnatum	clapper bush, green love, leaf of life, life plant, wonderful leaf	herb
Cuscutaceae		
Cuscuta americana	love, love bush, love vine, yellow dodder, yellow love	vine
Euphorbiaceae		
Croton astroites	marang, white marang	shrub
Croton flavens var. *rigidus*	marang, yellow marang	shrub
Jatropha gossypifolia	belly ache bush, body catta, wild physicnut	herb
Fabaceae / Caesalpinioideae		
Parkinsonia aculeata	horse bean, Jerusalem thorn	tree
Tamarindus indica	tamarind	tree
Fabaceae / Faboideae		
Abrus precatorius	crab's eye, jumbie bead, rosary bead, scrubber, wild licorice	vine
Fabaceae / Mimosoideae		
Acacia retusa	catch and keep, white police	vine
Acacia tortuosa	casha	shrub
Leucanea leucocephala	tan tan, tanty, wild tamarind	shrub
Pithecellobium unguis-cati	blackbead, bread and cheese, crabprickle, goatbush	shrub

Samanea saman	licorice, rain tree	tree
Lythraceae		
Ginoria rohrii	prickle wood, sugar ant	shrub
Myoporaceae		
Bontia daphnoides	white alling	shrub
Myrtaceae		
Eugenia biflora	black rodwood	shrub
Eugenia rhombea	crumberry	shrub
Polygonaceae		
Coccoloba venosa	cherry grape, chiggery grape, trible grape	tree
Rhamnaceae		
Colubrina elliptica	maubi, snakeroot	grass
Rubiaceae		
Randia aculeata	Christmas tree, ink berry	shrub
Spermacoce confusa	[none]	herb
Rutaceae		
Triphasia trifolia	sweet lime	shrub
Zanthoxyllum monophyllum	yellow prickle	tree
Sapindaceae		
Serjania polyphylla	basket wiss, basket wood, black wist, cabrite rotting, white root, white wist	vine
Solanaceae		
Solanum racemosum	cankerberry	shrub
Sterculiaceae		
Guazuma ulmifolia	bastard cedar, jackass calalu, jackocalalu, jacocalalu, West Indian elm	tree
Verbenaceae		
Citharexylum fruticosum	fiddlewood, old woman bitter, susannaleche	tree
Clerodendrum aculeatum	chuc chuc	shrub
Vitaceae		
Cissus trifoliata	sorrel vine	vine
Cissus verticillata	pudding vine	vine
Zygophyllaceae		
Guaiacum officinale	lignum vitae, liki wiki, pockenholt	shrub

Vegetation in Disturbed Sites

Nomenclature and common names are taken from Acevedo-Rodríguez 1996

Annonaceae		
Annona muricata	soursop, susake, sweetsop	tree
Annona squamosa	sugar apple	tree - shrub
Apocynaceae		
Plumeria alba	frangipani, klang hout, milk tree, milky bush, paucipan, snake root, wild frangipani, wormy tree	tree - shrub
Arecaceae		
Cocos nucifera	coconut palm	tree
Roystonea borinquena	cabbage palm, mountain cabbage	tree
Asclepiadaceae		
Cryptostegia grandiflora	purple allamanda, rubber vine	vine
Boraginaceae		
Cordia sebestena	bay almond, geiger, scarlet cordia, trumpet tree	tree
Caricaceae		
Carica papaya	papaya	tree
Combretaceae		
Bucida buceras	gree gree tree, gregery, gri gri	tree
Fabaceae / Caesalpinioideae		
Andira inermis	bastard mahogany, dog almond, hon kloot, pig turd	tree
Delonix regia	flamboyant tree, poinciana	tree
Tamarindus indica	tamarind	tree
Fabaceae / Faboideae		
Gliricidia sepium	pea tree, quick stick	tree
Fabaceae / Mimosoideae		
Samanea saman	licorice, rain tree	tree
Meliaceae		
Melia azedarach	chinaberry, hagbush, lilac	tree
Moraceae		
Ficus benjamina	ficus	tree
Musaceae		
Musa acuminata	banana	tree
Sapindaceae		
Meliococcus bujugatus	genip, kenep, keneppy tree, quenepa	tree
Sterculiaceae		
Guazuma ulmifolia	bastard cedar, jackass calalu, jackocalalu, jacocalalu, West Indian elm	tree

Vegetation in Mixed Dry Shrubland

Nomenclature and common names are taken from Acevedo-Rodríguez 1996

Agavaceae		
Agave missionum	century plant, karata	shrub
Bignoniaceae		
Crescentia cujete	calabash tree, gobi, gobi tree	tree - shrub
Cactaceae		
Pilosocereus royenii	dacta dul dul, didledoo, pipe organ	cactus
Dracaenacaceae		
Sanseviera trifasciata	guana tail, lizard tail, mother-in-law's tongue, rhamni, snakeplant	herb
Euphorbiaceae		
Croton flavens var. *rigidus*	marang, yellow marang	shrub

Vegetation in Mangrove Forest

Nomenclature and common names are taken from Acevedo-Rodríguez 1996

Capparaceae		
Capparis flexuosa	bottle will, dog caper, limber caper	scrambling shrub
Celastraceae		
Cassine xylocarpa	nothing nut, nut muscat, spoon tree, ton ton	tree - shrub
Combretaceae		
Conocarpus erectus	button mangrove, button wood	shrub
Laguncularia racemosa	white mangrove	tree
Euphorbiaceae		
Hippomane mancinella	death apple, manchineel, mangineedle, poison apple	tree
Fabaceae / Mimosoideae		
Acacia tortuosa	casha	shrub
Malvaceae		
Thespesia populnea	seaside mahoe	shrub
Rhozophoraceae		
Rhizophora mangle	mangelboom, red mangrove	tree
Solanaceae		
Solanum racemosum	cankerberry	shrub
Verbenaceae		
Avicenna germinans	black mangrove	tree
Citharexylum fruticosum	fiddlewood, old woman bitter, susannaleche	tree

Bird Species by Habitat

Species	**Dry Forest**	**Disturbed**	**Mixed Dry Shrubland**	**Mangrove Forest**	**Shoreline**
American Kestrel (*Falco sparverius*)		X			
Bananaquit (*Coereba flaveola*)	X	X			
Cattle Egret (*Bubulcus ibis*)		X			
Common Ground-dove (*Columbina passerina*)	X	X			
Gray Kingbird (*Tyrannus dominicensis*)	X	X	X		
Great Egret (*Casmerodius albus*)				X	
Green-throated Carib (*Eulampis holosericeus*)	X				
House Sparrow (*Passer domesticus*)		X			
Laughing Gull (*Larus atricilla*)					X
Lesser Antillean Bullfinch (*Loxigilla noctis*)	X	X	X		
Mangrove Cuckoo (*Coccyzus minor*)	X			X	
Northern Mockingbird (*Mimus polyglottos*)		X			
Pearly-eyed Thrasher (*Margarops fuscatus*)	X	X			
Puerto Rican Flycatcher (*Myiarchus antillarum*)	X	X			
Yellow Warbler (Dendroica petechia)	X				
Yellow-crowned Night-heron (*Nyctanassa violacea*)				X	
Zenaida Dove (*Zenaida aurita*)	X	X			
Total	10	11	2	3	1

Mammals

Domestic Goat (*Capra hircus*)

Donkey (*Equus asinus*)

Reptiles and Amphibians

Antillean Frog (*Eleutherodactylus antillensis*)

Crested Anole (*Anolis cristatellus*)

Green Iguana (*Iguana iguana*)

White-lipped Frog (*Leptodactylus albilabris*)

Invertebrates

Land Crab (*Cardisoma guanhumi*)

Zebra Longwing Butterfly (*Heliconius charithonius*)

Jack Spaniard wasps (*Polistes* sp.)