Comments on Applicant Response to the NMFS

US Army Corps of Engineers Permit Application Number SAJ-2004-12518

This document reviews material submitted to the NMFS by or on behalf of The Summers End Group, LLC, pursuant to a Department of the Army permit request for a private commercial marina in Coral Harbor, Coral Bay, St John, US Virgin Islands. The materials reviewed were responding to requests for additional information by the NMFS required for consultation under the Magnuson-Stevens Fisheries Management Act and the Endangered Species Act.

This analysis was performed on behalf of the Coral Bay Community Council and Save Coral Bay Inc., both non-profit corporations.

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1. Background

On July 12, 2018, the United States Army Corps of Engineers ("USACE") wrote to the National Marine Fisheries Service ("NMFS") requesting that NMFS evaluate a private commercial marina project located in Coral Harbor, Coral Bay, St John, U.S. Virgin Islands (the "USACE Letter", Reference 1). The USACE Letter referenced permit application and public notice number SAJ-2004-12518 (SP-JCM). USACE requested that NMFS evaluate the project impacts to species and habitats under the statutory authorities of NMFS.

On October 25, 2018, NMFS responded to the USACE letter ("NMFS Response", Appendix I) and identified significant concerns regarding impacts to protected resources. NMFS requested additional information and studies from USACE and from the developer.

The marina developer, Summers End Group, LLC, (the "Applicant", or "SEG") responded to the NMFS letter in correspondence dated December 13, 2019 ("SEG Response", Appendix II). We have only recently received a copy of the Applicant's response and have now completed an initial review of the Applicant's comments and additional materials submitted therewith.

It is our conclusion following review of the above documents that the Applicant's responses are highly flawed and do not meet the requirements for EFH consultations under the Magnuson-Stevens Act or for protected resources under Section 7 of the Endangered Species Act ("ESA"). We base this conclusion on the following points, each of which are discussed in greater detail within the body of this note:

1. The Applicant has failed to respond to several of the issues raised by NMFS in the 2018 NMFS letter.

2. The Applicant has failed to use the best available scientific information within their response, as required by federal regulations.

3. The Applicant has reached incorrect conclusions in their analysis due to the use of flawed and incomplete data.

4. The conclusions reached by the Applicant regarding the size of the "Action Area", the impacts to ESA-listed species within the Action Area, the impacts to Essential Fish Habitat, and the impacts to water quality are all inaccurate and substantially misstate and underestimate the impacts of the proposed project.

2. Federal Regulations Require Use of Best Available Scientific Information

Pursuant to the Magnuson-Stevens Fisheries Conservation and Management Act, federal agencies must consult with NMFS regarding any of their actions authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken that may adversely affect Essential Fish Habitat ("EFH"). The regulations governing EFH consultations are specified in 50 CFR §600.920 - Federal agency consultation with the Secretary.

The use of best available scientific information for EFH consultations is required under 50 CFR §600.920(d) which reads as follows:

> "(d) Best available information. The Federal agency and NMFS must use the best scientific information available regarding the effects of the action on EFH and the measures that can be taken to avoid, minimize, or offset such effects. Other appropriate sources of information may also be considered."

We have conducted a thorough review of the scientific literature regarding the Coral Bay Harbor environment, including published research on habitats, sedimentation, water circulation, and other relevant topics. Although numerous federally funded studies conducted by academic researchers have taken place over the past decade, none of these studies have been cited by the Applicant or their consultants.

It is must be noted that in their 17 page response letter (Appendix II) the Applicant did not cite a single scientific reference to support their conclusions. The Applicant included several additional documents and studies ostensibly supporting the conclusions in the letter, however none of these additional documents included substantial references to authoritative scientific sources. The additional documents referenced in and attached to the Applicant's letter were:

1. **Numerical Modeling Analysis,** authored by Sea Diversified Inc. (Appendix III): This document has four references, only one of which is a scientific report. However the one scientific report was a description of the generic model used by Sea Diversified, not anything specific to Coral Harbor, St John.
2. **Avoidance and Minimization**, author not specified (Appendix IV): no references cited.
3. **Alternatives Analysis**, author not specified (Appendix V): no references cited.
4. **Geophysical Investigation and Bathymetric Survey**, authored by Sea Diversified Inc., (Appendix VI): no references cited.

The Applicant has not referenced a single existing scientific study of the conditions in Coral Harbor which are relevant to the analysis performed. This is not because of a lack of studies – in our review we have identified significant numbers of highly relevant, published, peer-reviewed scientific studies and analyses, many of which were funded by federal grants through NOAA, EPA and others.

A partial listing of the most relevant studies, on which we base most of the comments in this review, is shown below, and a more complete bibliography is appended to this note. The scientific articles referenced by us are the following:

1. Brooks, G., Devine B., Larson R. and Rood B., 2007, Sedimentary Development of Coral Bay, St. John, USVI: A Shift From Natural to Anthropogenic Influences. Caribbean Journal of Science, Vol. 43, No. 2, 226-243, 2007
2. Coral Reef Habitat Assessment for U.S. Marine Protected Areas: U.S. Virgin Islands. NOAA's National Ocean Service Management & Budget Office, Special Projects. February 2009 https://www.coris.noaa.gov/activities/habitat_assessment/usvi.pdf
3. Hartwell, S.I., D.A. Apeti, A.L. Mason, and A.S. Pait. 2017. An Assessment of Tributyltin and Metals in Sediment Cores From the St. Thomas East End Reserves. NOAA Technical Memorandum NOS NCCOS 217. Silver Spring, MD. 20 pp. https://doi.org/10.7289/V5/TM-NOS-NCCOS-217
4. Hayes, D.F.; Chintamaneni, R.; Bommareddy, P.; and Cherukuri, B., "Propwash Impacts On Water Quality Around Dredging And Other Marine Construction Activities," Proceedings of the WEDA XXX/TAMU 41, San Juan, Puerto Rico, June 6-9, 2010.
5. Landry, Joan B., William Judson Kenworthy and Giuseppe Di Carlo. The effects of docks on seagrasses, with particular emphasis on the threatened seagrass, Halophila johnsonii. 2008. http://aquaticcommons.org/15156/1/Dock%20Report.Landry%20Kenworthy%20and%20DiCarlo.pdf
6. Liao, Q., Wang, B., and Wang, P.F. (2014) In Situ measurement of sediment resuspension caused by propeller wash with an underwater Particle Image Velocimetry and an Acoustic Doppler Velocimeter. Flow Measurement and Instrumentation, 41, 1-9.
7. Whitall, D., C. Menza, and R. Hill. 2014. A Baseline Assessment of Coral and Fish Bays (St. John, USVI) in Support of ARRA Watershed Restoration Activities. NOAA Technical Memorandum NOS NCCOS 178. Silver Spring, MD. 74 pp.
8. Zhang, Feng & Dai, Chun-Ni & Xu, Xue-Feng & Wang, Chuan-Kun & Ye, Qin. (2017). Resource Assessment of Tidal Current Energy in Hangzhou Bay Based on Long Term Measurement. IOP Conference Series: Earth and Environmental Science. 68. 012017. 10.1088/1755-1315/68/1/012017. https://www.researchgate.net/publication/317152675_Resource_Assessment_of_Tidal_Current_Energy_in_Hangzhou_Bay_Based_on_Long_Term_Measurement

4. Outline of this Report

This report is organized to follow the comments made by NMFS in their request for additional information and the responses submitted by the Applicant.

- The first section discusses computation of the "Action Area" based on the models supplied by the Applicant, but augmented with the best available scientific data provided by others. An enhanced model for computing sediment transport based on current gradients and sediment components is presented.

- The second section discusses impact on protected resources, including ESA-listed corals and Essential Fish Habitat. The effect of circulation currents is briefly reviewed. The potential for impacts to deeper coral habitat is also discussed.

- The third section discusses the minimization, avoidance and compensatory mitigation measures offered by the Applicant and their adequacy to compensate for the impacts to the environment.

- The fourth section discusses the Applicant's alternatives analysis, including a discussion of the "No Action" alternative.

- The final section discusses deficiencies in the Applicant's "Geophysical Investigation".

5. Analysis of "Action Area"

The Applicant has provided an estimate of the "Action Area" of the proposed marina and concluded that it extends 120 meters from the marina structure, encompassing 45 acres, and does not include any ESA-listed coral colonies.

This conclusion by the Applicant grossly underestimates the extent of the Action Area as a result of the following errors made by the Applicant and/or their consultants:

1. The composition of sediments described by the Applicant does not agree with far more detailed scientific studies performed by others.

2. The Applicant has failed to provide any data at all on the depth of sediments or the volume of sediments that would be resuspended over time.

3. The tidal current velocity is based on a model using data from a buoy which does not measure wave heights entering Coral Bay.

4. The tidal current used in the estimate does not agree with direct observations made over a longer period of time and reported by the Applicant in other documents submitted for this same project.

5. The Applicant has failed to consider the transport of sediments by circulating current patterns as shown in their own current models (they solely considered straight line tidal currents).

6. The Applicant has failed to consider the transport of finer sediments in the uppermost portions of the water column where the currents are the greatest.

7. The Applicant has used a 92% cutoff value for current velocity in their model without any explanation or justification for this assumption, which we believe is incorrect.

After analyzing the data provided by the Applicant, particularly their water circulation study, and incorporating the best available scientific information, as required by federal regulations, we conclude that **the Action Area should extend 725 meters from the southernmost reach of the marina, and encompass an area of 170 acres**. We also conclude that at least two identified sites for **ESA-listed coral species at the entrance to Coral Harbor will be within the Action Area** and will be impacted by resuspended sediments transported to these locations. We also conclude that there is a **significant likelihood that circulation patterns modeled by the Applicant will be capable of transporting sediments into Hurricane Hole**, within the Virgin Islands Coral Reef National Monument.

5.1. Sediment Composition, Sediment Depth and Fall Velocity

The most comprehensive scientific study of sediments in Coral Harbor was published in 2007 and reported on samples taken from 59 sites either through use of a "VibraCore" tube or Ponar grab samplers. This extremely relevant study is attached as Appendix VII (the "2007 Sediment Study").

The main findings of this study that are relevant to the present analysis involve the thickness of the uppermost sediment layer, the particle composition of the layer, and the distribution of particle sizes within the layer. The 2007 Sediment Study found that "the surficial facies in the study area is the sandy mud/muddy sand facies. It is generally an 8-50 cm thick, fining-upward sequence with an indistinct, gradational or burrowed basal contact. It typically consists of 25-60% mud-size (<63 um) particles."

The study also reports "Surface sediments in Coral Bay show a general pattern of finer sediments near the bay head and coarser sediments near the bay mouth. Finest sediments are concentrated in Coral Harbor with most in the 2ø - 6ø mean grain size range (medium sand to medium silt). The finest sediments in Coral Harbor are medium silt size, and are confined to the innermost portion." The term "bay head" refers to Coral Harbor, and "innermost portion" refers to the portion of Coral Harbor in the vicinity of the proposed marina.

Based on the data in this scientific study we can draw the following conclusions regarding the sediments in the vicinity of the proposed marina:

1. The uppermost layer of sediment is 8 – 50 cm thick.
2. This layer consists of 25% - 60% mud and silt.
3. The finer particles in this layer are "medium silt" with a size of 6 phi.
4. The finest particles are closest to the surface ("fining upwards")

The velocity at which particles fall through a column of water is shown in Appendix VIII, from which it can be seen that a 6 phi particle (medium silt) has a "settling velocity" of 0.023 cm/sec, which would be the slowest settling velocity for the uppermost sediments in Coral Harbor.

The best available scientific data, cited above, provides a far more comprehensive data set than the corresponding information provided by the Applicant in their "Numerical Analysis Modeling" study by Sea Diversified Inc. ("SDI"). The SDI (attached as Appendix III) study provided just a few sentences of information on how sediment composition was determined. The report simply stated: "Several sediment samples were collected by Sea Diversified within the footprint of the proposed marina and at the location of the deployed ADCPs. For each location, 2 samples were collected and analyzed… The results indicate that the samples collected along the shoreline in shallower water contain the

least amount of silt with levels ranging from 0 and 0.3% (NW and SW). Samples collected in deeper water contained silts levels ranging from 3% to 18% with sample SE containing the most."

The information in the SDI report on sediment composition does not agree with the prior scientific studies, particularly in the percentage of silt (particles less than 63 micrometer diameter) in the samples. The scientific data indicates 25% - 60% silt, whereas the SDI report indicates 0 – 18% silt.[1]

The SDI report provides no data on the depth of the silt layer, which was reported as 8 – 25 cm in the 2007 Sediment Study.

The SDI report provides no information on the method of sediment sample collection. The 2007 Sediment Study provides extensive details on the VibraCore and Ponar sample methodology. It is possible that manual collection of samples by SDI allowed significant amounts of the finer silt to be carried away during collection and before measurement.

Based on the best available scientific research, it is our conclusion that the seabed in the vicinity of the proposed marina is characterized by a relatively thick layer of mud and silt, averaging 15 cm in thickness. This layer is composed of 25%-60% particles of 63 micrometers and smaller, with the smallest particles in the "medium silt" range. The settling velocity of the smallest particles is 0.023 cm/sec.

5.2. Tidal + Wave Induced Currents

The SDI study utilized a numerical model to compute a distribution of probable water velocities in the vicinity of the project. They concluded that 92% of the time the velocity from combined tidal and wave influences would be less than 0.06 meters per second averaged throughout the water column.

There are five significant problems with this conclusion:

1. The modeled velocity is a function of wave heights and tidal flows however SDI is using data from a buoy that does not measure waves entering Coral Bay.

[1] Since the sample collection methodology was not reported by Sea Diversified, we can only speculate on the reasons why their estimate of the silt component fraction differs so substantially from the scientific data reported in Brooks, et. al. (2007). We speculate that the manual sampling done by SDI was performed in areas without seagrass cover, so as to avoid disturbance of the surface and seagrass when collecting the samples. We also speculate that the intense winds of hurricanes Irma and Maria scoured the seabed in this part of Coral Harbor, and may have removed much of the finer silt, particularly in areas without seagrass (which stabilizes the silt). The Brooks studies used a Vibracore sampling methodology, and did not select areas without seagrass cover. So a possible explanation is that the SDI samples contained less fine silt as a consequence of the time (post-Irma) and the location (without seagrass) of the sample collection.

2. Actual measured current velocity reported by Summers End Group consultants differ from the theoretical value predicted by the SDI model.

3. There is no explanation or justification for using a 92nd percentile cut-off for wave height and current speed.

4. The SDI Model validation is based on samples from a single week.

5. Although SDI reported current stratification within the water column, they failed to consider the implications of this on the suspended sediment transport.

In the remainder of this section each of these problems is addressed in detail, leading to a more accurate estimate of current velocity and sediment transport than the value used by SDI in their report.

5.2.1. The modeled velocity is a function of wave heights and tidal flows however SDI is using data from a buoy that does not measure waves entering Coral Bay.

The data that SDI used for offshore wave heights is sourced from Caricoos Buoy 41052 located south of the western end of St John. Waves traversing this location do not enter Coral Bay. Although there may be a close correlation between wave heights at this location and wave heights at the mouth of Coral Bay, no evidence has been supplied by SDI to validate this correlation.

The location of buoy 41052 and the direction from which waves entering Coral Bay originate are shown in the graphic below.

5.2.2. Actual measured current velocity reported by Summers End Group consultants differ from the theoretical value predicted by the SDI model.

In 2014, Summers End Group reported current velocity measurements taken in the vicinity of the proposed marina. Their data was included in the Environmental Assessment Report submitted with their 2014 USACE permit application. The data table below is on page 6-20 of that report:

Table 6.05b-3. Current Velocity Measurements at Project Site

Date	Velocity m/s	Direction	Wave height	Turbidity (NTU)
5/12/2012	0.09	330°	4-6"	1.11
5/22/2012	0.1	330°	2-3"	2.12
6/17/2012	0.08	150°	2-3"	3.25
6/18/2012	0.09	330°	4-6"	0.98
6/23/2012	0.11	330°	4-6"	1.76
6/31/2012	0.10	330°	4-6"	0.99
7/31/2012	0.05	150°	none	1.65
8/2/2012	0.07	330°	4-6"	2.65
8/12/2012	0.1	150°	4-6"	0.87
9/14/2012	0.09	160°	4-6"	0.67
9/22/2012	0.1	150°	4-6"	1.73
10/7/2012	0.08	150°	4-6"	1.89
10/8/2012	0.1	330	6"	2.13
11/13/2012	0.09	150°	1"	6.01
12/8/2012	0.09	330°	2-3"	2.10
1/16/2014	0.10	150°	3-4"	1.34
1/20/2014	0.08	330°	None	1.09
1/24/2014	0.1	330°	3-4"	0.96
2/03/2014	0.09	330°	4-6"	0.67
2/25/2014	0.1	150°	2-3"	2.11

The average current velocity in this set of values, reported by Summers End, is 0.09 m/s which is 50% greater than the theoretically modeled value used by SDI (0.06 m/s).

Additional actual current measurements within Coral Harbor were reported by the Applicant in the Water Environment Consultants (WEC) study of Dec 2017, entitled "Marina Site Suitability Analysis." This data also differs from the value cited in the SDI report. The SDI measurements were taken during only one week in July 2019. The WEC study, on the other hand, reports data during twelve months in 2016 and 2017.

The 2017 WEC report states: "Currents during typical astronomical tides and windes were measured at the project site using a current meter and were found to be on the order of 0.1 m/s, or 0.3 ft/s (Applied Technology and Management et al. 2014). Bioimpacts Inc (2017) measured currents at the site over a 2-year period intermittently spanning from December 2015 until June 2017 and

concluded the currents at site were primarily influenced by tidal fluctuations and winds. The highest recorded current measurement was 0.6 ft/s with an average current less than 0.3 ft/s. Table 6-1 summarizes their measurements."

The data cited in the WEC report is shown below:

Month/Year	CURRENTS			Tidal State	Winds
	18° 20.649'N 64° 42.847'W	18° 20.598'N 64° 42.824'W	18° 20.555'N 64° 42.804'W		
June-17	0.3ft/sec SW	0.3ft/sec W	0.3ft/sec SW	falling	E
	0.4ft/sec SW	0.2ft/sec SW	0.3ft/sec SW	falling	E
	0.3ft/sec SW	0.2ft/sec SW	0.3ft/sec SW	falling	E
	0.3ft/sec SW	0.2ft/sec SW	0.3ft/sec SW	falling	E
May-17	0.4ft/sec NNW	0.5ft/sec NNW	0.5ft/sec NNW	rising	SE
	0.4ft/sec NNW	0.6ft/sec NNW	0.5ft/sec NNW	rising	SE
	0.4ft/sec NNW	0.2ft/sec NW	0.5ft/sec NNW	rising	E
	0.6ft/sec NW	0.5ft/sec NW	0.4ft/sec NW	rising	E
April-17	0.2ft/sec SW	0.3ft/sec SW	0.3ft/sec SW	falling	NE
	0.2ft/sec SW	0.2ft/sec SW	0.3ft/sec SW	falling	NE
	0.1ft/sec W	0.1ft/sec W	0.3ft/sec NW	rising	E
	0.2ft/sec W	0.1ft/sec NW	0.3ft/sec NW	rising	E
	0.2ft/sec SW	0.2ft/sec W	0.3ft/sec SW	falling	SE
March-17	0.3ft/sec NW	0.4ft/sec NW	0.3ft/sec NW	rising	NE
	0.2ft/sec NW	0.2ft/sec NNW	0.4ft/sec NW	rising	NE
September-16	0.5ft/sec NNW	0.4ft/sec NNW	0.4ft/sec NNW	rising	E
	0.3ft/sec W	0.3ft/sec W	0.3ft/sec SW	falling	E
	0.4ft/sec NNW	0.3ft/sec NW	0.3ft/sec NNW	rising	SE
August-16	0.1ft/sec W	0.1ft/sec SW	0.1ft/sec NW	slack	SE
	0.1ft/sec SW	0.0ft/sec	0.2ft/sec NW	slack	SE
	0.5ft/sec NNW	0.5ft/sec NNW	0.5ft/sec NNW	rising	SE
	0.4ft/sec NW	0.5ft/sec NNW	0.5ft/sec NW	rising	SE
	0.2ft/sec W	0.2ft/sec SW	0.2ft/sec SSW	falling	E
July-16	0.5ft/sec NW	0.5ft/sec NW	0.4ft/sec NW	rising	SE
	0.3ft/sec SW	0.3ft/sec SW	0.3ft/sec SW	falling	SE
	0.2ft/sec SW	0.2ft/sec SW	0.2ft/sec SW	falling	SE
	0.1ft/sec SW	0.1ft/sec SSW	0.2ft/sec SSW	falling	E
June-16	0.3ft/sec SW	0.2ft/sec SW	0.4ft/sec SW	falling	SE
	0.4ft/sec NNW	0.5ft/sec NNW	0.7ft/sec NNW	rising	SE
	0.3ft/sec NW	0.4ft/sec NW	0.5ft/sec NNW	rising	E
May-16	0.4ft/sec NW	0.2ft/sec NW	0.4ft/sec NW	rising	E
	0.6ft/sec NW	0.5ft/sec NNW	0.4ft/sec NNW	rising	SE
	0.3ft/sec SSW	0.3ft/sec SSW	0.3ft/sec SSW	falling	SE
	0.2ft/sec SW	0.2ft/sec SSW	0.2ft/sec SSW	falling	SE
February-16	0.3ft/sec SSW	0.2ft/sec SSW	0.3ft/sec SSW	falling	ESE
	0.3ft/sec SW	0.2ft/sec SW	0.4ft/sec SW	falling	NE
January-16	0.4ft/sec WNW	0.5ft/sec NW	0.5ft/sec NNW	rising	NE
	0.4ft/sec NW	0.4ft/sec NW	0.4ft/sec NNW	rising	NE
	0.5ft/sec NW	0.5ft/sec NNW	0.4ft/sec NW	rising	NE
December-16	0.2ft/sec SW	0.3ft/sec SW	0.3ft/sec SW	falling	NE
	0.2ft/sec SW	0.3ft/sec SW	0.3ft/sec SW	falling	NE
	0.3ft/sec SW	0.3ft/sec SW	0.3ft/sec SW	falling	NE
	0.3ft/sec SW	0.3ft/sec SW	0.3ft/sec SW	falling	E
	0.4ft/sec NW	0.5ft/sec NNW	0.5ft/sec NW	rising	NE
	0.3ft/sec NNW	0.4ft/sec NW	0.5ft/sec NW	rising	NE
	0.4ft/sec NW	0.4ft/sec NNW	0.3ft/sec W	rising	NNE
	0.4ft/sec SSW	0.5ft/sec SW	0.4ft/sec SW	rising	NNE

Based on these actual measurements, taken over extended periods of time from multiple locations in the vicinity of the proposed marina, it is our conclusion that the correct average current in Coral Harbor is 0.1 meter/sec as opposed to the value of 0.06 m/s used in the SDI report.

5.2.3. There is no explanation or justification for using a 92nd percentile cut-off for wave height and current speed.

SDI analyzed wave height data from Buoy 41052 over a period of four years and concluded that 92% of the time the wave heights at that buoy would correlate with current velocities less than or equal to 0.06 m/sec.

This means that 8% of the time, equivalent to 2 hours per day, or 29 days a year, or 4 weeks a year, the wave heights can be expected to correlate with currents in excess of 0.06 m/s according to the SDI model. During these times sediments will be transported longer distances due to higher current velocities. It is also quite likely that the higher wave heights will occur during winter months when yacht traffic at the marina is at the peak.

SDI offered no explanation for using a 92nd percentile cutoff, or any analysis of what the sediment dispersion would be during the 8% of the year when the currents were greater than the cutoff value.

5.2.4. The SDI Model validation is based on samples from a single week.

SDI used a single week (five days) of measurements to validate the conclusions of their model. However a single week of data is not sufficient to calibrate a model, particularly when weather conditions are fairly static throughout that one week period but variable throughout the year.

It is well known that wave conditions vary considerably between winter months and summer months. Whether or not the model correlates with winter wave patterns is undetermined since measurements were only run for one week in the summer. Furthermore, the peak yachting season is in the winter months, when wave heights are known to be influenced by northern weather patterns.

5.2.5. Although SDI reported current stratification within the water column, they failed to consider the implications of this on the suspended sediment transport.

The actual current measurements conducted over five days by SDI confirmed significantly higher current velocity within 1 meter of the surface, as opposed to the velocity closer to the seabed. In their analysis SDI chose to use an average of the velocity measurements throughout the water column.

The silt composition of Coral Harbor has a range of particle sizes, from Fine Sand through Medium Silt. As this sediment is transported by a stratified current, the heavier and larger sand particles will settle the fastest and enter the region of lower current velocity. The smaller, lighter particles, on the other hand, will remain closer to the surface where the current velocity is higher.

It can be expected in this scenario that the lighter silt particles will be transported greater distances than the average velocity figure would indicate. In fact, according to the measurements reported by SDI, the current velocity near the surface ranges from 0.1 m/s to 0.2 m/s which could have the effect of transporting the finer sediments far greater distances than the average 0.06 m/s current used by SDI.

We have created a "Vertical Current Gradient and Mixed Sediment Model" to confirm this analysis. The model, attached as Appendix IX, utilizes a variable current in the water column, as reported by SDI from their ADCP observations. It also uses a mixed sediment composition of Fine Sand through Medium Silt, as reported by Brooks, et. al.,2007. It then computes the distance traveled by different components of the resuspended sediment based on fall velocities and current at depth.

The result of this model confirms that the lighter weight, smaller sized silt particles will spend a greater time in the upper parts of the water column (due to their slower settling times). Since currents are greater closer to the surface, these particles are transported for longer distances than the average current would indicate.

Based on all of the foregoing considerations it is our conclusion that the best data available indicates an average transport velocity of 0.1 m/s should be used for computation of the Action Area in the SDI model. We believe this is a conservative figure which will likely be exceeded many days of the year.

5.3. Action Area Computation

The method used in the SDI study to compute the extent of the Action Area comprises the following steps:

1. Determine the particle size of the disturbed sediments.
2. Determine the fall velocity of that size particle.
3. Determine the time taken to fall a distance of 2 meters.
4. Determine the 92nd percentile of current velocity.
5. Compute the distance traveled based on velocity and time.

We have used the same approach, however with the best data available based on scientific research. The computation uses the following parameters:

Parameter	Value Used by SDI	Best Scientific Value	Notes (below)
Particle Size	Coarse Silt	Medium Silt	1
Fall Velocity	0.1 cm/sec	0.023 cm/sec	2
Computed Time for 2m Fall	2000 seconds	8696 seconds	3
Current Velocity	0.06 meter/sec	0.1 meter/sec	4
Distance Traveled	120 meters	870 meters	5

The notes below reference the rows in the table above and provide the basis for the selected data values.

Note 1: The smallest particle size in the top layer of sediment is "Medium Silt" and since the smallest particles have the slowest settling time, it is this component that should be used to estimate the extent of sediment transport. The 2007 Sediment Study indicated the presence of a considerable layer (8 – 25cm) of sediment comprised 25-60% of silt, indicating a large quantity of the Medium Silt, particularly in the uppermost region (an upward-fining layer).

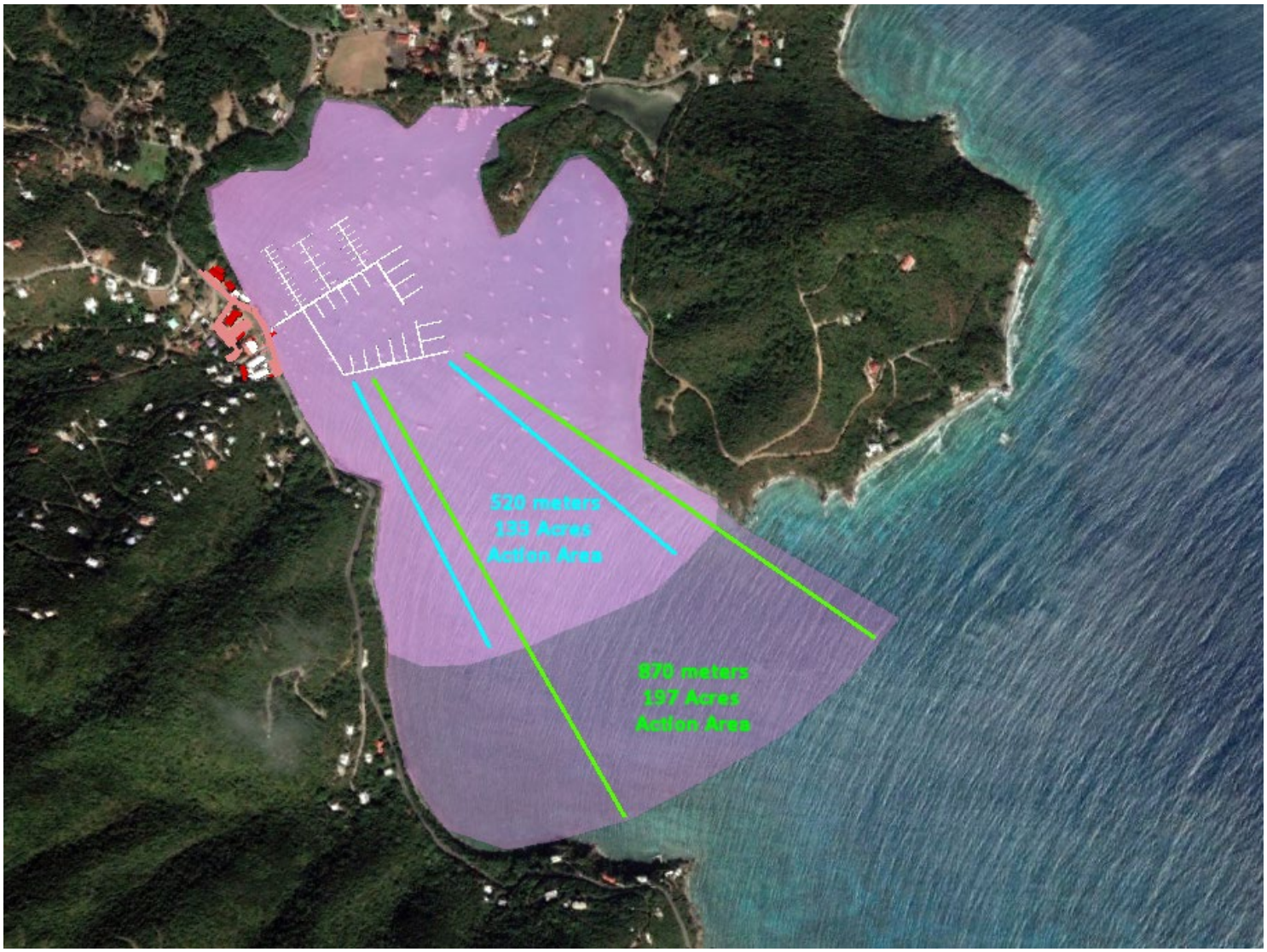
Note 2: The lowest fall velocity (settling speed) for Medium Silt is 0.023 cm/sec. When computing the maximum travel distance it is inappropriate to use the settling speed of the largest particles. It is the smallest particles that will travel the greatest distance. Given the large quantity of silt at the marina site, it is certain that the suspended sediment will have a large component of the smaller silt grains, which are also closest to the surface and most susceptible to resuspension.

Note 3: Computed value, based on the Applicant's statement that all ESA-listed corals are found at depths of 2 meters or less (this has not been independently verified). Time to fall is computed as 200cm / Fall Velocity.

Note 4: The actual observations taken over a twelve month period and reported by the Applicant indicate an average current of 0.1 meter/sec. The value used by SDI (0.06 m/s) is based on modeling from an inappropriate data source (Caricoos Buoy 81052).

Note 5: Computed value (time * velocity).

Based on this analysis we conclude that the "Action Area" extends a distance **of 870 meters** from the marina docks. Even if the lower velocity of 0.06 m/s is used, the Action Area would extend 522 meters from the marina docks. The Action Area based on the use of best scientific data in the calculations is shown in the graphic below:



The "Action Area" corresponding to the 0.1 m/s current velocity encompasses **197 acres**. The "Action Area" corresponding to the 0.06 m/s current velocity encompasses 133 acres. We believe that due to the large depth and quantity of silt, the higher transport velocity in the upper layers of the water, and the variability of wave heights and currents over the course of a typical year, that the larger estimate of **197 acres is the most accurate and most appropriate for assessing impacts to ESA-listed resources and habitat** based on the SDI model.

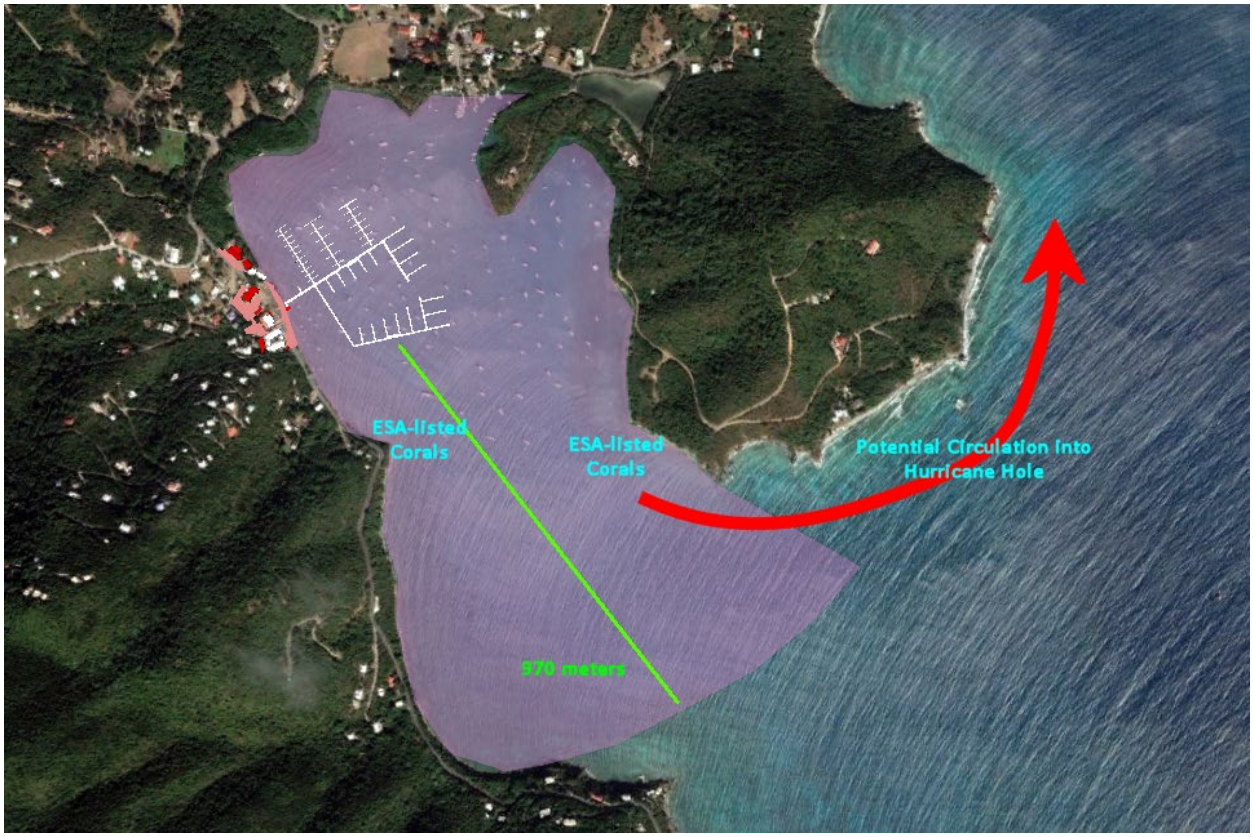
We recognize that this Action Area is larger than the area suggested by USACE (which was 110 acres) however we believe based on all of the forgoing analysis that it is the best estimate derived from the best available scientific sources, using the computational method of SDI. In a later section a superior model for Action Area computation is proposed based on all of the known scientific and observational data concerning the project environment.

6. ESA-Listed Corals Within the Action Area

The extent of the Action Area based on the best scientific data indicates that not only will the marina construction and operations impact the ESA-listed corals at the west and east mouth of the harbor (Pen Point and Harbor Point), but there is significant potential for impacts to ESA-listed corals within Hurricane Hole due to the current patterns circulating from the mouth of Coral Harbor into Hurricane Hole.

The revised estimates based on the actual sediment composition indicate that transport of sediments at a depth of 2 meters will definitely impact both Pen Point and Harbor Point. The cutoff figure of 92% is problematical because it indicates that for up to 4 weeks a year (8%) there may be transport velocities in excess of what is included within the current analysis. There has been no justification provided for the 92% cutoff figure. If this were to happen on a daily basis, for example for 2 hours per day (8%) then it is likely that ESA-listed corals would be impacted even based on the applicant's own analysis.

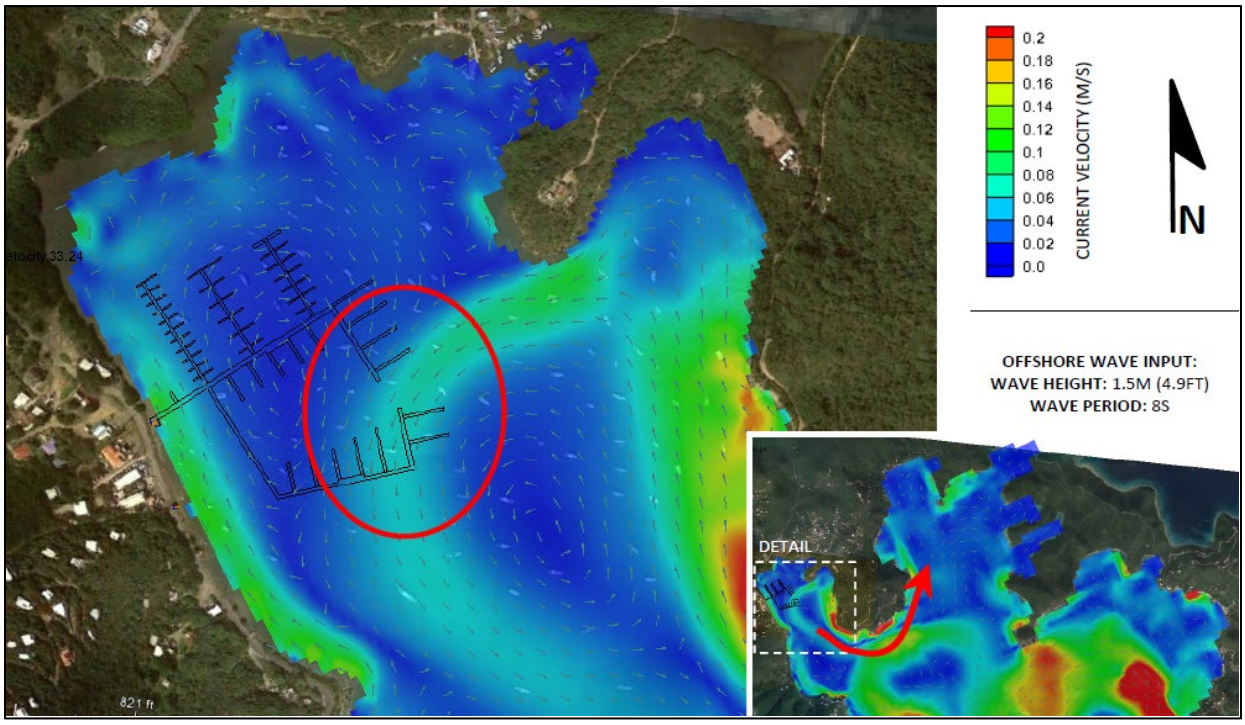
The image below shows the location of ESA-listed corals at two locations at the mouth of the harbor, as well as potential circulation pattern for suspended sediments into Hurricane Hole (Virgin Islands Coral Reef National Monument). The current flow into Hurricane Hole is discussed later.



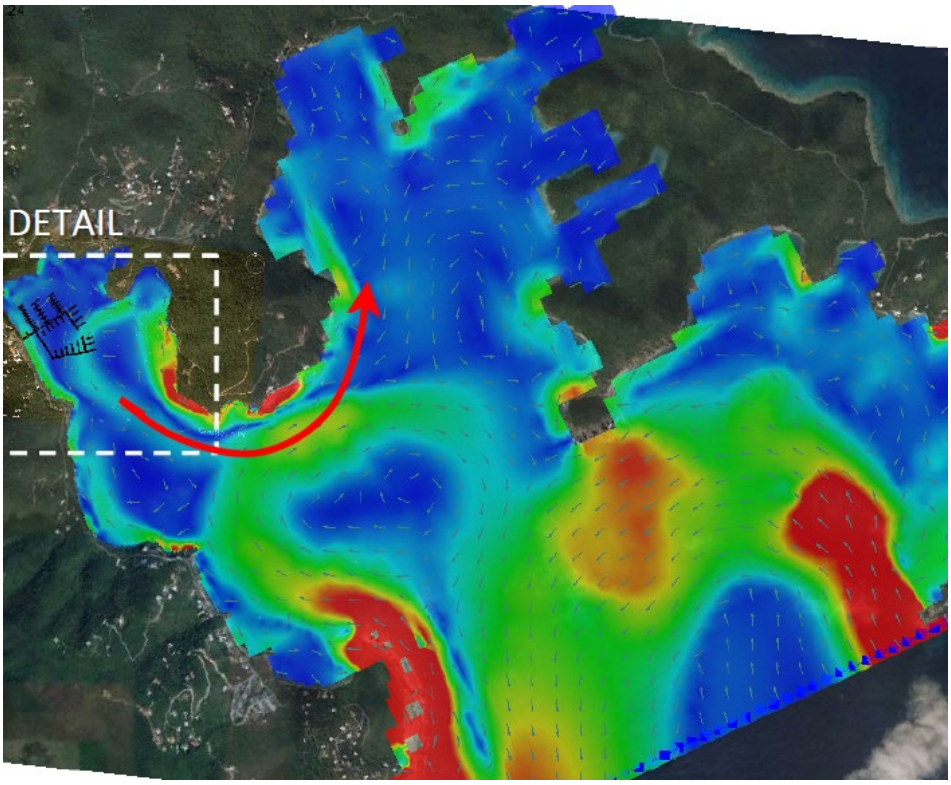
7. Circulation Currents

The water circulation modeling provided in the study indicates that a swath of substantially higher current passes directly over the area where mega yachts will be navigating, resulting in higher velocity transport in the most impacted area.

This is shown in the graphic below, taken from the Applicant's report (the green swath is modeled current in excess of 0.08 m/s and the red circle encompasses the mega yacht berths):



The band of higher current directly traversing the mega yacht berths has the potential to carry fine sediments beyond the mouth of Coral Harbor, where they are susceptible to being carried into Hurricane Hole, within the Virgin Islands Coral Reef National Monument. The red arrow in the diagram below shows this transport route based on the current modeling done by the applicant.



Potential impacts to the marine resources in Hurricane Hole is a major concern expressed by several authorities in comments to USACE. In 2015 the National Park Service sent a formal comment letter to USACE, including the following statement (from Virgin Islands National Park Superintendent Brion Fitzgerald):

> My area of greatest immediate concern, due to its geographic proximity to this proposed marina development is Hurricane Hole. The submerged monument lands within Hurricane Hole support the most extensive pristine and well developed mangrove habitat on St. John. The monument provides spawning stocks and critical developmental habitats that allow for the restoration of depleted fishery resources and enhancement of adjacent fishing grounds. The area offers outstanding opportunities for education and scientific research due to the diversity, complexity and relationship of the natural resources and provides a dynamic laboratory for study and learning.

Dr. Caroline Rogers, who has done extensive research on species diversity in Hurricane Hole, including many published articles and books, submitted the following comments during the 2015 Public Comment period by USACE for the proposed marina:

> "A significant omission in the SEG application is the failure to even mention the possible effects of sediments and other pollutants (created during pile driving and other construction activities, and released as by-products from boat operations/maintenance) on nearby areas, including those in National Park and National Monument waters.

No information (data) at all is provided in the application on water circulation patterns that would allow an evaluation of the likelihood that construction and operation of the marina would cause deterioration of water quality that could jeopardize the health of marine organisms within and outside the marina location. There is a lack of the most fundamental information---how do the currents flow? How strong are they?

Most notably, the extraordinary ecosystem within Hurricane Hole, Virgin Islands Coral Reef National Monument, which is unique within the Caribbean in terms of its high diversity of corals in mangroves, is potentially at great risk. Hurricane Hole is of ecological importance not only to St. John but also to the entire Caribbean and even the Pacific in terms of value as a research site. To date, no other mangrove area in the Caribbean is known to have such a high number of coral species. Over 30 coral species out of about 45 known from the entire Caribbean have been found in Hurricane Hole. Several threatened coral species grow here, and some that are rare especially in shallow water grow in the protective shade of the mangrove trees. This area has been shown to be a possible refuge for corals at a time of climate change. Corals here survived during the severe bleaching/disease events in 2005/2006 that resulted in the loss of about 60% of the corals on USVI reefs. It is possible that thriving corals in Hurricane Hole can produce coral larvae that can be transported out of Hurricane Hole where they could help to replenish degraded coral reefs. Hurricane Hole, like other mangrove ecosystems, is an important nursery for reef fishes and other marine organisms that later move out to coral reefs and sea grass beds offshore."

Dr. Caroline Rogers, 2015 Comment Letter to USACE

Based on the current modeling done by SDI on behalf of the applicant, together with the data presented earlier on sediment composition and current velocities, we believe there is a high likelihood that fine sediments will be transported into the protected waters of Hurricane Hole within the Virgin Islands Coral Reef National Monument. Although we haven't attempted to quantify the extent of this sediment transport based on the currently available data and modeling, the modeled circulation patterns clearly indicate that impacts to Hurricane Hole protected species and habitat is a major concern of the proposed project.

8. Analysis of SDI Methodology and "Action Area" Model

As we have pointed out in the prior discussion, there are multiple problems with the methodology and model used by Sea Diversified Inc (SDI) in the computation of the "Action Area" for the Applicant's proposed project. In this section we summarize the problems with the methodology and model used, and offer an enhanced model based on scientifically reported sediment constituents and field observations of current gradients.

8.1. Limitations on the SDI Sampling Protocol

According to their published report, the field work conducted by SDI consisted of "several sediment samples" collected at six different locations. No description of the method of sample collection, method of sediment constituent determination, or depth of sediment layer was provided. The report did not include any information on the date of the sample collection or the weather and water conditions at the time.

The current measurements conducted by SDI consisted of data collected by two ADCP devices at two locations, over a continuous period of five days. The weather conditions appear to have been fairly constant over that period. The dates for the current samples (July 16 – July 20, 2019) are during the summer months, when water conditions tend to be far calmer than during winter months.

Other than the sediment samples and current measurements from two locations, all of the remaining data and charts, including the current circulation, were computed by a computer based simulation.

Without independent verification, and based on the very limited sampling protocol (limited locations and limited dates) it would be unwise to draw too many conclusions from this report. The sediment constituents in the SDI report, for example, differ markedly from the far more extensive and rigorous data reported in numerous scientific studies.

8.2. Limitations on the SDI Action Area Computational Model

Although the model used to compute the Action Area was not explicitly stated in the SDI report, the model can easily be inferred from their reported assumptions and conclusions, specifically:

1. The SDI report states that they used a single fall velocity of 0.1 cm/sec, which is within the fall velocity range for Coarse Silt.
2. The SDI report states that they modeled sediment transport to a depth of 2 meters, based on their statement that there are no corals of interest within the study area at greater depths.

3. The SDI report states that they used a 92nd percentile current velocity of 0.06 m/sec to determine the distance the sediments would be transported.

Based on these highly simplified assumptions, the SDI report concluded that sediments would be transported a distance equal to (200 cm / 0.1 cm/sec) * 0.06 m/sec giving a value of 120 meters maximum transport distance and an area of approximately 45 acres.

We find it surprising that SDI used such a simplistic computational model which does not align with their own field observations. First, the SDI field data indicates a range of sediment sample sizes, with a corresponding range of fall velocities, as opposed to the single fall velocity used in their computation. Second, the SDI field data collected through the ADCP current measurements indicates a current gradient with significantly higher current velocities near the surface of the water, dropping to lower velocities deeper in the water column.

These two observations mean that the finer components of the sediment (the Medium Silt) with a slower fall velocity will spend a longer time in the upper portion of the water column where the current velocity is the highest. Therefore the finer components will travel a farther distance than the heavier components.

Because their computational model did not take account of these factors, the SDI conclusions are flawed. We have developed a more sophisticated model of sediment transport as described next.

8.3. An Enhanced Model for Current Gradients and Mixed Sediments

Based on the best available scientific data we know that the uppermost sediment layer in Coral Harbor consists of 25%-60% muddy silt to a depth of 8 – 25 cm (Brooks, et. al.,2007). The model we have developed measures the transport distances for three constituents of the reported sediment: Very Fine Sand, Coarse Silt, and Medium Silt.

Based on the ADCP measurements done by SDI, as well as numerous other studies (Dye Transport) we know that surface currents in Coral Bay are significantly higher than currents at greater depths. The ADCP charts included in the SDI report demonstrate this effect. For this reason we have used a “Current Gradient” in our model that computes current as a function of depth, using a linear function for the gradient (a later refinement uses a power function gradient, based on hydrodynamic theory).

The assumptions built into this model are as follows:

- Coral Bay sediments of interest consist of Very Fine Sand, Coarse Silt, and Medium Silt. The fall velocities for each constituent are provided by the USGS Wentworth Scale (Appendix VIII).
- Current gradient is a linear function, with the surface current twice the average current, and falling to zero current at a depth of 3 meters. Each of these parameters can be varied in the model, but they correspond to the ADCP observations.[2]
- The current velocity at time T is computed based on the depth at time T (from Fall Velocity) and the current as a function of depth. The velocity is then integrated over depth to compute total distance traveled.

The model equations expressing these statements are shown below:

Transport Distance (TD) Equation

$$TD = \int_{D=0}^{D=MaxDepth} CV(D)/FV \, dD$$

where

TD = *Sediment Transport Distance*
D = *Depth from Water Surface*
$CV(D)$ = *Current Velocity at Depth D*
FV = *Fall Velocity for Sediment Constituent*

and

Current Velocity Linear Gradient Equation

$$CV(D) = (-SC/ZCD)*D + SC$$

where

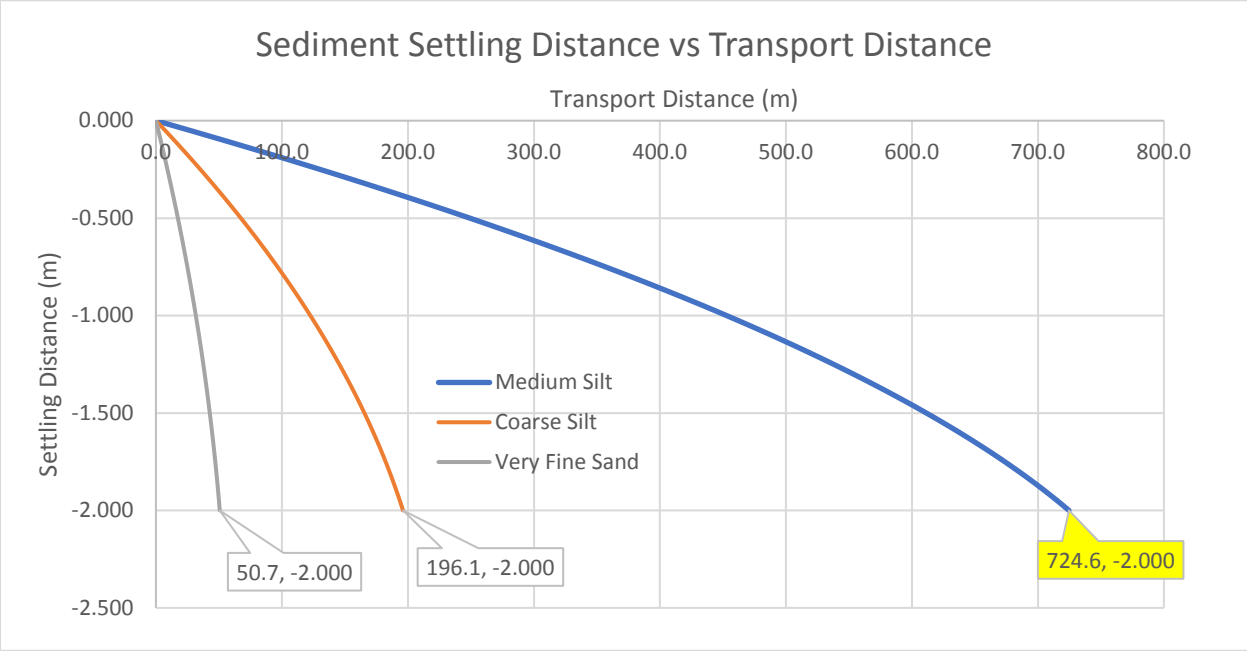
SC = *Surface Current* (cm/s)
ZCD = *Depth of Zero Current*

substituting the CV Linear Gradient Equation and solving the integral yields

$$TD = (-SC/(2*ZCD*FV))*D^2 + (SC/FV)*D$$

[2] A refinement of the model uses a "Power Function" gradient for current, which is based on hydrodynamic theory. This refinement does not substantially change the conclusions owing to the relatively shallow depths considered.

Using this enhanced model of current gradients, and the parameters in the table below, we have computed the Transport Distance for the Medium Silt component to be 724 meters. The transport distance versus depth chart for each of the primary sediment components is shown in the chart below, based on the current gradient model:



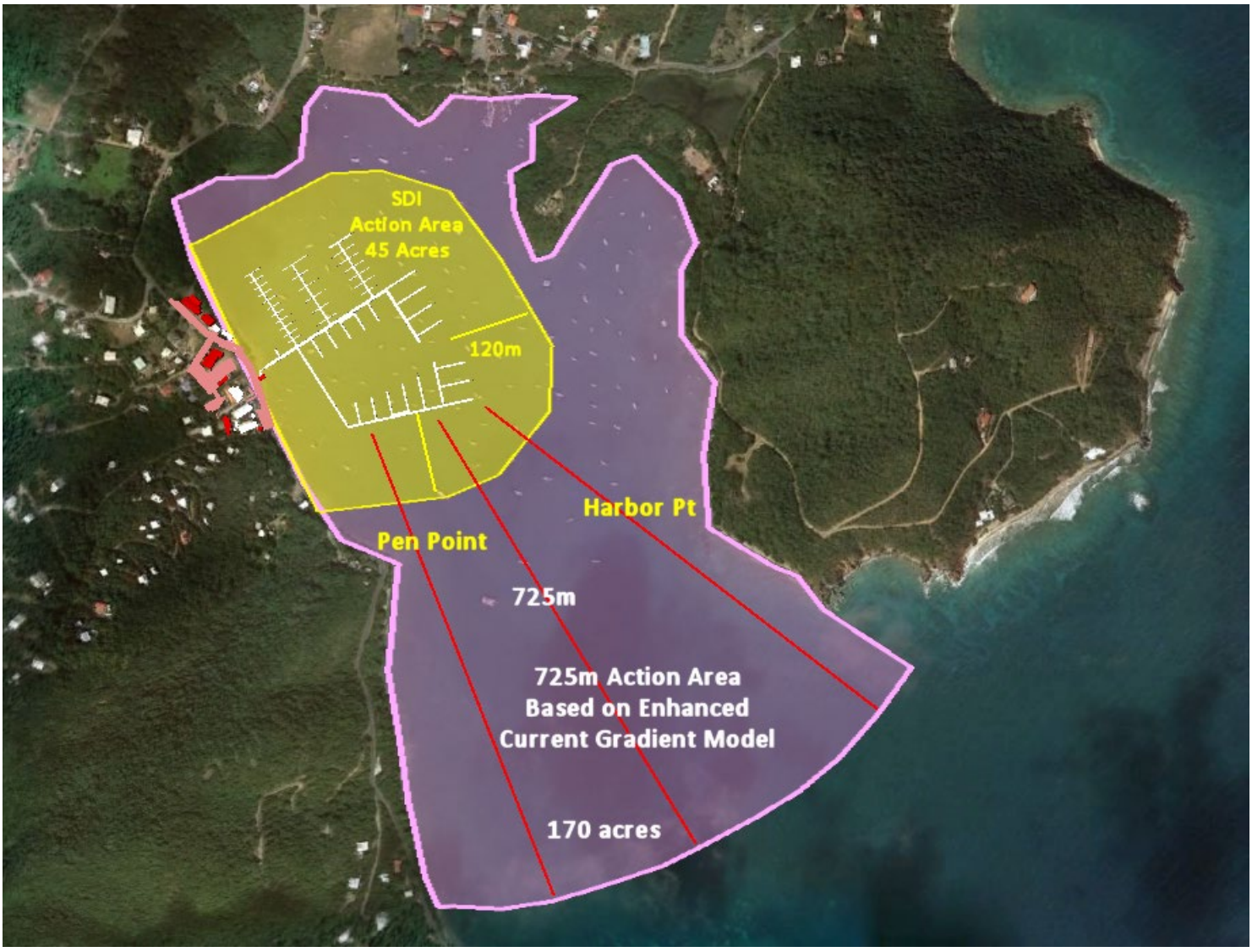
The parameters used in this model run, and the resulting transport distances, are as shown below:

Model Parameter	**Value**
Surface Current	0.125 cm/sec
Zero Current Depth	3 meters
Average Current	0.063 cm/sec
Fall Velocity (Medium Silt)	0.023 cm/sec
Fall Velocity (Coarse Silt)	0.085 cm/sec
Fall Velocity (Very Fine Sand)	0.329 cm/sec
Model Output	**Value**
Very Fine Sand Transport Distance	51 meters
Coarse Silt Transport Distance	196 meters
Medium Silt Transport Distance	**725 meters**
Action Area Size	**170 acres**

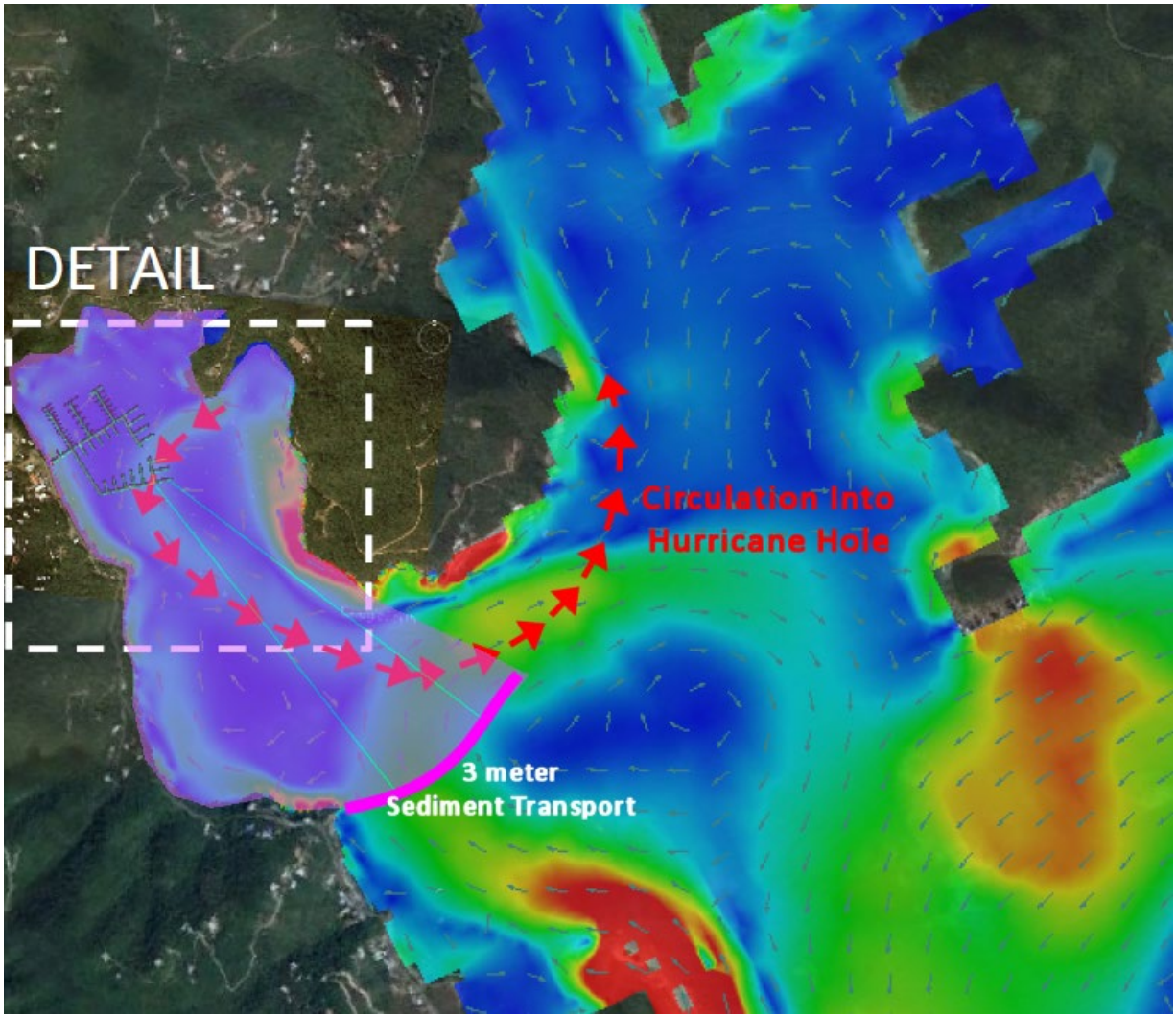
8.4. Action Area Based on Enhanced Current Gradient Model

The Action Area corresponding to the transport distance for medium silt in the enhanced current gradient model is 170 acres. It extends outside the mouth of Coral Harbor, and includes both Pen Point and Harbor Point, as well as coral colonized hardbottom off of the southern end of the Fortsberg peninsula. This Action Area will also transport sediments into Hurricane Hole due to the circulation currents discussed earlier.

Therefore our best estimate of the Action Area for the Applicant's proposed project, based on the current gradient model, is as shown in the diagram below. **The transport distance to a depth of 2m for the Medium Silt component of Coral Harbor sediments will be 725 meters, corresponding to an Action Area of 170 acres.** For comparison the Action Area defined in the SDI report (120m and 45 acres) is shown overlaid in yellow:



When the enhanced current gradient model is run for sediment transport to a depth of 3 meters, the interaction with circulating currents into Hurricane Hole becomes apparent. At 3 meters the sediments are transported approximately 1020 meters. Water depths at the entrance to Coral Harbor are well in excess of 3 meters, so any sediments transported that distance will be caught in circulating currents as illustrated below:



The potential for impact to ESA-listed resources within Hurricane Hole is a matter of great concern, as evidenced by the testimony in 2015 of Park Superintendent Brion Fitzgerald and Dr. Caroline Rogers. In order to quantify this risk a far more detailed study of circulating current patterns needs to be performed, including calibration under a range of wind and sea conditions, throughout the year. Additionally, quantitative studies of the volume of fine sediments within the marina footprint need to be undertaken, and calibrated models of propeller wash and seabed scouring from mega yacht activity need to be factored into the analysis.

9. Impacts to Essential Fish Habitat – Sea Grasses

NMFS asked the Applicant for an estimate of the amount of seagrass that would be lost as a consequence of the construction and operation of the marina, and the portion of total seagrass in Coral Harbor represented by that loss.

The question asked by NMFS was: "What is the approximate proportion of seagrass estimated to be lost due to the proposed project to total seagrass (available for ESA-listed species foraging and refuge) in Coral Harbor?"

The Applicant's single sentence response was: "In total it is estimated that 3.75 acres of seagrass may be lost."

We have conducted an extensive analysis of all of the impacts on seagrasses in the immediate vicinity of the proposed marina, and documented those findings in prior correspondence with the Army Corps (Appendix X). To confirm our analysis we asked the researcher cited by the Applicant as an authority on shading impacts to sea grasses (Dr. Brooke Landry) to evaluate our analysis as compared to the analysis performed by the Applicant's consultant. Dr. Landry stated:

> "Thank you for forwarding the NMFS letter as well as Appendix C2, the [Applicant's] rebuttal. I can't imagine how the [Applicant's] consultant determined a 46% survival rate based on the data presented in our dock study. The docks, grated or not, all had a significant negative impact on underlying seagrasses.
>
> I've read through your counter-estimates and I find them much more appropriate than what the consultant came up with. It's an incredibly thorough and thoughtful approach to estimating shading impact and I would recommend any scientist in the field consider using similar methods."

It is important to note that our analysis was performed prior to our detailed investigation of the sediment composition and water circulation in Coral Harbor. Our analysis was based solely on the impacts of dock and vessel shading, and the impacts of propeller wash on resuspended sediments in the immediate footprint of the marina. Based solely on these factors our analysis concluded that there will be a loss of 12-14 acres of sea grasses within the footprint of the marina navigational area, as detailed in the table below and further analyzed in the attached reference:

Impact Factor	**Acres of Sea Grass Impacted**
Shading from Fixed Marina Structures	1.313 acres
Shading from Boats Docked at Marina	5.085 acres
Shadow Elongation factor	22%
Total Shading Impact	**7.801 acres**
Total Dense Sea Grass Cover in Navigational Area	13 acres
Range Estimate for Cumulative Impact of Prop Wash	25-50% (4.25 – 6.5 acres)
Total Sea Grass Impact (all factors)	**12.1 – 14.3 acres**

We have now completed a review of the scientific literature on sediment composition and sediment depths, coupled with current velocity and current patterns, and this analysis significantly increases our prior estimate of seagrass impact. We now understand (as discussed later) that the entirety of Coral Harbor, as well as some areas outside of the inner harbor, may be impacted by sediment transport.

Without more detailed research involving precise sediment depths inside the proposed marina, and resuspension rates from propeller wash it is difficult to accurately estimate the volume of deposition of fine sediments on locations remote from the immediate footprint of the marina. However we do know based on the scientific research done by Dr. Brooks, Dr. Devine and others (Brooks, et. al.,2007) that the uppermost silt layer within the marina footprint ranges from 8cm – 25 cm in depth, an extremely deep layer of muddy silt which is well known to all residents who have swum or walked in those waters.

9.1. Cumulative Impact of Shading on Pre-Existing Conditions

One of the great concerns expressed by us in prior correspondence with USACE was the cumulative impact of shading on the pre-existing sediments in Coral Harbor. Based on the research performed by Dr. Devine and others, we know that a significant portion of the uppermost sediment layer is comprised of material that originated on the sloping hillsides above Coral Harbor. The Brooks, et. al., 2007, report states: "Sediment constituents [in the surficial facies] generally consist of abundant to dominant terrigenous clastic material that commonly increases toward the surface."

This sediment is clearly associated with modern development on the hillsides, and poorly designed roadways and stormwater management practices. The report concludes: "In comparison with other anthropogenically-impacted coastal systems, Coral Bay is similar in that accumulation rates have increased by up to one order-of-magnitude in response to anthropogenic activities. Unlike these other systems, Coral Bay contains a distinct anthropogenic signal represented by deviations in surficial sediment texture and composition. Consequently, anthropogenic activities have not only resulted in a dramatic increase in sediment accumulation rates, but have altered sediment distribution patterns as well."

The concentration of terrigenous sediments is greatest in the vicinity of the proposed marina, as illustrated in this graphic from the Brooks, et. al.,2007, study:

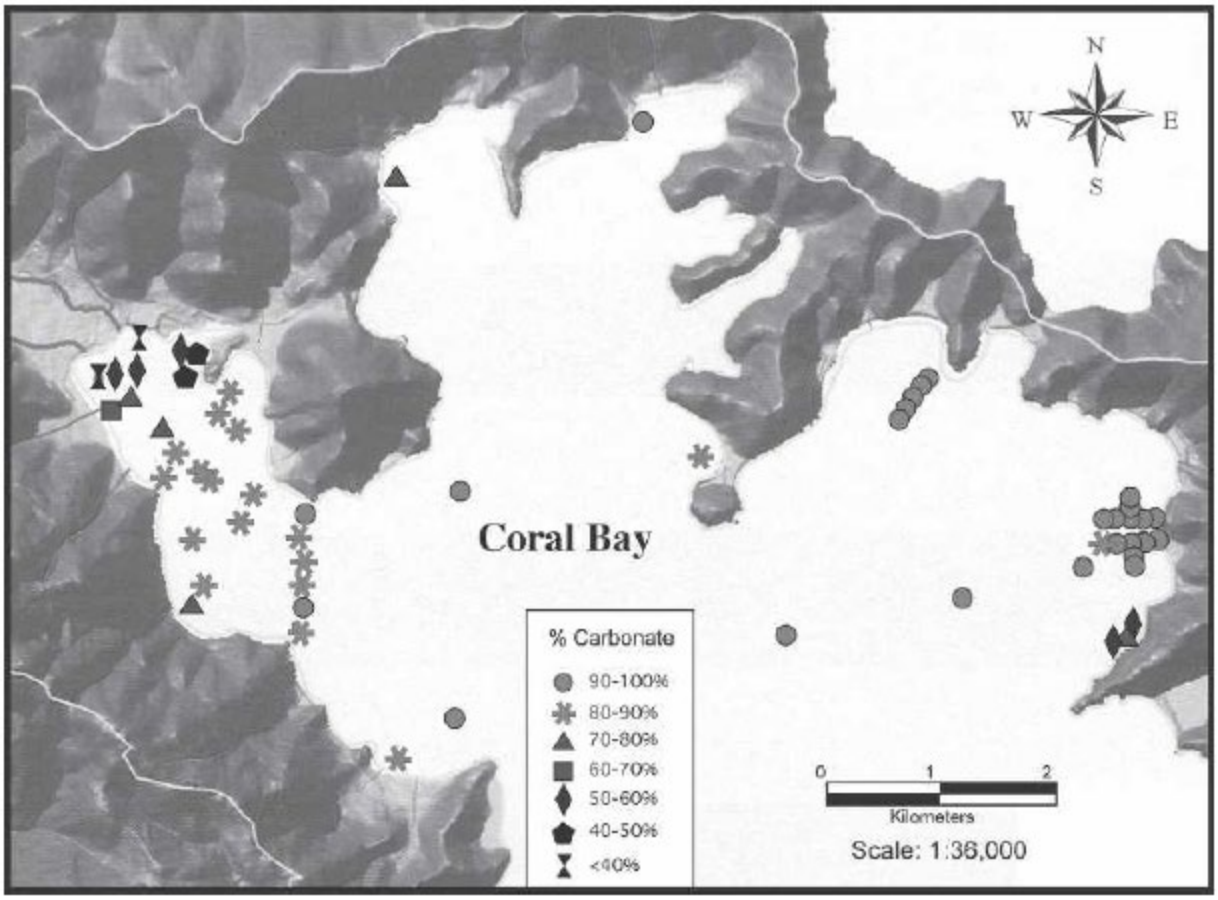


FIG. 6. Map of Coral Bay showing the distribution of calcium carbonate in surface sediments. The non-carbonate fraction consists dominantly of terrigenous sediments from island runoff. Note that terrigenous sediments are concentrated near heaviest island development in Coral Harbor.

Currently vast quantities of terrigenous sediment is trapped within the root structures of sea grasses on the western flank of Coral Harbor. If 12-14 acres of this seagrass were to die due to shading from vessels and fixed dock structures, then this has the potential to release the sediments previously trapped in the root structure. The released fine sediments could then be deposited on adjacent seagrass causing massive seagrass die off within the entire marina footprint.

This is a cumulative impact of the marina on existing sedimentation in Coral Harbor. Pursuant to Army Corp regulations all cumulative impacts must be considered, in addition to direct and indirect impacts. The Applicant has never discussed this aspect of their project impacts.

To quantify the extent of the possible cumulative impact, if just one quarter (25%) of the total sediment within the 28 acre marina footprint were resuspended due to seagrass die off, wind and wave action and propeller wash, this would amount to resuspension of 152,460 cubic feet of silt (based on 25% of an average silt depth of 15cm (6")). If this

total sediment load were dispersed uniformly across the 90 acres of Coral Harbor it would deposit 0.47" of silt over the entire inner harbor. There is no question that this would severely impact virtually all of the benthic habitat, including sea grasses, macro algae, and coral colonies within Coral Harbor.

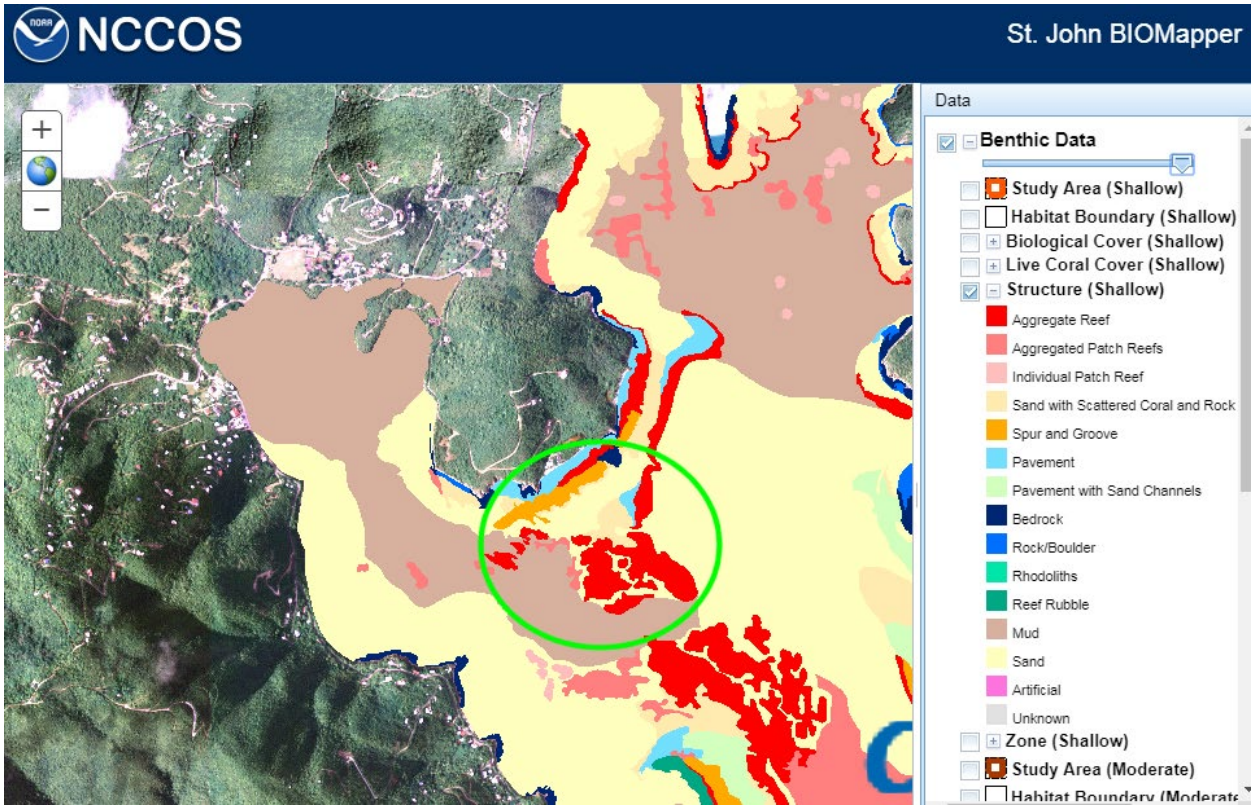
9.2. Conclusion: Direct, Indirect and Cumulative Impacts to Seagrass

The failure of the Applicant to (1) consult the prior scientific literature regarding sediment composition in Coral Harbor, and (2) provide an independently reviewable model for sea grass and EFH impacts, and (3) accurately report on the shading impacts published by their only cited reference (Dr. Landry), and (4) consider cumulative impacts, has led to a gross misstatement of the impacts on Essential Fish Habitat, specifically seagrasses.

In response to the question posed by NMFS, it is our conclusion following detailed analysis that the construction and operation of the proposed marina will impact a minimum of 12-14 acres of seagrass, with significant potential to impact 100% of the total seagrass available for ESA-listed species foraging and refuge in Coral Harbor.

10. Potential Impacts to Deeper Coral Reef Structures

In addition to the coral resources previously identified at Pen Point and Harbor Point, there is coral colonized hardbottom structure found directly south of the Fortsberg peninsula. The NOAA "BIOMapper" was used to locate these reef structures, which are shown within the green circle below:



According to the NOAA data, these structures include Aggregate Reef, Aggregate Patch Reef, Individual Patch Reef, Spur and Groove, and other areas of nearshore structure. We have analyzed the potential for sediment transport from the proposed marina location to these reef areas based on the enhanced model for current gradient. The methodology and model results are discussed below.

9.1. Modeling Deeper Sediment Transport

The vertical structure of current gradients is often modeled using a simple "power law" which represents the ratio of a current at a given depth below the surface to the current at the surface in terms of the ratio of the depths raised to a fractional exponent. Empirically that exponent is generally 1/6 or 1/7. The power law for vertical current structure is shown below:

layers. The power law is often used for vertical structural description of flow velocity as follows:

$$\frac{U}{U_0} = (\frac{Z}{Z_0})^{\alpha}$$

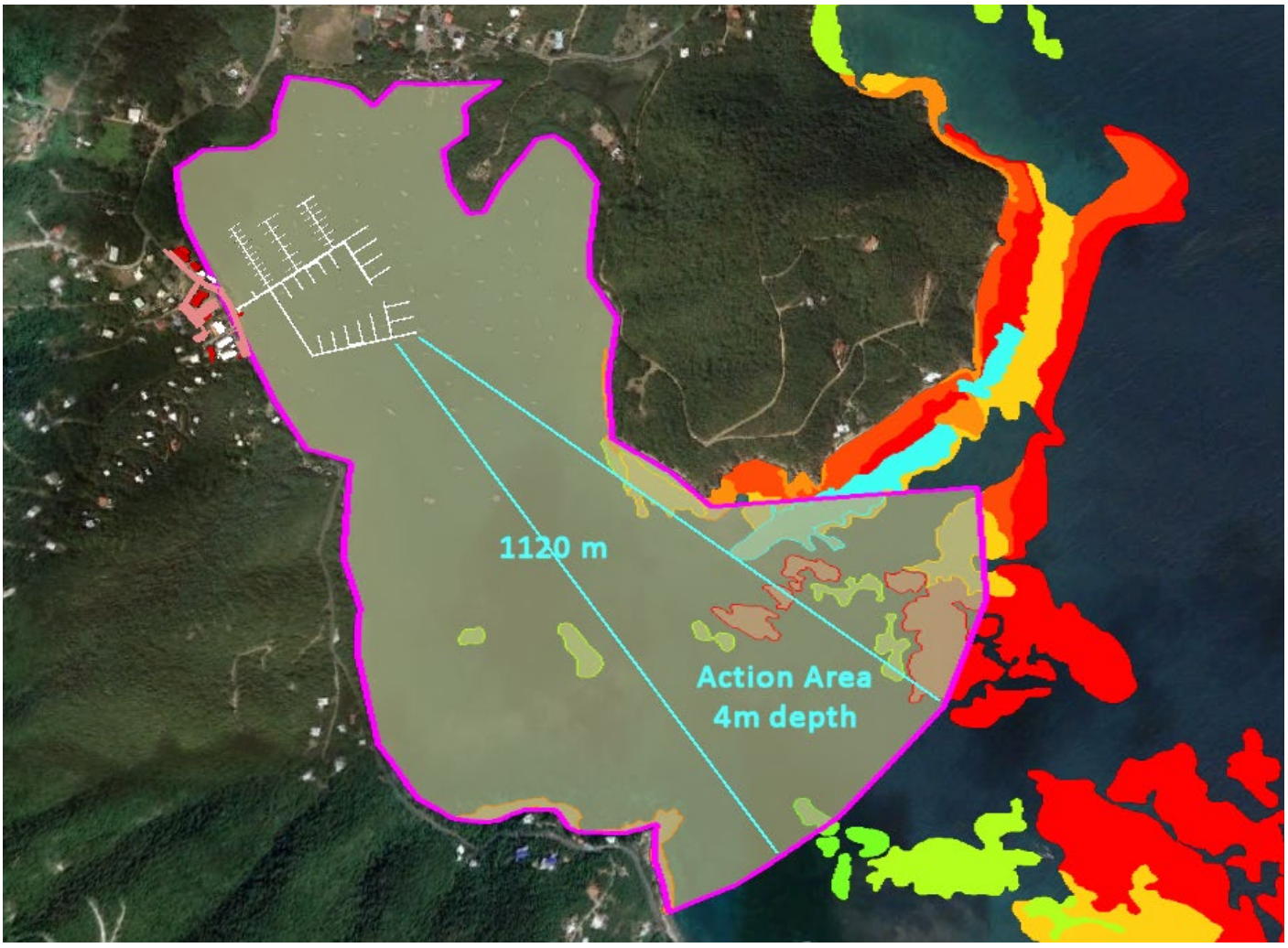
Z_0, sea surface measured from the seabed, m
Z, water depth measured from the seabed, m
U_0, current velocity at sea surface, ms^{-1}
U, current velocity at Z depth, ms^{-1}
α, power law exponent

We have used the power law to model currents based on the observed surface currents and the general observations by SDI from their ADCP measurements on the drop off of current at deeper depths. Using this model we computed the transport distance for the finer sediment components (Medium Silt) to a depth of 4 meters, which is the approximate depth of the deeper colonized hardbottom structures south of Fortsberg. The model predicts a transport distance of 1,120 meters at a depth of 4 meters with a 0.07 m/s surface current and a power law exponent of 1/7. The transport time corresponding to this depth is 290 minutes.

We note from the ADCP data and the tide tables that the ebb tide (flowing out from Coral Harbor) typically has a duration of around 6 hours, which is sufficient time to transport the sediments the modeled distance.

When an overlay of the sediment transport region is combined with the BIOMapper delineation of deeper coral structure the potential for sediment impacts to these regions becomes clear. Without further research we do not know the extent of living coral at this location, but it is clearly habitat suitable for coral growth and impacts need to be fully considered.

The overlay of the 4 meter sediment transport, based on the enhanced current gradient model, is shown in the illustration below.



We are also aware of coral structures along the shoreline of Saunders Bay, which are shown above as the brown colored region at the lower left of the Action Area. Without a more detailed analysis of depth and current it is unclear whether sediments could reach that location, and it is in need of further study.

11. Analysis of Compensatory Mitigation Proposed by Applicant

The analysis of impacts to protected resources including seagrasses and ESA-listed species clearly demonstrates a requirement for substantial compensatory mitigation. The Summers End Group has, over the years, proposed many different elements of a "compensatory mitigation plan" however these elements have never been nearly sufficient to compensate for the habitat loss and impacts to aquatic function resulting from the proposed project.

The most recent document published by the Applicant on this subject is entitled "Compensatory Mitigation Plan for the Development of the St John Marina, Summers End Group, US Virgin Islands" and is dated February 2018, prepared by Bioimpact Inc. ("SEG Mitigation Plan", Reference 2)

11.1. Applicant's Proposed Compensatory Mitigation

Section VII of the SEG Mitigation Plan describes seven components of their proposed mitigation. These are:

1. Thalasia Transplant
2. Clean Up of Debris in Coral Harbor
3. Clean Up of Debris and Repair of Corals Within 750 Acres of Coral Harbor
4. Mangrove Planting
5. Placement of Informational Buoys
6. Informational Signage
7. Pumpout and Waste Facilities

Apparently subsequent to this document being published the Applicant has decided to eliminate some of the items in this plan. Specifically, according to the SEG Response (Appendix II), items 1 and 3 are now no longer part of their plan. Their letter states "Applicant no longer proposes to transplant sea grass as part of its mitigation proposal" (page 16). Their letter also states "ESA-Listed Coral Relocation is no longer proposed based on the results of the circulation study" (page 12).

The remaining elements of the proposed "compensatory mitigation" are reviewed below:

1. **Thalasia Transplant:**
   DELETED

2. **Clean Up of Debris in Coral Harbor:**
   The Applicant proposes to remove 1200 square feet of submerged hurricane debris, which presumably will allow approximately the same area of seagrass to recolonize the impacted area. We note that in the two and a half years since Hurricane Irma large quantities of storm debris have already been removed from Coral Harbor, particularly in the shallower waters with densest seagrass. These cleanups were

funded, in part by FEMA. It isn't clear what quantity of debris remains and whether it is located in areas where seagrass will grow.

3. **Clean Up of Debris and Repair of Corals Within 750 Acres of Coral Harbor: DELETED**

4. **Mangrove Planting**:
The Applicant proposes to plant 300 red mangroves propagules along the exposed shoreline in front of the marina. Based on aerial photography from the 1950's we can determine that this shoreline has not supported mangrove growth for at least 70 years, and possibly longer. The shoreline in this location is exposed to near constant wind and waves and is not a suitable habitat for mangrove plantings.

Furthermore, in their latest plans, the Applicant has proposed a boardwalk in the precise location where the mangroves had previously been proposed (the rip-rap revetment). Their most recent rendering shows a neat hedge of mangroves on the water side of the boardwalk, which is clearly not a feasible plan for mangrove planting due to water depth and exposure:

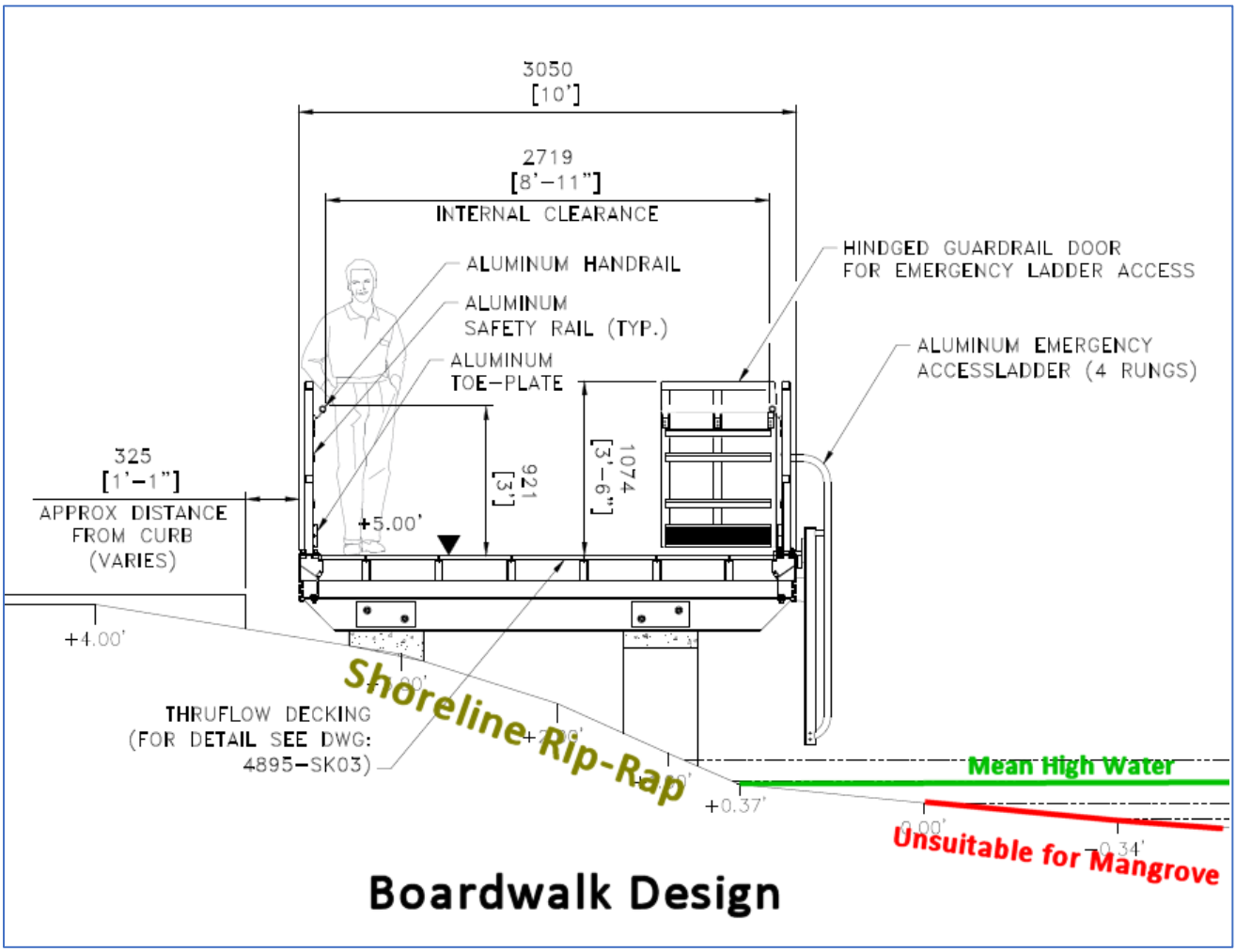
Bird's Eye View Of Renovated Retail Area

In the NMFS Letter of October 2018, the NMFS said "While the NMFS normally recommends against out-of-kind mitigation for seagrass impacts, the NMFS acknowledges the severity of the degradation of mangroves from Hurricane Irma along the shoreline and supports restoration of this area as compensatory mitigation."

Unfortunately the "mitigation" proposed by the Applicant does not address the restoration of degraded mangroves from Hurricane Irma, primarily because those

mangroves are not located on property under the control of the Applicant. The Applicant proposal is for an infeasible planting of mangroves bordering a boardwalk that extends over the water. The Applicant is not restoring the previously healthy mangrove north of the proposed marina location.

To further illustrate the infeasibility of the proposed mangrove/boardwalk design, copied below is an excerpt from the Applicant's most recent submission to the Army Corps, detailing the placement of the boardwalk above the rip-rap revetment along the shoreline, and extending over the water. It is clear that (a) the mangroves cannot be planted above Mean High Water because this would place them beneath the boardwalk, nor can they be planted in the rip-rap which is entirely covered by boardwalk, and (b) in order to provide some space for growth, the mangroves propagules would need to be planted well below Mean Sea Level, which is not viable for mangrove propagule plantings.



The statement made by the Applicant in their February 2018 "Mitigation Plan" document regarding the mangrove planting is copied below:

> Three hundred red mangrove propagules will be planted along the shoreline across the 850 feet of shoreline on approximate 3 feet centers. The mangroves will be carefully placed so that they have the greatest chance of survival and will be placed just above the MHW line. The mangroves will be placed amid the riprap/stones on the southern end of the property. Mangroves will be replaced over the five year monitoring as necessary to assure colonization of the entire shoreline.

Clearly this statement cannot be reconciled with the boardwalk design specifications.

5. **Informational Signage:**
   In the 2018 NMFS Letter, informational signage was dismissed as not being mitigation for loss of protected seagrass habitat. NMFS said: "The NMFS acknowledges the Mitigation Plan includes other mitigation activities, including providing signage and information to promote the protection of natural resources and safe boating practices and providing a pump out and waste disposal facility to all boaters in the facility. While the NMFS views the activities as beneficial, the NMFS cannot accept these activities as mitigation for the loss of seagrass habitat."

6. **Placement of Informational Buoys:**
   See comment (5) above.

7. **Pumpout and Waste Facilities:**
   See comment (5) above.

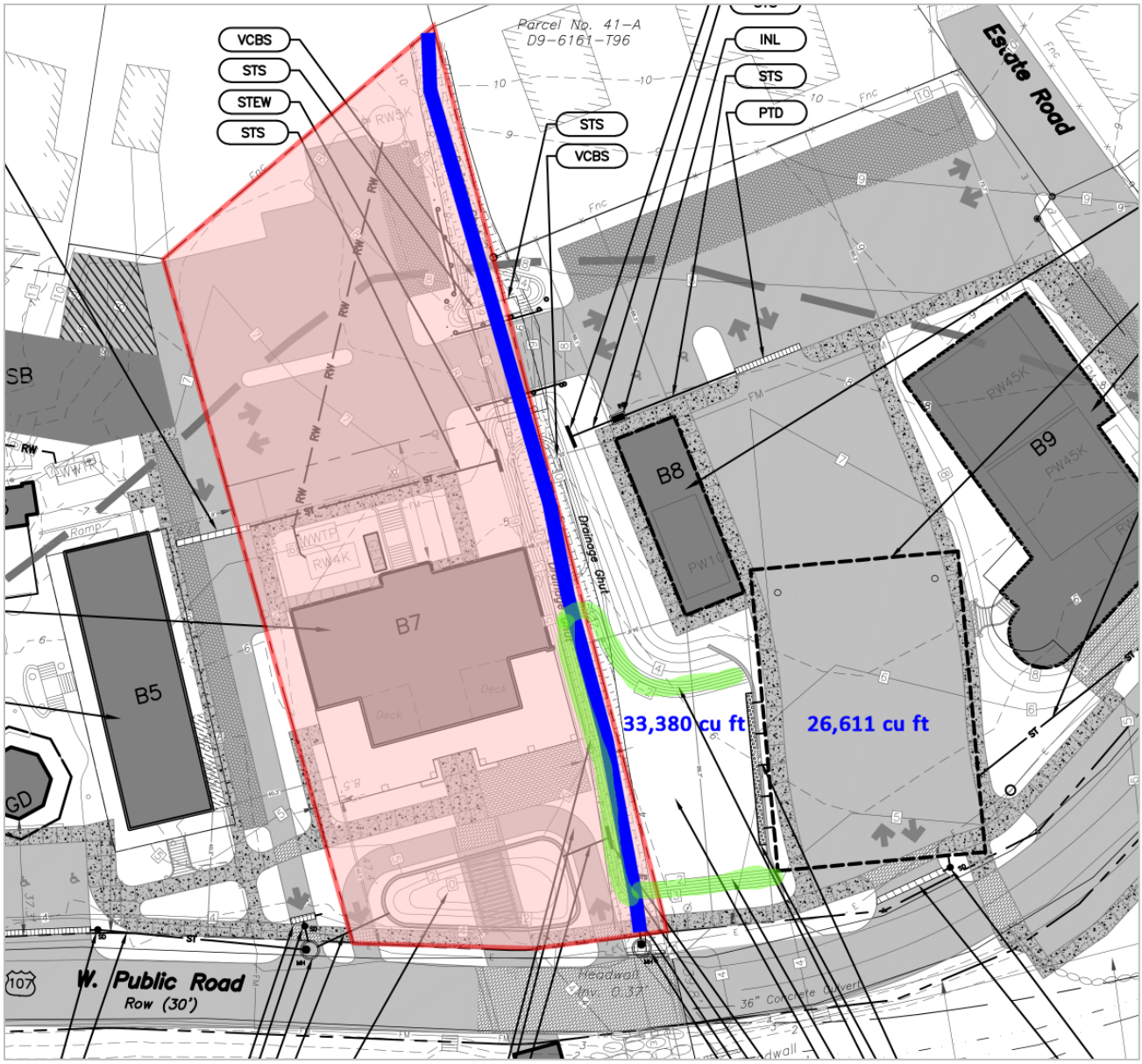
11.2. Stormwater Management

In addition to the seven specific items listed in the Applicant's Compensatory Mitigation Plan, their original plan submission included engineering to capture sediment laden stormwater runoff in the main drainage gut traversing the project. This was proposed as a means to improve water quality in Coral Harbor.

The Applicant had originally proposed reshaping of the gut to divert the first half hour of runoff into approximately 60,000 cubic feet of retention basin and underground stormwater detention to allow settling of contaminants before emptying into Coral Harbor. The original plans for this stormwater management are shown in an illustration below.

The **RED** line encloses property no longer accessible to the Applicant. This property was sold in 2016 to a third party with no involvement or interest in the marina project. The **BLUE** line is the path of the main storm drainage gut. As you can see, the gut is entirely on the property no longer accessible to the Applicant.

The green shaded area is the outline of a stormwater detention pond originally proposed by the applicant. The construction of this pond involved extensive grading and diversion of the gut flow. That grading can no longer be done because it is on the adjacent parcel.

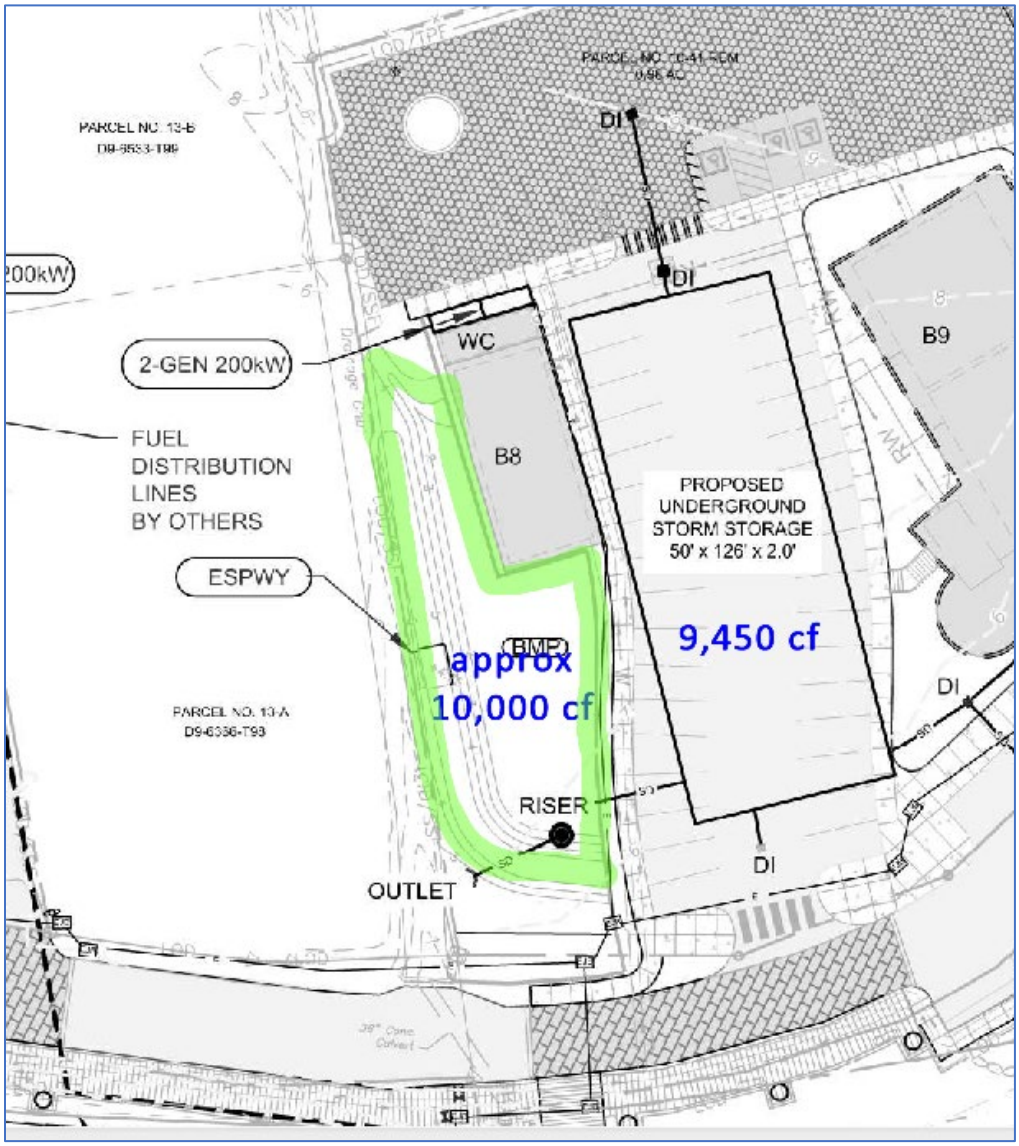


The 2016 sale of the two parcels through which the main gut channel flows invalidated the Applicant's initial stormwater management plans. Since the gut is no longer on SEG property they can no longer capture the majority of the gut flow for treatment. In their revised plans they propose to divert a small portion of the runoff into approximately 20,000 cubic feet of detention basin. No analysis of the adequacy of this plan has been submitted (the prior Stormwater Calculations analysis is no longer relevant). Reshaping

of the gut is no longer possible since it involves work on property inaccessible to the Applicant.

The components of the new stormwater design are shown in the illustration below. This plan has never been accompanied by engineering calculations or environmental assessment. It provides about one third of the detention capacity as the prior, engineered plan. There is no document describing how storm water flows that are not traversing the Applicant's property will be diverted off the adjacent parcel.

Based on new construction that has taken place since 2016, we do not see any way the "revised" stormwater plan can be successful.



11.3. The 75-Position Public Mooring Field

The Applicant has, at times, said that they would install a public mooring field of 75 moorings for local boaters. There has never been a design for this component of the project, nor has there been any information on the location, installation, maintenance or management of the mooring field. In fact, this component of the Summers End project was removed from the Army Corps permit application in 2015.

On August 15, 2017, the Applicant submitted additional material to USACE, including a letter responding to comments made by the National Park Service. This letter included the following statement by the Applicant:

> "The mooring field requested has been removed from this application even though it was previously approved the Department of Planning and Natural Resources, Division of Coastal Zone Management. ("DPNR"). This idea, which was first suggested by National Marine Fisheries Service as a mitigation measure, would have helped abate on going impacts caused by poor mooring practices and unauthorized boating activities. While installation and management of a properly designed mooring field could greatly reduce the ongoing degradation currently occurring within Coral Harbor as a result of illegal moorings, there was strong public objection, especially by boaters within the bay. DPNR approval does not require construction of every component permitted and is contingent on receipt of all other required permits. By removing the mooring field from the ACOE permit application, Summer's End Group will not be seeking to obtain the remaining permits that would be necessary for the installation of the mooring field. Consequently, the mooring field does not need to be considered in the review of the pending application."

Based on this statement by the Applicant we cannot assume that there is any intention of constructing the mooring field, nor can it be considered as an element of mitigation.

11.4. The Proposed Compensatory Mitigation for Impacts to EFH in Inadequate

Summarizing all of the foregoing, the total proposed mitigation amounts to possibly 1200 square feet of seabed cleared of debris and possibly suitable for seagrass growth. The mangrove plantings will not be successful as proposed. There is no mooring field. The revised stormwater management plan has not been demonstrated to be feasible.

With impacts to EFH amounting to 12-14 acres of seagrass loss and probable impacts throughout Coral Harbor, the Applicant's mitigation plan must be rejected by NMFS.

12.NMFS Request for Additional Avoidance and Minimization Measures

The NMFS letter of October 2018 requested the Applicant provide additional avoidance and minimization measures to reduce impacts on protected resources. The NMFS wrote:

> "The NMFS recommends additional avoidance and minimization of impacts by reducing the number of slips in shallow areas where there would be little clearance between the sea bottom and moored vessels. Such adaptations could include the use of single pilings in place of finger piers and a significant reduction in the number of slips and vessel sizes the applicant aims to accommodate."

Rather than respond to these specific suggestions, the Applicant has chosen to repeatedly cite their "Alternatives Plan" and has steadfastly refused to consider any actual additional avoidance and minimization measures.

The Applicant included in their response to NMFS a document entitled "Avoidance and Minimization" (attached Appendix IV) which we have reviewed to assess the measures described therein**. It is our conclusion that none of the measures described in this document are acceptable as minimization or avoidance, and that there are multiple misstatements contained within the document.**

We review the avoidance and minimization claims made by the Applicant in the following section.

12.1. Applicant's Claimed Avoidance and Mitigation

The Applicant has made many statements about avoidance and mitigation in their response to the NMFS. We have closely examined the original plans submitted to the Army Corps in 2014, and compared them with the plans most recently submitted, in 2017, in order to objectively review all changes and assess what actual avoidance and minimization measures have been taken during that period.

It is important to note that the 2018 letter from NMFS specifically requested that **additional** minimization measures be taken by the Applicant based on the projected impacts to protected resources. The letter did not request a recitation of measures that may have been taken prior to the application being submitted to USACE or reviewed by NMFS.

Listed below are each of the items identified by the Applicant in their response to NMFS, which were contained within "Avoidance and Mitigation" included in their response letter.

1) **Redesigned layout to provide only one main walkway from shore and shifted docks and slips further out into deeper water to avoid potential damage and shading to seagrass and inshore habitat.**
Please refer to the two dock layout drawings and the overlay drawings in Appendix XI of this note. The first drawing is the original plan submitted to USACE in March 2014. The second drawing is the most recent plan submitted to USACE in August 2017. The third drawing is an overlay of the two, with the 2014 drawing shaded in light red, and the 2017 drawing shaded in light turquoise. The final drawing is the overlay comparison with all layout changes highlights inside red ellipses.

It should be clear that **no substantial changes** have been made in the size, position or layout of the marina since the original submission in 2014.

The only changes that have been made are:

a) Removal of one finger pier at the southeast corner. This was due to the recent discovery of a significant historic shipwreck at that location. Further investigation by the Virgin Islands Historic Preservation Office (VISHPO) has been undertaken to ascertain the age, size and significance of this wreck.
b) Shortening of one finger pier at the southeast corner.
c) Removal of the "Red Mangrove For Shoreline Protection" from either side of the main pier.
d) Removal of the building at the head of the main pier. This was due to the sale of that building to a third party in 2016.
e) Slight relocation of the small structure at the head of the main pier from the south side of the pier to the north side of the pier. This was presumably due to the sale of the parcel directly upland of where that structure had been located.

Contrary to the statement by the Applicant, there never have been two main walkways from shore in any of the plan submissions to the Army Corps. Furthermore, the Applicant's claim that they "shifted docks and slips further out into deeper water to avoid potential damage and shading" is untrue, unless this design change occurred prior to the 2014 initial submission to USACE. The current location of the docks is identical to where it was in the 2014 submission.

2) **Changed dock construction from floating concrete (originally proposed) to raised fixed docks. Allows for greater light penetration into the water and reduces shading impacts.**
We have reviewed, through the Freedom of Information Act ("FOIA") every formal submission to the US Army Corps of Engineers that has ever been made by the Applicant. There is not a single drawing or document that describes use of "floating concrete" docks. This may have been part of an informal discussion prior to 2014, but

there is no "original proposal" on the record for this design. The statement by the Applicant is untrue.

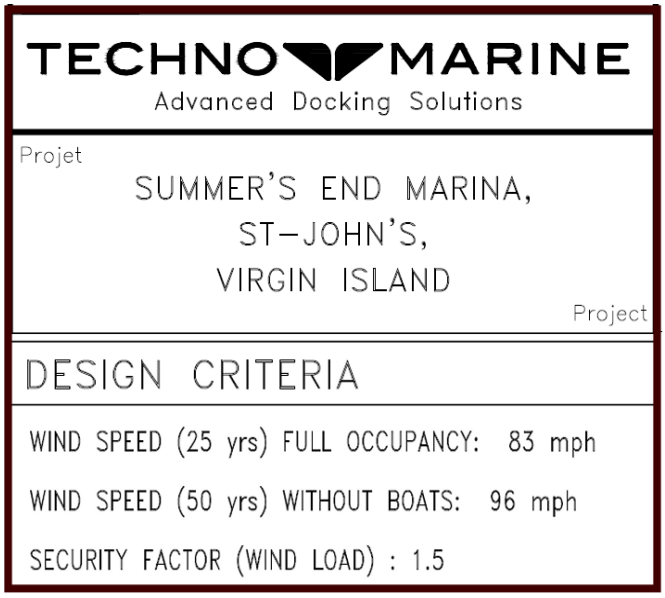
3) **Synthetic graded [sic] dock decking material over heavy aluminum framed dock sections rather than solid concrete allows for maximum light penetration and a faster dock and utility installation.**
The original submission to USACE described the 2014 design as follows: "The marina is designed to minimize the long-term impacts of shading on seagrasses as much as possible through the use of fixed docks instead of floating docks, raising of the height of the docks as high as practicable, use of mooring piles to reduce finger pier length and utilizing grated decking. Boat lifts will be used in the furthest landward slips in the marina to raise the boat hulls out of the water and, thus, decrease shading impacts."

There never has been a design submitted by the Applicant for approval involving use of solid concrete decking.

4) **Adjustments of piling locations for avoidance of impacts to coral.**
The Applicant has supplied no information regarding coral colonies within the footprint of the marina, nor has the Applicant supplied any information regarding changes in piling location to avoid impacts. It should be abundantly clear from the discussions on sediment resuspension that no coral within the footprint of the marina will be able to survive the construction and operation of the marina. The only way to minimize impacts on coral within the piling structures would be to relocate these coral colonies.

5) **Reduction of pilings from 1,333 to 960, reduction of 28%.**
The design submitted in August 2017, prior to Hurricane Irma and Hurricane Maria, reduced piling count from 1333 to 960. However the 2017 design also substantially reduced the wind strength of the structure to a point that it is a dangerous and infeasible design for the Coral Harbor location.

The 2017 drawings submitted for approval to USACE include the following design parameters:



The wind speeds at the marina site during hurricane Irma exceeded 200 miles per hour. During hurricane Maria, just two weeks later, wind speeds exceeded 150 miles per hour. The design submitted by the Applicant for approval, with maximum design wind speed of 96 mph, would have failed catastrophically in both of these storms, leaving a debris field covering a significant portion of Coral Harbor. Even with the 50% security factor, the winds in 2017 would have exceeded the strength of the marina design.

In terms of avoidance and minimization of adverse impacts, this design presents significant and unacceptable risks not only to protected marine resources, but also to public health and safety.

6) **Based on the recently completed Geotechnical Study of the dock location area results show that the use of a vibratory hammer will greatly increase the piling installation speed and reduce the days required for driving pilings.**
The "Geotechnical Study" has not yet been independently reviewed by qualified marine geologists. Individuals with experience in installation of moorings in Coral Harbor have expressed doubts about some of the conclusions in this report.

Nevertheless, if the report is accurate and vibratory driving would be possible, this does not constitute either an avoidance or a minimization measure for protected resources. It simply lessens the construction time.

7) **Removed from the original design of inclusion of two one-story buildings out on the docks, a reduction of vertical shading potential.**
We have never seen a design submitted to USACE which included "two one-story buildings out on the docks". These buildings were not on the original submission in 2014.

8) **Removed from development two non-shoreline upland parcels reducing overall potential construction impacts.**
The removal of parcels 13-A Carolina and 13-B Carolina was not done at the request of the Applicant. These parcels were sold in 2016 to a third party who had no interest in the marina. The elimination of these parcels from the design significantly increases, not decreases the impacts of the project on water quality in Coral Harbor.

In the original 2014 submission to the Army Corps, extensive work was done to reshape the main storm drainage gut on parcels 13-A and 13-B Carolina. The water flowing in the gut was diverted to a retention pond and underground basin, with a combined capacity of 60,000 cubic feet, capable of capturing the first half hour of rainfall flows from the watershed above the project. The design provided capacity for this sediment laden water to settle before being released into the harbor. That design was accompanied by engineering calculations to demonstrate its adequacy.

After parcels 13-A and 13-B were sold, the Applicant was required to revise their plans and eliminate any construction on these two parcels. Since the stormwater gut flows is located on the 13-A side of the boundary line, the Applicant is no longer able to do the extensive regrading necessary to divert the stormwater flow into retention basins.

As a consequence, the total stormwater retention capacity has been reduced by two-thirds, and in the 2017 plan submission to USACE there is now only 20,000 cubic feet of capacity, less than one third of what is required. This means that the capability to capture and treat the first half hour of sediment laden runoff has been eliminated from the Applicant's current plans.

This change is clearly not a reduction in impacts – it is a major increase in impacts as compared to prior plan submissions.

9) **Development of a comprehensive Hurricane Preparedness Plan for Coral Harbor, helping to maximize public safety and environmental protection.**
We have not seen the comprehensive plan described above, and in any case this would not constitute avoidance or minimization of impacts to protected resources.

10) **Customs and Border Protection office on site to help prevent illegal entry, drug trafficking and overall law enforcement presence.**
Over the six years we have been reviewing this project we have never seen any commitment from Homeland Security to provide a Customs and Border Protection office in Coral Bay. The Applicant repeatedly makes this claim, but there is no confirmation whatsoever from the relevant federal agency. Furthermore, this project feature, if it did exist, would not constitute avoidance or minimization of impacts.

Mitigation and improvements to Coral Bay and Harbor long term water quality and safety for vessels visiting Coral Harbor.

1) **Installation and management of up to 75 public moorings, designed for various sized vessels, professionally installed and maintained coupled with a Harbor Management Plan to help enhance environmental protection and public safety. Placement of the moorings will be determined in coordination with USVI DPNR.**
In the 2014 permit application to USACE there was some discussion of the 75 position public mooring field. However this element on the plan was removed by the Applicant in their 2015 resubmission to USACE.

> In August 2017 correspondence to USACE the Applicant stated: ""The mooring field requested has been removed from this application even though it was previously approved the Department of Planning and Natural Resources, Division of Coastal Zone Management. ("DPNR"). This idea, which was first suggested by National Marine Fisheries Service as a mitigation measure, would have helped abate on going impacts caused by poor mooring practices and unauthorized boating activities. While installation and management of a properly designed mooring field could greatly reduce the ongoing degradation currently occurring within Coral Harbor as a result of illegal moorings, there was strong public objection, especially by boaters within the bay. DPNR approval does not require construction of every component permitted and is contingent on receipt of all other required permits. By removing the mooring field from the ACOE permit application, Summer's End Group will not be seeking to obtain the remaining permits that would be necessary for the installation of the mooring field. Consequently, the mooring field does not need to be considered in the review of the pending application."

Given that (a) the mooring field is not an element of the pending permit application currently before the Army Corps, and (b) Summer's End statement in 2017 that they are not seeking permits necessary for the installation of the mooring field, it is surprising that they are now claiming this as an element of their mitigation plan.

2) **Marina to provide fixed and portable remote sewerage pump-out, for both docks, and moorings.**
Pumpout facilities for marine sewerage is certainly an excellent element of any marina plan and would, in fact, be a requirement for plan approval in the Virgin Islands.

3) **Installation of regulatory buoys marking shallow water and habitat.**
The installation of shallow water and habitat marking buoys does not constitute minimization or avoidance.

4) **Installation of channel markers to provide navigational safety.**
Channel markers have always been present in the main navigation channel of Coral Harbor, however some markers were damaged or destroyed in the hurricanes and need to be replaced.

5) **Provide vessel fueling that complies with EPA regulations.**
All fuel docks must comply with EPA regulations. The presence of a fuel dock directly south of one of the densest mangroves in Coral Harbor is not, however, a good idea. These mangroves were heavily impacted by hurricane Irma, and any fuel spills that migrate into the mangroves due to prevailing wind and current would seriously impact the recovery from new mangrove propagules.

It is difficult to see how the Applicant considers a fuel dock in close proximity to recovering mangroves to be a mitigation or improvement to water quality.

6) **Provide an information center for environmental pamphlets that educate visiting boaters and the public.**
This is certainly useful, but it does not constitute minimization, avoidance, or mitigation.

12.2. Conclusions Regarding Additional Avoidance and Minimization

In spite of the NMFS request for additional avoidance and minimization measures, including reducing the number of slips and reducing the size of vessels, the Summers End Group has done nothing except repeat their current plans and their flawed interpretation of the benefits of those plans. Real measures for minimization (such as a substantial reduction in the number of slips and eliminating large yachts from the plans) have not been seriously considered by the Applicant. Real measures for avoidance (such as moving the project to a less exposed location with less seagrass) have been ignored by the Applicant.

13. Applicant's Alternatives Analysis

We recognize that the review of alternatives for a project of this nature is a function principally performed by the Army Corps of Engineers, under Section 404(b) of the Clean Water Act, and/or under the NEPA guidelines. However the Applicant's response letter to the NMFS mentioned their "alternatives analysis" approximately fifteen (15) times, so we believe it is appropriate to briefly respond to the Applicant's Alternatives Analysis.

We submitted an independent Alternatives Analysis to USACE in August 2015 and identified a number of locations on St John that are more suited to fulfill the Project Purpose, and involve less environmental damage than the current proposal. We have attached this Alternatives Analysis as Appendix XII to this note.

However the unprecedented hurricanes of 2017 – Irma and Maria – have compelled us to take another look at the overall Alternatives Analysis, with particular focus on the "No Action" alternative required by Army Corps regulations. By "No Action" we mean the alternative of denying the permit for the proposed marina, and allowing the area to continue to be used as it would reasonably be forecast to evolve without marina construction requiring a USACE permit.

The reason that this new analysis is important in the aftermath of the 2017 storms is that baseline conditions in the area have changed significantly. We have seen how access to Coral Bay by water is critical for first responders after a disaster. We are seeing the marine environment slowly recovering, particularly the mangroves, but further impacts from marina construction could permanently impair numerous aquatic systems – seagrasses, mangroves, fish nurseries, and corals. Small businesses are starting up again, and they could not survive an extended downturn from large scale construction impacts.

These considerations have caused most residents of Coral Bay to oppose the construction of a 30 acre mega yacht marina, which they believe would cause irreparable damage to the natural, human and economic environment of Coral Bay.

13.1. Applicant's Rejection of "No Action" Alternative

In their 2014 application to USACE, the applicant provided these comments regarding the "No Action" alternative:

> "The No-Action Alternative of the proposed marina would avoid any potential negative impacts to the environment, which have been carefully considered and addressed. However, the No-Action Alternative negates the opportunity for the project impact to the St. John economy to a tune of over $32M and employment and wage impacts of a

> projected 90 jobs and $3M in employee earnings in just the first year of operation.
>
> A No-Action Alternative leaves vacant buildings and land to sit fallow. Additionally, the No- Action alternative results in maintaining the status quo with respect to illegal and improperly designed mooring in Coral Bay and the dumping of untreated human waste into the harbor with respect to pumpout unavailability. The continued damages to seagrasses and water quality would continue unabated for the foreseeable future under this No-Action scenario."

We have previously provided rebuttals to these comments, including the following points:

1. **The Applicant has never looked at the NET economic impact of the proposed project.**
   They have never considered the adverse impacts of their project on the existing eco-tourism based economy of Coral Bay. Since 2014 large numbers of regular visitors to Coral Bay have sent comment letters to USACE stating that they would no longer visit St John if this marina were constructed. Coral Bay is valued for its quiet ambiance and proximity to nature. A mega yacht marina in the heart of Coral Bay would cause significant adverse impacts to the visitor experience and is forecast to cause a greater loss to the tourism economy than the modest contribution from the economics of the marina operation.
2. **The Applicant has never demonstrated that land would "remain fallow" if the marina were not built.**
   Quite to the contrary, the primary reason there are vacant lots in the proposed marina district is that for over seven years the Summers End Group has had this land tied up in their plans and has been unwilling to allow any development to take place. In spite of many attempts to acquire this land for worthwhile commercial development, Summers End has been the party that has forced it to remain fallow. If the marina is not constructed there will be a major interest in developing this land for small businesses that would directly benefit the local population.
3. **The Applicant has never shown that there is significant "dumping of untreated human waste" into the harbor which is causing damage to seagrasses and water quality.**
   Although there is no question that human waste should either be properly treated by an on-board USCG approved marine sanitation device, or transported to a municipal waste water treatment facility, there is no scientific evidence that human waste is causing unsafe levels of bacterial contamination in Coral Harbor.

In fact, the data presented by the Applicant in their own Environmental Assessment Report indicated that water quality impacts from human waste were far below the standards established by the EPA for a clean body of water. The data presented by SEG (from their Environmental Assessment Report, 2014) is shown below:

Table 6.05d-1. Coral Bay Water Quality Data, Station STJ 53

Date	TSS (mg/L)	Turbidity (NTU)	Fecal Coliform (#/100mL)	Enterococci (#/100ml)	Temp (C)	Salinity (ppt)	D.O. (mg/L)
3/27/09	10.1	1.91	2	8	25.08	37.41	
6/29/09	35	1.63	0	0	29.92	36.23	6.40
10/8/09	2.6	1.99	1	0	29.97	35.72	8.67
6/16/10	4.2	4.17	0	2	29.70	36.15	
3/30/11	3.1	3.58	4	1	28.22	37.10	6.35
7/28/11	4.3	2.24	1	3	29,92	36.25	6.11
6/6/12	11.7	4.64	6	3	30.35	36.57	5.89
7/17/12	20.5	1.23	0	0	30.32	35.44	6.03
8/20/12	23.4	4.23	1	0	30.82	35.49	6.37
12/6/12	18.1	4.64	1	2	28.19	35.49	6.20

Although the data is quite old, this is the only evidence supplied by the Applicant regarding water quality. In 2014 I contacted Dr. Sharon Nappier within the Human Health Risk Assessment Branch of the EPA and asked for her opinion as to the significance of the bacterial counts in the samples reported above by the Summers End Group. She replied: "If those numbers are actual bacterial counts (colony forming units), then you would interpret your waterbody to be very clean and meeting our recommended criteria (at least for enterococci)." (email from Sharon Nappier, PhD, MSPH, Microbiologist, Office of Water, Office of Science and Technology, Health and Ecological Criteria Division, Human Health Risk Assessment Branch, US Environmental Protection Agency)

To summarize, the Applicant has not demonstrated that the "No Action" alternative would be detrimental to Coral Bay. They have not demonstrated that there would be more environmental degradation by not developing the project than there would be by constructing the marina. And although they would undoubtedly argue otherwise, they have not objectively demonstrated demand for their project within the yachting community. Therefore the Applicant has not successfully rebutted the "No Action" alternative.

13.2. Analysis of "No Action" Alternative

In the following section we analyze the "No Action" alternative, including likely development scenarios, and contrast the impacts of this alternative with the impacts already discussed for the Applicant's "preferred alternative" (marina construction).

13.2.1. Development Scenario for "No Action" Alternative

In order to properly analyze the "No Action" alternative we need to make some reasonable assumptions regarding the pattern of development in Coral Bay and Coral Harbor over the next 5 - 10 year period.

We know that there are resident investors who are anxious to purchase or lease the properties that have been tied up by the Summers End Group for over seven years. Some of the uses that have been suggested include:

- A "Coral Bay Waterside Park" on the property between the roadway and the shoreline (Parcels 10-17 and 10-18). This narrow parcel is unsuited for commercial development due to its proximity to the water, the fact that it is filled land and not suitable for in-ground septic systems, and lack of off-road parking.
- A small commercial center, including hardware store, automobile rental, and bakery, on Parcel 10-41.
- A boutique hotel on Parcel 10-19.

Each of the above small-scale developments would be fully in keeping with the current development pattern of Coral Bay and would present little or no adverse environmental impact.

On the water, there is a clear need for improvements in the handling of marine wastes, including solid waste and marine sewage. A proposal for a pumpout boat was presented to DPNR four years ago but it was rejected on the basis that it would not be needed if the marina were constructed. This proposal could have been partially funded under the federal Clean Vessel Act.

The installation and management of transient moorings for visiting boaters, to avoid the need for anchoring, could easily be accommodated under a Marine Uses Plan, as currently being promoted by the Coral Bay Yacht Club and the Department of Planning and Natural Resources.

And finally, the installation of small seasonal access docks, which would be removed during storm season and could be permitted under the CZM Minor Permit program of DPNR, is a concept endorsed by all shoreline business owners. We envision up to three of these small docks at strategic locations around the harbor where they could be placed in a way to avoid impact to all protected resources.

13.2.2. Environmental Impacts for "No Action" Scenario

As compared to the Applicant's "Preferred Alternative" (which is the construction of the proposed marina), the "No Action" alternative obviously has dramatically less environmental impact and damage to protected resources.

- The Applicant's preferred alternative will destroy a minimum of 12-14 acres of seagrass, with the potential to adversely impact the entire benthic habitat of Coral Harbor. The "No Action" alternative will result in improvements in benthic habitat, over time, as moorings are brought up to standard, debris is removed from the harbor, and wastes are properly managed. There would be no impacts to EFH.

- The Applicant's preferred alternative will adversely impact ESA-listed species, including protected corals and endangered green sea turtles and hawksbill turtles. The "No Action" alternative will not impact any protected species.

- The Applicant's preferred alternative will result in adverse impacts to water quality due to resuspension of large quantities of sediments, leaching of toxic bottom paints, and killing seagrasses at the outflow of the main stormwater drainage gut (the seagrasses currently at that location provide a filtration and trapping function for sediments). The "No Action" alternative will not adversely impact water quality.

- The Applicant's preferred alternative will impact air quality due to the diesel exhaust from yacht engines. It will impact the human environment through sound and night light pollution, None of these impacts will occur under the "No Action" alternative.

- The Applicant's preferred alternative has not considered the impacts of climate change and sea level rise. The marina structures are not designed for current expected conditions, much less for the anticipated more frequent and more intense weather patterns over the next 20 years. The "No Action" alternative is far less impacted by these factors, e.g. moorings rise with rising sea levels.

It should be readily apparent that the "No Action" alternative has dramatically less adverse environmental impacts than the Applicant's preferred alternative.

13.2.3. Economic Impacts for "No Action" Scenario

The Applicant has made repeated claims that their project would result in the creation of 90 jobs in the Coral Bay area, and produce an economic contribution of around $9 million per year.

As we have pointed out previously, the job creation numbers involve considerable double counting, because many of the positions the developers say they will be creating are already in existence in the multiple businesses in the marina location. Our analysis indicates that the NET job creation will be around 25 seasonal jobs for marina workers. The Caribbean marina industry is highly seasonal, running from November through May, and virtually shut down the remainder of the year (due to the potential for tropical storm impacts). The jobs are therefore not attractive to family wage earners who need year-round income.

The economic contribution, as stated earlier, does not take into account the loss of revenues from the existing eco-tourism businesses currently operating in Coral Bay. We believe, based on the statements of hundreds of respondent, that there would be a significant drop-off in tourism-related income for several years during the marina construction and early years of operations. The NET effect of this is to more than nullify any economic gains the marina claims it will make. This economic analysis has previously been submitted in expert reports and economic models to the Army Corps.

The "No Action" alternative, on the other hand, would support the continued recovery of Coral Bay by assuring local business owners that their investments will not be lost when a major marina construction problem is initiated. Several business owners have stated that they are unwilling to make significant capital investments as long as the possibility of the marina, with its considerable impacts on the community, is a possibility.

The economy of Coral Bay has historically been driven by small business ownership, in the form of vacation rentals, water sports, convenience stores, restaurants, and similar enterprises. This model sustains economic cycles and is far more resilient than a large commercial marina with all of its concomitant economic risks.

13.3. Alternatives Analysis: Conclusion

It is our opinion that the "No Action" alternative is the preferred course of action for this project, because it will:

a) Avoid the major impacts to protected marine resources that any other alternative would entail, including impacts to EFH and ESA-listed species

b) Allow the economy of Coral Bay to continue its recovery and growth in ways consistent with the development of the community over the past 40 years

c) Allow for enhanced use of Coral Harbor by promoting use of environmentally sound boating practices

d) Permit investment in small businesses in the parcels currently being held for development by the Summers End Group.

14.Geotechnical Investigation and Bathymetric Survey

We have reviewed the "Geotechnical Investigation and Bathymetric Survey" conducted by Sea Diversified Inc. in September 2019 and have the following comments:

1. The report does not cover the entire area of construction of the marina, and in particular omits the piling locations nearest the shore where bedrock depth is presumed to be closest to the surface.

2. The illustration on the next page overlays the geophysical map with the marina dock structures to identify the quantity and location of pilings not within the survey. We found that 242 piling locations were not included in the survey (enclosed in red border), as detailed below:

Piling Location	**Quantity**
Main Pier up to First North Dock	42
First North Dock Main Pier	44
First North Dock Finger Piers	34
Boat Lift Pilings	66
Boardwalk Pilings	56
Total Piling Locations Not Surveyed	**242 Pilings**

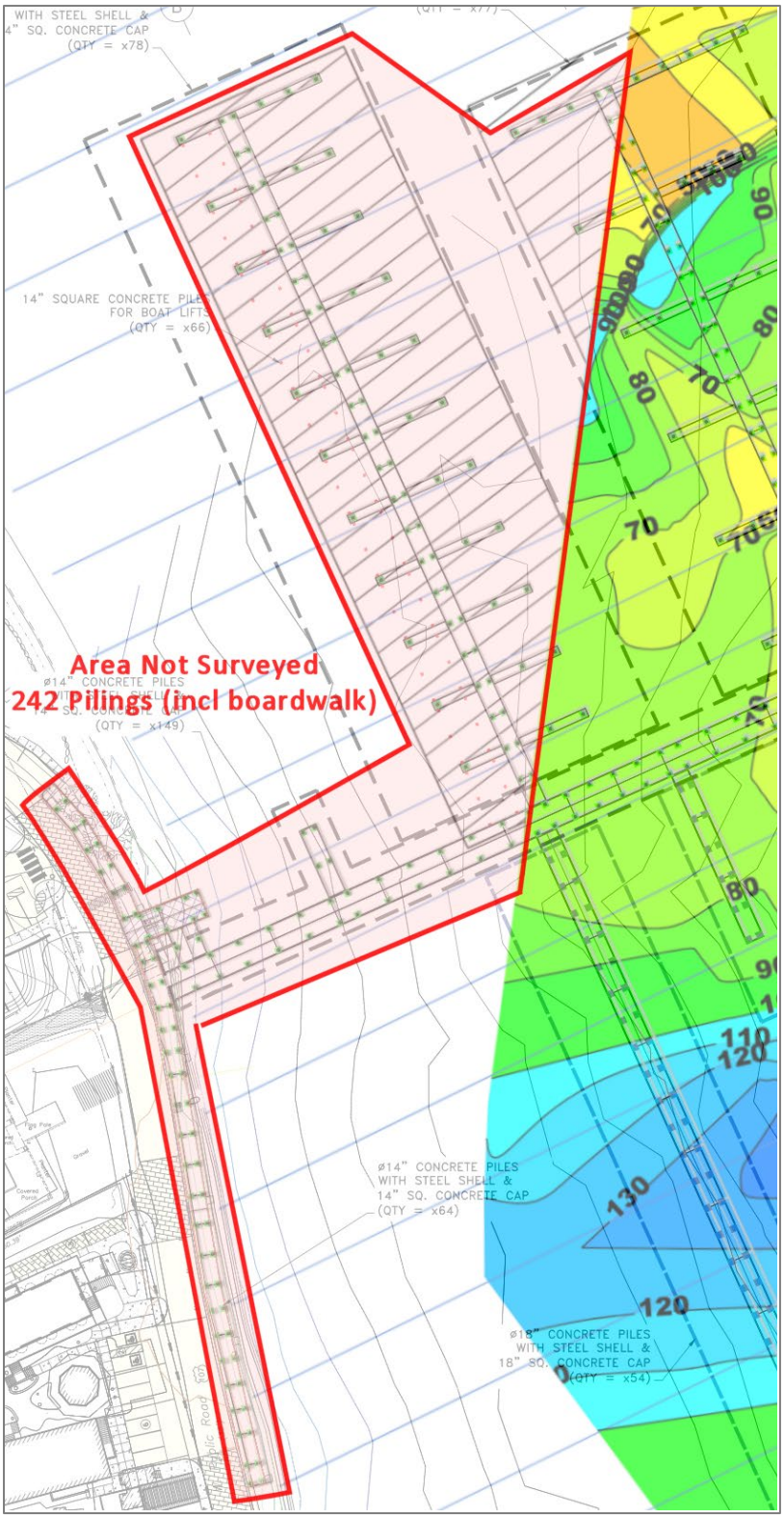
3. The report does not provide any of the underlying digital data to allow an independent analysis of the findings. There appears to be a boundary layer near the surface in the two "typical seismographic clip" illustrations but without the underlying data the significance of the near surface boundary cannot be verified.

4. The findings do not correlate with anecdotal information on the depth to solid rock at many locations throughout Coral Harbor.

5. There are features on the depth chart that seems questionable, including what appears to be a deep "sinkhole" to 130' depth approximately 200' from the shore.

6. We request that any future report on seismic findings for depth to bedrock include the entire marina site and include all of the original digital data so the findings and conclusions can be independently verified.

OVERLAY – SEA DIVERSIFIED INC. ISOPACH PLOT ON DOCK PLAN PILING LOCATION DETA



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