

APPENDIX A

Project Correspondence

Final Environmental Assessment Broward County Shore Protection Project Segment II Beach Renourishment Broward County, Florida



U.S. Army Corps of Engineers
JACKSONVILLE DISTRICT

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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

Virginia Fay
Asst. Regional Administrator
NMFS-SERO-HCD
263 13th Ave South
St. Petersburg, FL 33701

Dear Ms. Fay:

Pursuant to the National Environmental Policy Act of 1969, as amended, (NEPA) and the U.S. Army Corps of Engineers Regulation (33 C.F.R. 230.11), this letter constitutes the U.S. Army Corps of Engineers, Jacksonville District (Corps) Notice of Availability of the proposed Finding of No Significant Impact (FONSI) and draft Environmental Assessment (EA) for the for the continued periodic nourishment of the Broward County Shore Protection Project (BCSPP), Segment II Beach Nourishment in Broward County, Florida. This letter also serves to convey the Essential Fish Habitat (EFH) Assessment, which is incorporated in the project's draft EA.

The Corps is initiating coordination with NMFS under the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). Per the September 3, 2019 and October 2, 2019 EFH Findings between NMFS' Southeast Regional Office and South Atlantic Division, U.S. Army Corps of Engineers and Jacksonville District, respectively, the EFH Assessment for the project is integrated within the draft EA. Per the 2019 Findings, the February 2004 "Preparing Essential Fish Habitat Assessments: A Guide for Federal Action Agencies" document, and 50 C.F.R. 600.920(e)(3), an EFH Assessment must include specific items. Each item is addressed in the table below with a reference to where the information is located in the draft EA:

EFH Required Item	Draft EA Location(s)
Description of the Proposed Action	<p>What is the action?</p> <ul style="list-style-type: none"> - <i>Section 1.1 Project Description</i> - <i>Section 2.2 Alternative 1 (Preferred Alternative)</i> <p>What is the purpose of the action?</p> <ul style="list-style-type: none"> - <i>Section 1.3 Project Need or Opportunity</i> <p>How, when and where will it be undertaken?</p> <ul style="list-style-type: none"> - <i>Section 1.1 Project Description</i> - <i>Section 2.2 Alternative 1 (Preferred Alternative)</i> <p>What will be the result of the action?</p> <ul style="list-style-type: none"> - <i>Section 4 Environmental Effects</i>
Analysis of the potential adverse effects (individual and cumulative) of the action on EFH and the management species	<p>What EFH will be affected by the action?</p> <ul style="list-style-type: none"> - <i>Section 3.1.2 Essential Fish Habitat</i> <p>What are the adverse effects to EFH that could occur as a result of this action?/ How would they impact managed species?/ What would be the magnitude of effects?/What would the duration be?</p> <ul style="list-style-type: none"> - <i>Section 4 Environmental Effects, specifically Section 4.4 EFH</i>
Proposed Compensatory Mitigation	- <i>None required</i>
Avoidance and Minimization	- <i>Section 6 Environmental Commitments and Compliance</i>

Additionally, the guidance states that for projects that may have substantial impacts on EFH, additional information may be necessary. The following additional items are considered and addressed throughout the draft EA:

EFH Additional Information Item	Draft EA Location(s)
Results of on-site studies to evaluate the habitat and/or site-specific effects of the project	- <i>Appendix E: Other Reports and Related Documents</i>
Review of pertinent literature and related information	- <i>Literature cited throughout draft EA</i>

The Corps has determined that the effects of the continued periodic nourishment of the BCSPP, Segment II Beach Nourishment in Broward County, Florida would have minimal adverse effects on EFH and no adverse effects on federally managed fish species. The magnitude of the impacts are minor and insignificant. Details on the Preferred Alternative and the EFH assessment can be found in the project's draft EA, which is available for your review on the Jacksonville District's Environmental planning website, under Broward County:

<http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/>

(On that page, click on the "+" next to "Broward". Scroll down to the project name.)

Due to current circumstances with COVID-19, the Corps is requesting that any questions or comments you may have be submitted in writing via electronic mail to Kristen.L.Donofrio@usace.army.mil within 30 days of the date of this letter. Correspondence may also be sent to the letterhead address above, however due to limited staff availability at the District office, electronic submittal comments via email is preferred.

Sincerely,



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Angela E. Dunn
Chief, Environmental Branch



June 18, 2020

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Colonel Andrew Kelly, Commander
U.S. Army Corps of Engineers, Jacksonville District
Planning and Policy Division, Environmental Branch
701 San Marco Boulevard
Jacksonville, Florida 32207-8175

Attention: Kristen L. Donofrio

Dear Colonel Kelly:

NOAA's National Marine Fisheries Service (NMFS) reviewed the *Draft Environmental Assessment and Finding of No Significant Impact for the Broward County Shore Protection Project Segment II Beach Renourishment* dated May 2020 (Draft EA) and provided to the NMFS by letter dated May 18, 2020. The Draft EA describes plans to conduct periodic nourishment along 8.9 miles of Broward County shoreline using sand from upland sources. The Preferred Alternative includes placing approximately 413,000 cubic yards (cy) of sand along the beach between the following Florida Department of Environmental Protection (FDEP) monuments:

- Reach 1: Approximately 166,000 cy of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 cy of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: Approximately 42,000 cy of sand to be placed between R-36 and R-41.3 above and below MHW.
- Reach 3: Approximately 32,000 cy of sand to be placed between R-41.3 and R-51 above MHW only.
- Reach 4: Approximately 151,000 cy of sand to be placed between R-51 and R-72 above and below MHW.

For the Preferred Alternative, the Jacksonville District's initial determination is the proposed periodic nourishment would not have a significant adverse effect on corals and hardbottom habitat, including worm reef (hardbottom colonized by *Phragmatopoma lapidosa*); the South Atlantic Fishery Management Council (SAFMC) designates these habitats as essential fish habitat (EFH) and Habitat Areas of Particular Concern (HAPCs). As the nation's Federal trustee for the conservation and management of marine, estuarine, and anadromous fishery resources, the NMFS provides following comments and recommendations pursuant to authorities of the Fish and Wildlife Coordination Act and the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Consultation History

By letter dated June 23, 2014, the NMFS provided a detailed consultation history starting in 1999 and including related consultations (i.e., Broward Segment III). In that letter, and a follow-up letter dated July 15, 2014, the NMFS indicated the project would lead to substantial and unacceptable impacts to aquatic resources of national importance (ARNI) in accordance with Part IV, Section 3(a) and Section 3(b) of the Memorandum of Agreement (MOA) between the Department of Commerce and the Department of the Army, dated August 11, 1992. During the subsequent coordination, the NMFS and Jacksonville District agreed on changes to the biological monitoring plan, specifically the monitoring design, transect



placement, and number of sites for monitoring impacts to staghorn coral (*Acropora cervicornis*). In addition, the Jacksonville District agreed to make changes to the coral relocation plan, including the recipient site and performance criteria. Lastly, the District agreed to revise the performance criteria for the mitigation reefs constructed as compensatory mitigation. Based on these changes, the NMFS removed objections to the project by letter dated March 9, 2015. However, this letter also noted changes the NMFS requested that the District did not adopt, including octocoral relocation, additional compensatory mitigation, and revisions to the biological monitoring plan that would facilitate discrimination of project-related impacts from storm impacts.

Alternatives Analysis

The Draft EA presents two alternatives, the No Action Alternative and Alternative 1 (the Preferred Alternative). For the Preferred Alternative, the District expects the sand placement located between R-25 and R-27 (Reach 1) will establish a fill template to supplement the Hillsboro Inlet bypassing project. The feeder beach, located between R-28 and R-31 (Reach 1), will introduce sand into the coastal system to provide a slow sustained transport to the south that may extend the time required until the next nourishment. The fill placed between R-51 and R-72 (Reach 4) is intended to provide shore protection. The remaining fill, located between R-41.3 and R-51 (Reach 3), will be placed above MHW only and is intended to provide sand to portions of the beach where the berm is deflated. Under the Preferred Alternative, nourishment of Segment II would occur on a periodic cycle or as-needed basis using any combination of existing sand sources (Ortona Mine, Immokalee Mine, Witherspoon Mine, and/or Cemex Mine) and/or Garcia upland sand mine.

Essential Fish Habitat within the Project Area

EFH described in the Draft EA include unconsolidated marine bottom, hardbottom, worm reef, coral, and coral reef habitats. SAFMC identifies unconsolidated marine bottom, hardbottom, worm rock, coral, and coral reef habitats as EFH for several species, including red grouper (*Epinephelus morio*), gag (*Mycteroperca microlepis*), gray snapper (*Lutjanus griseus*), mutton snapper (*L. analis*), white grunt (*Haemulon plumieri*), and spiny lobster (*Panulirus argus*). Unconsolidated marine bottom habitats are EFH for cobia (*Rachycentron canadum*), black seabass (*Centropristis striata*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*S. maculatus*), spiny lobster, and pink shrimp (*Farfantepenaeus duorarum*). SAFMC also designates worm reef, coral, and coral reef habitats as HAPCs for several species within the snapper/grouper complex. HAPCs are subsets of EFH that are rare, particularly susceptible to human-induced degradation, especially important ecologically, or located in an environmentally stressed area. Hardbottom, worm reef, coral and coral reefs directly benefit fishery resources of the Atlantic Ocean by providing water quality benefits, foraging opportunities, and nursery habitat. Further, worm reef, coral, and coral reefs are part of a habitat complex that includes unconsolidated marine bottom, seagrass, mangroves, and nearshore hardbottom. This complex supports a diverse community of fish and invertebrates within the Atlantic Ocean. SAFMC provides additional information on EFH and HAPCs and their support of federally managed fishery species in *Fishery Ecosystem Plan of the South Atlantic Region* (available at www.safmc.net).

Through coordination with FDEP, the NMFS received permit plates depicting the location of the nearshore hardbottom edge from surveys conducted during February through April 2019. However, NMFS does not have a recent benthic survey report characterizing the habitat. Notably, a study conducted in 2011 reported staghorn coral near the nearshore hardbottom edge off FDEP monument R-29 with considerably higher abundances starting near R-31 and continuing southward toward the southern end of the project area (Gilliam et al. 2012)¹. Additionally, the placement of fill between R-28 and R-36

¹ Gilliam DS, Walker B, D'Antonio N. 2012. Nearshore *Acropora* surveys between Port Everglades and Hillsboro Inlets, Broward County Florida. Prepared for the Broward County Board of County Commissioners. 21pp, plus appendices.

and between R-42 to R-51 has not previously been evaluated in an EFH consultation. NMFS requires a characterization of the hardbottom habitats offshore these areas in order to have a complete EFH assessment.

Impacts to EFH in the Project Area

The Draft EA states impacts will be short term and may include temporary increases in turbidity and smothering or burial of non-motile macrofaunal communities within the feeder beach footprint. The District does not expect burial of hardbottom or corals due to the distance between the equilibrium-toe-of-fill (ETOF) and the mapped hardbottom edge, which ranges from 200 to 800 feet from shore. The Draft EA does not quantify the area of potential impacts to coral, hardbottom, or worm reef habitats from sediment stress, burial, or turbidity. The NMFS is concerned the potential impacts to hardbottom, worm reefs, and corals, including staghorn coral listed as threatened under the Endangered Species Act (ESA) from sediment stress, burial (including partial burial), and turbidity may be underestimated in the Draft EA. Notably these habitats are located less than 500 feet from the ETOF in a number of locations (e.g., R-25.5; just north of R-28; R-31.3 to R-37; R-41 to R-44.5; R-46 to R-49.5) and measures to monitor for impacts beyond the ETOF are not described in the Draft EA.

Minimization and Compensatory Mitigation

The NMFS letter dated March 9, 2015, describes agreements reached between the Jacksonville District and NMFS regarding coral relocation as an impact minimization measure. Specifically, all qualifying corals (defined as corals with a diameter larger than 10 centimeters) were to be relocated outside of impact areas, and no less than 10 colonies of each relocated species were to be monitored. If less than 10 colonies were collected from a species, all of that species would be monitored. In addition, a performance standard of at least 85 percent of the monitored colonies remaining securely attached and containing live tissue after two year of monitoring was established. The Draft EA does not describe the number of corals relocated, monitoring events completed, and if the coral relocation met the performance standard.

Compensatory mitigation for unavoidable impacts to EFH from the project is also not described in the Draft EA. As noted in the consultation history summary, the prior EFH consultation included recommendations for mitigation of impacts to EFH and associated performance monitoring. The Draft EA does not describe the status of the mitigation for the prior impacts. Based on discussions with FDEP staff on June 11 and 16, 2020, the NMFS became aware the mitigation reefs for the prior impacts have not been constructed.

Stony Coral Tissue Loss Disease

The Draft EA acknowledges the Stony Coral Tissue Loss Disease (SCTLD) may continue to spread across the Florida Reef Tract and that natural and anthropogenic sedimentation and turbidity effects may exacerbate the effects of coral disease on corals, including ESA-listed species. The NMFS appreciates the Jacksonville District incorporating the text NMFS developed on SCTLD in the Draft EA.

Recommended Changes to the Draft EA

- The Jacksonville District should provide the status of the mitigation reefs that were required as a component of the last nourishment.
- The Jacksonville District should clearly specify locations (using R Monuments) where no previous nourishment has been conducted.
- The Jacksonville District should describe and depict the locations of the predicted ETOF and distance between the ETOF and hardbottom habitats.
- The Jacksonville District should incorporate results from a benthic characterization, including coral surveys where surveys have not been previously conducted, or where existing information is more than two years old.

- The Jacksonville District should update the cumulative impact section to include the impacts resulting from Port Everglades Deepening Project
- The Environmental Commitments and Compliance section of the Draft EA references Executive Order 13089, regarding Coral Reef Protection. The Draft EA states "...implementation of protective measures during construction will avoid and/or minimize effects to these ecosystems." The Jacksonville District should describe the specific protective measures and locations they will be implemented to comply with the Executive Order, including measures to minimize impacts to corals, including ESA-listed corals.

EFH Conservation Recommendations

Section 305(b)(4)(A) of the Magnuson-Stevens Act requires NMFS to provide EFH Conservation Recommendations for any federal action or permit which may result in adverse impacts to EFH. Therefore, NMFS recommends the following to ensure the conservation of EFH and associated fishery resources:

EFH Conservation Recommendations

1. The Jacksonville District should provide recent survey information (collected within the last two years) characterizing hardbottom communities likely to be affected by the project, including areas not previously surveyed (R-25 to R-32 and R-42 to R-51) or evaluated in the prior EFH consultation. This recommended survey area also includes areas where the hardbottom edge is within 500 feet of the ETOF (R-25.5; just north of R-28; R-31.3 to R-37; R-41 to R-44.5; R-46 to R-49.5). The surveys should identify benthic community composition and condition and the coral species present, including ESA-listed corals. Please provide the new information in context with results from previous surveys (e.g. Gilliam et al. 2012).
2. Once benthic resource surveys for the full extent of the Broward Segment II project area are complete, the Jacksonville District should propose specific and enforceable measures to avoid or minimize impacts to coral, hardbottom, and worm reef from sediment and turbidity resulting from the nourishment project and include a summary of these assessments in the Final EA.
3. The Jacksonville District should provide the status of the coral relocation that was required as an impact minimization measure for the previous project. Specifically, please provide the number of corals relocated, a summary of the monitoring efforts, and the number of corals that met the coral relocation success criteria. In the case the success criteria were not met, additional compensatory mitigation should be provided.
4. The Jacksonville District should provide compensatory mitigation for the past and the proposed new impacts to coral, hardbottom, or worm reef likely caused by the filling. An assessment of prior impacts to these habitats and the status of the required mitigation, including additional mitigation to address time lag due to delays in construction, should be included in the Final EA. The Jacksonville District should coordinate with NMFS staff in the West Palm Beach Field Office to discuss steps for completing the mitigation agreed to during earlier coordination and any needed updates to the performance criteria to reflect new best practices, changes to the coral species assemblage expected to recruit to the reefs due to the Stony Coral Tissue Loss Disease, or lessons learned since NMFS finalized consultation for the previous work in 2014. The mitigation type, location, and amount should be determined using a functional assessment.
5. The Jacksonville District should provide a biological monitoring plan describing pre-construction and post-construction surveys that includes mapping the nearshore hardbottom edge and evaluating data from 150-meter shore-perpendicular transects. The NMFS requests an opportunity to review the draft monitoring plan prior to its finalization.
6. When revising the Draft EA, the Jacksonville District should include an assessment of potential cumulative impacts with the Port Everglades Deepening Project.

Section 305(b)(4)(B) of the Magnuson-Stevens Act and implementing regulation at 50 CFR Section 600.920(k) require the Jacksonville District to provide a written response to this letter within 30 days of its receipt. If it is not possible to provide a substantive response within 30 days, in accordance with the “findings” with the U.S. Army Corps of Engineers, an interim response should be provided to NMFS. A detailed response then must be provided prior to final approval of the action. The detailed response must include a description of measures proposed by the Jacksonville District to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with the EFH conservation recommendations, the Jacksonville District must provide a substantive discussion justifying the reasons for not following the recommendations.

Thank you for the opportunity to provide comments. Please direct related correspondence directed to the attention of Mr. Kurtis Gregg at our West Palm Beach office, 400 North Congress Avenue, Suite 270, West Palm Beach, Florida, 33401. He may be reached by telephone at (561) 440-3167 or by e-mail at Kurtis.Gregg@noaa.gov.

Sincerely,

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/ for

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc: COE, Kristen.L.Donofrio@usace.army.mil
FWS, Ashleigh_Blackford@fws.gov
EPA, Powell.Duncan@epa.gov
FWCC, Lisa.Gregg@MyFWC.com
FDEP ERP, Gregory.Garis@dep.state.fl.us, Brendan.Biggs@dep.state.fl.us,
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DEPARTMENT OF THE ARMY
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Planning and Policy Division
Environmental Branch

August 18, 2020

Virginia Fay
Assistant Regional Administrator
NMFS-SERO-HCD
263 13th Ave South
St. Petersburg, FL 33701

Dear Ms. Fay:

This letter is provided by the U.S. Army Corps of Engineers, Jacksonville District (Corps) in response to your June 18, 2020 letter regarding the Essential Fish Habitat (EFH) consultation and agency review comments on the proposed Finding of No Significant Impact (FONSI) and draft Environmental Assessment (EA) for the Broward County Shore Protection Project Segment II Beach Renourishment project in Broward County, Florida.

In a webinar/telephone call/correspondence on August 18, 2020, staff from the Corps and National Marine Fisheries Service (NMFS) Southeastern Regional Office (SERO) Habitat Conservation Division (HCD) reviewed the concerns and EFH Conservation Recommendations presented by NMFS. The Corps prepared the enclosed responses (Attachment 1) in accordance with the intentions of 50 CFR 600.920(k) under the Magnuson-Stevens Fisheries Conservation and Management Act (MSFCMA) to meet the conservation recommendations provided by NMFS in their June 18, 2020 letter. Pursuant to NEPA, Corps' responses to NMFS' comments on the draft EA and submitted during the draft EA's public and agency comment period will be included in Appendix B of the Final EA.

The Corps appreciates the collaboration and input provided by NMFS on this project. The submission of the enclosed responses completes the Corps' requirements for EFH consultation under the MSFCMA's EFH provisions. Per the 2019 Findings and 50 CFR 600.920(k)(2), if NMFS does not agree that the consultation requirements are complete, NMFS has 10 days from the date of this letter to elevate any remaining concerns.

Questions regarding this project and its consultation should be directed to Ms. Kristen Donofrio by email Kristen.L.Donofrio@usace.army.mil or telephone 904-232-2918. Thank you for your assistance.

Sincerely,



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Angela E. Dunn
Chief, Environmental Branch

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Attachment 1

Corps' Responses to NMFS EFH Conservation Recommendations

**Broward County Shore Protection Project,
Segment II Beach Renourishment in
Broward County, Florida**



**US Army Corps of Engineers
JACKSONVILLE DISTRICT**

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The U.S. Army Corps of Engineers, Jacksonville District (Corps) and National Marine Fisheries Service (NMFS) Southeast Regional Office (SERO) Habitat Conservation Division (HCD) staff coordinated to provide responses to the NMFS' Essential Fish Habitat (EFH) Conservation Recommendations provided in their letter dated June 18, 2020. The NMFS' EFH Conservation Recommendations are listed below along with the Corps' responses:

NMFS CONSERVATION RECOMMENDATION #1:

The Jacksonville District should provide recent survey information (collected within the last two years) characterizing hardbottom communities likely to be affected by the project, including areas not previously surveyed (R-25 to R-32 and R-42 to R-51) or evaluated in the prior EFH consultation. This recommended survey area also includes areas where the hardbottom edge is within 500 feet of the ETOF (R-25.5; just north of R-28; R-31.3 to R-37; R-41 to R-44.5; R-46 to R-49.5). The surveys should identify benthic community composition and condition and the coral species present, including ESA-listed corals. Please provide the new information in context with results from previous surveys (e.g. Gilliam et al. 2012).

CORPS RESPONSE #1:

The project's non-federal sponsor (NFS), Broward County, has conducted biological monitoring and surveys in accordance with the project's biological monitoring plan, which was a requirement of the state of Florida's Department of Environmental Protection (FDEP) water quality certification. The plan includes nearshore hardbottom monitoring via permanent transects and hardbottom edge mapping for Reaches 2-4 (R-32 to R-80). A copy of the latest survey information collected in compliance with the plan will be electronically provided to NMFS.

For Reach 1 (R-25 to R-31), a reconnaissance survey is scheduled to be conducted late-summer or fall 2020 and will identify benthic community composition and condition and the coral species present, including ESA-listed corals. After this survey, transects will be established and a baseline survey will be completed. Following the completion of the reconnaissance and baseline surveys and prior to the start of construction in Reach 1, the Corps and NMFS will compare the new survey information to previous survey findings. If the new survey shows the presence of hardbottom resources that may be subject to indirect or direct impacts resulting from the project, the Corps will coordinate with NMFS for any necessary mitigation and/or relocation efforts.

NMFS CONSERVATION RECOMMENDATION #2:

Once benthic resource surveys for the full extent of the Broward Segment II project area are complete, the Jacksonville District should propose specific and enforceable measures to avoid or minimize impacts to coral, hardbottom, and worm reef from sediment and turbidity resulting from the nourishment project and include a summary of these assessments in the Final EA.

CORPS RESPONSE #2:

To minimize potential effects to hardbottom resources, the Corps designed the feeder beach feature in Reach 1 so that the estimated toe of fill (ETOF) in Reach 1 would be more than 500 feet away from hardbottom. Placement will occur only above the mean high water line (MHWL) in Reach 3 (below the MHWL is not currently permitted by FDEP or the Corps' Regulatory Division (RD)). Reaches 2 and 4 are already permitted by FDEP and RD, so consultation was completed under their permit. Also, the following minimization and/or protection measures will be included in the project's plans and specifications:

- The Contractor and all personnel associated with the project will be informed of the presence of resources protected by the Endangered Species Act of 1973, including listed corals, and the need to avoid contact with these resources. All construction personnel will be advised that there are civil and criminal penalties for harming or destroying federally-listed species which are protected under the Endangered Species Act of 1973, as amended. The Contractor may be held responsible for any federally-listed species harmed or destroyed due to construction activities. (SARBO PDCs EDUCATE.1 and EDUCATE.3)
- If any construction activities cannot be done without affecting hardbottom areas, or if any actual or potential incident involving damage to, or disturbance of, hardbottoms should occur, the Contractor must immediately cease work in these areas and notify the Corps.
- Existing hardbottom areas will be designated on the contract drawings for awareness.
- The MHWL will be marked in areas where placement will only occur above the MHWL. A visual inspection will be conducted to ensure placement does not occur below the MHWL.
- Construction activities will avoid hardbottom areas and will be conducted in a manner that will not cause damage to these resources. (SARBO PDCs INWATER.2, CORAL.1)

Additionally, the Corps requires contractors to submit an Environmental Protection Plan (EPP) which is developed by the Contractor based on the project's plans and specifications. Key components of the EPP include descriptions of how the Contractor will implement the protective measures for species that require specific attention, methods for protection of features (e.g. vegetation, animals, water) to be preserved within authorized work areas, and procedures to be implemented that will provide the required environmental protection to comply with applicable laws and regulations. The Corps reviews and approves the EPP to ensure all minimization measures and environmental protections are considered and will be appropriately implemented.

Following the completion of the reconnaissance and baseline surveys and prior to the start of construction in Reach 1, the Corps and NMFS will compare the new survey information to previous survey findings. If the new survey shows the presence of hardbottom resources that may be subject to indirect or direct impacts resulting from the project, the Corps will coordinate with NMFS for any necessary additional avoidance, minimization (e.g. relocation), and/or mitigation efforts.

NMFS CONSERVATION RECOMMENDATION #3:

The Jacksonville District should provide the status of the coral relocation that was required as an impact minimization measure for the previous project. Specifically, please provide the number of corals relocated, a summary of the monitoring efforts, and the number of corals that met the coral relocation success criteria. In the case the success criteria were not met, additional compensatory mitigation should be provided.

CORPS RESPONSE #3:

The previous nourishment was conducted by Broward County. The nourishment and its associated mitigation are discussed in the 2015 Limited Reevaluation Report and Environmental Assessment¹ (LRR/EA). A summary of the relocation effort for NMFS is provided in this response:

On August 7, 2020, RD provided the attached 2018 Segment II Relocated Stony Coral Monitoring Draft 24-month Report (see Attachment 2). In summary, the report states the following information:

- Colony relocation occurred between March and September 2016, and 814 colonies of 13 species were relocated from the surveyed area.
- A FDEP approved Coral Relocation Plan was prepared in compliance with the permit and required a subset (25%) of each relocated species and a set of control colonies, naturally occurring at the relocation sites, to be monitored approximately 6, 12, 18, and 24 months post-relocation for colony stability and condition and growth assessment. The monitoring effort included 210 relocated colonies representing 12 species and 25% of the total relocated colonies, and 66 control colonies of 12 species.
- Success criteria required at least 85% of the monitored colonies remain securely attached and contain live tissue after two years of monitoring.
- In terms of attachment, the relocation effort was successful. 96% of the relocated colonies (201 of 210) remained attached. (For comparison, 89% of the control colonies (59 of 66) remained attached.)
- The 24-month relocated colony survival rate was 49%, which was below the 85% success criteria. However, the 24-month control colony survival rate was 67%, which was also below the defined success criteria. High relocated colony attachment success, few observations of colonies impacted by predation or boring sponge, and the high prevalence of disease supports the conclusion that the lower than expected relocated colony survival was driven by disease-related tissue mortality. Additionally, the high prevalence of disease recorded in the control colony population indicates that the disease-related mortality was an event impacting the entire local community.

¹ A copy of this report is available on the Corps' environmental website at <https://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/>. (Click "+Broward County" and scroll to "Broward County Shore Protection Project, Segment II, LRR".)

NMFS CONSERVATION RECOMMENDATION #4:

The Jacksonville District should provide compensatory mitigation for the past and the proposed new impacts to coral, hardbottom, or worm reef likely caused by the filling. An assessment of prior impacts to these habitats and the status of the required mitigation, including additional mitigation to address time lag due to delays in construction, should be included in the Final EA. The Jacksonville District should coordinate with NMFS staff in the West Palm Beach Field Office to discuss steps for completing the mitigation agreed to during earlier coordination and any needed updates to the performance criteria to reflect new best practices, changes to the coral species assemblage expected to recruit to the reefs due to the Stony Coral Tissue Loss Disease, or lessons learned since NMFS finalized consultation for the previous work in 2014. The mitigation type, location, and amount should be determined using a functional assessment.

CORPS RESPONSE #4:

The previous nourishment and its mitigation were conducted by Broward County in compliance with the County's FDEP and RD permits. Based on correspondence with RD on August 7, 2020, a modification was issued in July 2020 authorizing a time extension to perform the required compensatory mitigation, which has not yet been completed. Since the previous nourishment and mitigation are separate from the Corps' civil works project, additional questions regarding the details of the relocation and/or mitigation actions should be directed to RD.

The Corps does not anticipate the upcoming work to result in any new impacts to coral, hardbottom, or worm reef; however, this determination will be confirmed through the upcoming surveys. If the survey shows the presence of hardbottom resources that may be subject to indirect or direct impacts resulting from the project, the Corps will coordinate with NMFS for any necessary additional avoidance, minimization (e.g. relocation), and/or mitigation efforts. The Corps designed the feeder beach feature in Reach 1 so that the ETOF in Reach 1 would be at least 500 feet away from hardbottom. Placement will occur only above the MHWL in Reach 3, which is not currently permitted by FDEP or RD. Reaches 2 and 4 are already permitted by FDEP and RD, so consultation was completed under the permits.

If unexpected impacts to hardbottom resources were to occur as a result of the civil works project, mitigation amounts will be determined by a functional assessment completed by NMFS and the Corps. The Corps would coordinate the appropriate mitigation requirements with U.S. Army Corps of Engineers, South Atlantic Division (SAD) and NMFS.

NMFS CONSERVATION RECOMMENDATION #5:

The Jacksonville District should provide a biological monitoring plan describing pre-construction and post-construction surveys that includes mapping the nearshore hardbottom edge and evaluating data from 150-meter shore-perpendicular transects. The NMFS requests an opportunity to review the draft monitoring plan prior to its finalization.

CORPS RESPONSE #5:

The project's NFS, Broward County, is developing a biological monitoring plan. NMFS will have the opportunity to review the draft monitoring plan prior to its finalization.

NMFS CONSERVATION RECOMMENDATION #6:

When revising the Draft EA, the Jacksonville District should include an assessment of potential cumulative impacts with the Port Everglades Deepening Project.

CORPS RESPONSE #6:

The Port Everglades Deepening Project is mentioned in the EA's cumulative effects section 4.18. Although an EIS describing the potential effects of the authorized Port Everglades Deepening Project was completed in 2015, due to new information, the Corps is preparing a supplemental NEPA document, which will consider cumulative effects of the project in more detail. This EA's cumulative effects section will be updated to reference the March 2020 spillage model and the minimization measures memorialized in the August 7, 2018 Memorandum for the Record (MFR); however, please note that considerations of the potential effects of the deepening project are still being determined.

Attachment 2

**Segment II Relocated Stony Coral Monitoring,
Broward County, Florida**

DRAFT 24-Month Report



**US Army Corps of Engineers
JACKSONVILLE DISTRICT**

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**Segment II Relocated Stony Coral Monitoring
Broward County, Florida**

DRAFT 24-Month Report

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For the:

**Broward County
Board of County Commissioners**



2018

Table of Contents

List of Tables	II
List of Figures	II
1. Project Area and Scope of Work.....	1
2. Methods	1
2.1 Relocation Sites	1
2.2 Colony Monitoring.....	3
3. Results.....	4
3. Discussion.....	14
Literature Cited	16
Appendix.....	17

List of Tables

Table 1. Relocation site and zone (tag number) locations (degrees and decimal minutes), number of tagged relocated and control colonies, and date monitoring period completed for each zone..... 3

Table 2. The abundance of tagged relocated stony coral colonies by species and size class included in the monitoring effort and the proportion each represents of the total relocated colonies. 5

Table 3. The number of tagged stony coral control colonies by species and size class (colony diameter) included in the monitoring effort. 6

Table 4. Relocated and control species colony survival summary data recorded during each monitoring event. 7

Table 5. Relocated and control species colony initial summary data by size class (colony diameter cm) and the percent survival by size class during the 24-month event 8

Table 6. Relocated and control stony coral percent colony survival and percent colony live tissue by monitoring event and Relocation Site 9

Table 7. Relocated and control stony coral species percent colony live tissue and percent diseased colonies for each monitoring event..... 11

Table 8. Relocated and control stony coral colony image-traced species summary data for the 24-month event. 13

Table 9. Stony coral recruit summary data for the relocated and control colonies..... 14

Appendix Tables. 17

List of Figures

Figure 1. Locations of the three Relocation Sites. 2

1. Project Area and Scope of Work

Within the Broward County Segment II shore protection project (SPP) area the equilibrium toe of fill (ETOF) was estimated to overlap 4.9 acres of nearshore hardbottom. The SPP area included beach sections off Pompano Beach and Lauderdale-by-the-Sea (Pompano) (R-36 to R-41.3) and north Fort Lauderdale (Ft. Lauderdale) (R-53 to R-72). In order to minimize impacts associated with potential stony coral burial, the SPP permit required a portion of the stony coral community to be relocated from those hardbottom areas which may be buried (Florida Department of Environmental Protection (FDEP) Permit Number 0314535-001-JC, Specific Condition No. 32). A FDEP approved Coral Relocation Plan was prepared in compliance with the permit (CB&I 2015). The Coral Relocation Plan identified specific selection criteria that was used to define the stony coral colonies that were relocated from the impact area (Gilliam 2016). The Coral Relocation Plan also required a subset (25%) of each relocated species and a set of control colonies, naturally occurring at the relocation sites, to be monitored approximately 6, 12, 18, and 24 months post-relocation. This report summarizes the results from the 24-month (final) monitoring event.

2. Methods

2.1 Relocation Sites

Colony relocation occurred between March and September 2016, and 814 colonies of 13 species were relocated from the surveyed area (Gilliam 2016). The Coral Relocation Plan states that colonies should be relocated to the Segment II mitigation artificial reefs if deployed prior to coral relocation. The reefs had not been deployed; therefore, colonies were relocated to three suitable locations on the nearshore hardbottom adjacent to the project area (Figure 1) (Table 1) (Gilliam 2016). All colonies removed from the Pompano Beach section were relocated to Relocation Site 1, and all colonies removed from the Ft. Lauderdale beach section were relocated to Relocation Sites 2 and 3. Within Relocation Sites 1 and 2 two monitoring zones were established. Each zone was marked with a tagged center pin, and all tagged colonies were mapped by recording the distance and bearing from the center pin. Multiple zones were established at Sites 1 and 2 in order to facilitate mapping by reducing the distance from the center pin to the colonies (Table 1). The radius of all zones was less than 15 m. The Coral Relocation Plan set a goal of monitoring 25% of the relocated colonies. These monitored colonies should also include all of the listed species, all colonies of species represented by 10 or fewer colonies and, in general, the species and size class distribution of the relocated colonies. Control colonies, located within approximately 15 m of the zone center pin, were also tagged and mapped within the zones of Relocation Sites 1 and 2. No control colonies were identified within Relocation Site 3.

Colony relocation efforts occurred over several months. The Coral Relocation Plan states that relocated coral monitoring should occur once immediately after relocation efforts (initial monitoring event). In response to an on-going disease event (Walton et al. 2018), initial colony

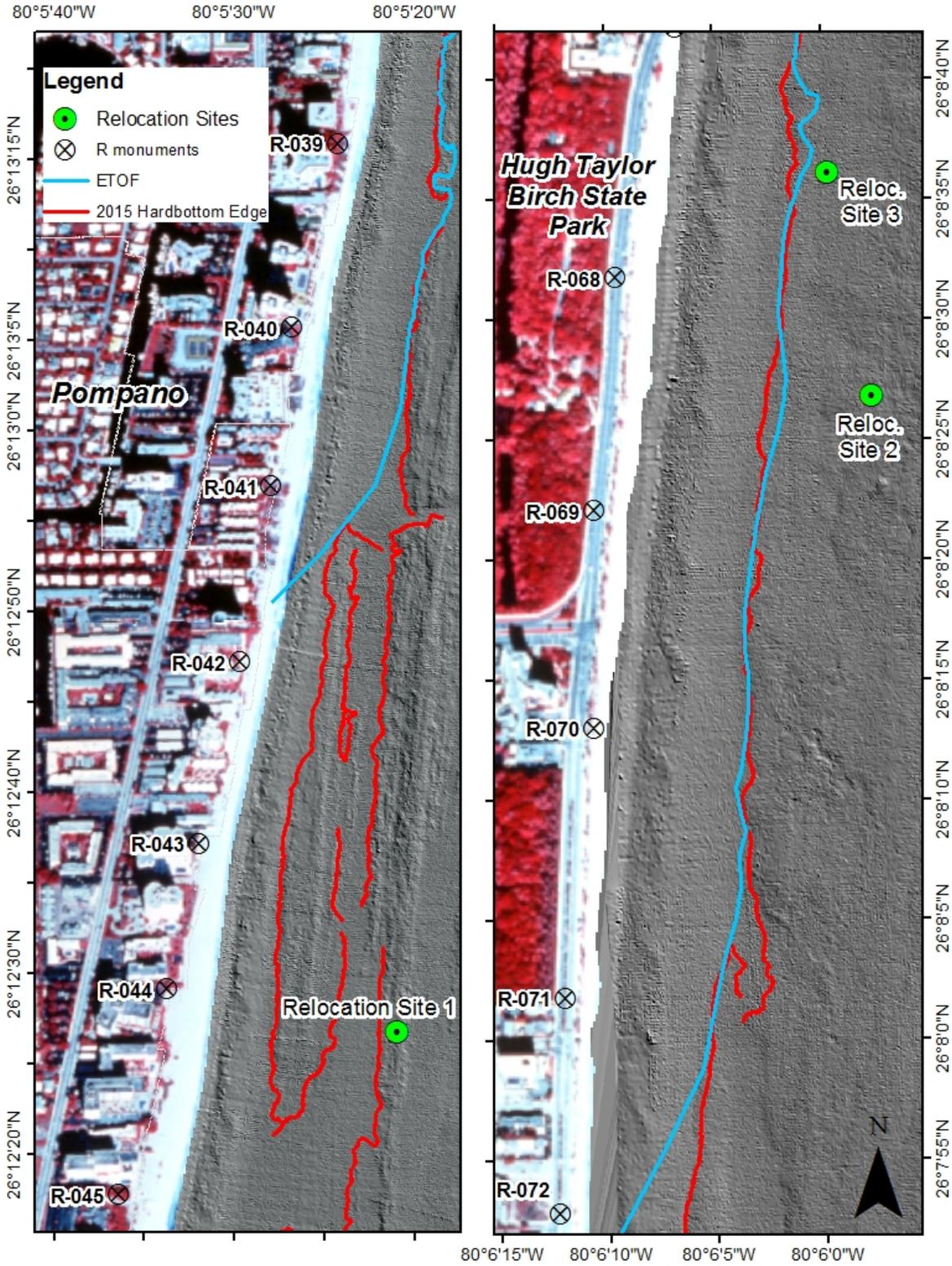


Figure 1. Locations of the three Relocation Sites.

data were collected as the relocation efforts occurred to reduce the post-relocation time period, especially for those colonies relocated at the start of the effort (Table 1). Therefore, the initial colony data were collected on different dates for each relocation site or zone. All initial colony demographic data were targeted to be collected within a month of colony relocation. The 6-month monitoring event occurred at all sites within several days in order to begin to standardize the monitoring effort (Table 1). The 12, 18, and 24-month events also occurred as single events conducted over several days (see Table 1).

Table 1. Relocation site and zone (tag number) locations (degrees and decimal minutes), number of tagged relocated and control colonies, and date monitoring period completed for each zone.

Site	1	1	2	2	3
Zone	G14	G15	G18	19	99
Latitude	26 12.466 N	26 12.453 N	26 08.447 N	26 08.440 N	26 08.602 N
Longitude	80 05.349 W	80 05.345 W	80 05.964 W	80 05.960 W	80 05.997 W
# Relocated Colonies	72	26	76	30	6
# Control Colonies	20	15	15	16	0
Initial Monitoring	28-Mar-16	28-Mar-16	11-May-16 & 22-Jun-16	22-Jun-16 & 15-Jul-16	30-Sep-16
6-month monitoring	4-Nov-16	4-Nov-16	9-Nov-16	9-Nov-16	4-Nov-16
12-month monitoring	24-Apr-17	24-Apr-17	25-Apr-17	25-Apr-17	25-Apr-17
18-month monitoring	26-Oct-17	26-Oct-17	24-Oct-17	24-Oct-17	26-Oct-17
24-month monitoring	19-Apr-18	19-Apr-18	18-Apr-18	18-Apr-18	18-Apr-18

2.2 Colony Monitoring

The Coral Relocation Plan states that monitoring should include for each tagged colony (relocated and control) a record of colony stability and condition and a growth assessment. Research divers recorded attachment status (missing, loose, or secure), total length (cm) and width (cm), and the length (cm) and width (cm) of live tissue of all tagged colonies. Several parameters were estimated *in situ* to determine colony health and condition. The presence of disease and bleaching were recorded. Research divers also estimated total colony area percent partial mortality and differentiated dead areas into percent old mortality and recent mortality. A growth assessment of the relocated colonies was completed *in situ* by recording the presence of

colony edge growth over the attachment material or onto the reef surface. In addition to the *in situ* measurements, a digital image was taken of each colony. The images were taken with a digital camera attached to a PVC framer. Date and colony tag numbers were included within each image. The framer improves colony image comparisons between monitoring events by providing consistent planar views of the colony. These consistent planar images facilitate measuring changes in tissue area between monitoring events. National Coral Reef Institute (NCRI) developed software (Coral Point Count with Excel Extensions, CPCe, <http://www.nova.edu/ocean/cpce/index.html>) was used to trace the tissue area (cm²) in each colony planar image. The software automatically calculates the area (cm²) encompassed by the traced portion of the image. If dead areas were present within the living area of a colony, these dead areas were also traced. The dead area subtracted from the previously traced living tissue area provides a measure of the living tissue area. These image analyses were completed for all species except *Acropora cervicornis*. Planar images do not effectively capture complete changes in tissue area for branching species. Research divers also identified and measured the diameter (cm) of all stony coral recruits (colonies \leq 4 cm diameter) within 25 cm of the tagged colonies.

3. Results

Table 2 lists the relocated colonies included in the monitoring effort by species and size (colony diameter) class, and the proportion each species and size class represents the total colonies relocated. The monitoring effort included 210 colonies representing 26% of the total relocated. Data for each colony collected during each monitoring event are summarized in Appendix Tables 1-15. The only ESA listed stony coral species relocated was *A. cervicornis*, and all 15 relocated colonies were included in the monitoring effort. *Agaricia agaricites* (5 total relocated colonies) was the only species relocated but not represented in the initial monitoring effort. An attempt was made during the 6-month monitoring event to add these colonies to the population of monitored colonies. No relocated *A. agaricites* colonies within the greater relocation areas were found. Four *Meandrina meandrites* colonies were relocated but only three are represented in the monitoring effort. A 10-15cm size class *M. meandrites* colony was not included in the initial monitoring effort. During the 6-month event this colony was not found.

Table 3 lists the 66 tagged control colonies by species and size class. Control colonies represent 31% of the number of tagged relocated colonies. Three species, *Colpophyllia natans*, *M. meandrites*, and *Isophyllia sinuosa*, were not found within the monitoring zones. A single *Diploria labyrinthiformis* colony and *Orbicella annularis* colony were found in a monitoring zone and were included in the monitoring effort.

During the 24-month event 201 (96%) relocated and 59 (89%) control colonies were securely attached to the substrate. Eight of the 15 relocated *A. cervicornis* colonies were missing and one relocated *Solenastrea bournoni* colony was detached. Of the controls, one *A. cervicornis* colony, two *P. astreoides* colonies, and one *S. siderea* colony were missing, and one *M. cavernosa* and two *S. siderea* colonies were detached. Relocated and control colonies were recorded as missing during all monitoring events; however, seven of the total nine missing relocated and six of the seven control colonies were recorded as missing during either the 18-month or 24-month events.

Table 2. The abundance of tagged relocated stony coral colonies by species and size class included in the monitoring effort and the proportion each represents of the total relocated colonies.

Species	Size Class				Total
	10-15 cm	16-30 cm	31-50 cm	>50 cm	
Abundance					
<i>Dichocoenia stokesii</i>	27	17	1	0	45
<i>Solenastrea bournoni</i>	5	18	14	2	39
<i>Pseudodiploria clivosa</i>	3	15	14	3	35
<i>Siderastrea siderea</i>	18	2	0	0	20
<i>Stephanocoenia intersepta</i>	8	9	0	0	17
<i>Montastraea cavernosa</i>	1	4	7	1	13
<i>Pseudodiploria strigosa</i>	0	4	5	4	13
<i>Colpophyllia natans</i>	0	2	6	0	8
<i>Acropora cervicornis</i>	2	7	5	1	15
<i>Meandrina meandrites</i>	0	3	0	0	3
<i>Isophyllia sinuosa</i>	1	0	0	0	1
<i>Porites astreoides</i>	1	0	0	0	1
Total	66	81	52	11	210
Proportion					
<i>Dichocoenia stokesii</i>	14%	31%	50%	NA	18%
<i>Solenastrea bournoni</i>	16%	24%	37%	25%	26%
<i>Pseudodiploria clivosa</i>	23%	20%	31%	30%	24%
<i>Siderastrea siderea</i>	22%	22%	0%	NA	22%
<i>Stephanocoenia intersepta</i>	28%	28%	0%	NA	27%
<i>Montastraea cavernosa</i>	10%	40%	41%	25%	32%
<i>Pseudodiploria strigosa</i>	0%	33%	42%	100%	43%
<i>Colpophyllia natans</i>	0%	40%	60%	NA	50%
<i>Acropora cervicornis</i>	100%	100%	100%	100%	100%
<i>Agaricia agaricites</i>	0%	0%	NA	NA	0%
<i>Meandrina meandrites</i>	0%	100%	NA	NA	75%
<i>Isophyllia sinuosa</i>	100%	NA	NA	NA	100%
<i>Porites astreoides</i>	100%	NA	NA	NA	100%
Total	18%	29%	39%	41%	26%

Table 3. The number of tagged stony coral control colonies by species and size class (colony diameter) included in the monitoring effort.

Total Area Species	Size Class				Total
	10-15cm	16-30cm	31-50cm	>50cm	
<i>Dichocoenia stokesii</i>	4	1	0	0	5
<i>Solenastrea bournoni</i>	0	2	1	0	3
<i>Pseudodiploria clivosa</i>	0	3	1	0	4
<i>Siderastrea siderea</i>	1	3	0	0	4
<i>Stephanocoenia intersepta</i>	2	6	1	0	9
<i>Montastraea cavernosa</i>	0	3	7	7	17
<i>Pseudodiploria strigosa</i>	2	0	0	1	3
<i>Acropora cervicornis</i>	0	1	0	1	2
<i>Agaricia agaricites</i>	0	1	0	0	1
<i>Porites astreoides</i>	10	6	0	0	16
<i>Diploria labyrinthiformis</i>	0	0	0	1	1
<i>Orbicella annularis</i>	0	1	0	0	1
Total	19	27	10	10	66

Tables 4 (relocated colony) and 5 (control colony) summarize colony survival by species. The 24-month relocated colony survival was 49% (103 of 210 colonies) (Table 4), and total control colony survival was 67% (44 of 66 colonies) (Table 5). Dead (100% mortality) colonies were recorded during each monitoring event, but the greatest proportion of dead colonies for the relocated (69% of all dead) and control (67%) corals were recorded during the 6-month event.

All relocated *M. meandrites* and *I. sinuosa* colonies suffered 100% tissue mortality by the 6-month event. While no other species had 0% survival 24 months post-relocation, seven additional relocated species (*Dichocoenia stokesii*, *C. natans*, *Montastraea cavernosa*, *A. cervicornis*, *Pseudodiploria strigosa*, *P. clivosa* and *S. bournoni*) had less than 85% survival by the 24-month event. Three species (*Siderastrea siderea*, *Stephanocoenia intersepta*, and *P. astreoides*) had 95% or greater survival (Table 4). All control *D. stokesii*, *P. strigosa*, and *D. labyrinthiformis* colonies suffered 100% tissue mortality by the 6-month event. Five additional control species (*M. cavernosa*, *P. clivosa*, *A. cervicornis*, *S. bournoni*, and *P. astreoides*) had less than 85% survival after 24 months (Table 4). Control colonies of *S. siderea*, *S. intersepta*, *A. agaricites*, and *O. annularis* has 100% survival after 24 months. Mean total percent colony survival was less than 85% for all relocated size classes (colony diameter) and for control sizes classes except 31-50 cm (Table 5).

During the 24-month monitoring event, Relocation Site 1 had 35% relocated and 60% control colony survival rates, and Relocation Site 2 had 59% relocated and 81% control colony survival rates (Table 6). All six relocated colonies at Site 3 were living by the 24-month event (Table 6).

Table 4. Relocated and control species colony survival summary data recorded during each monitoring event.

Species	Initial	6-month		12-month		18-month		24-month	
	Colonies	Alive	%	Alive	%	Alive	%	Alive	%
Relocated									
<i>D. stokesii</i>	45	5	11%	4	9%	4	9%	4	9%
<i>S. bournoni</i>	39	38	97%	35	90%	34	85%	30	77%
<i>P. clivosa</i>	35	23	67%	18	49%	17	49%	15	43%
<i>S. siderea</i>	20	20	100%	19	95%	19	95%	19	95%
<i>S. intersepta</i>	17	17	100%	17	100%	17	100%	17	100%
<i>M. cavernosa</i>	13	11	85%	10	77%	7	54%	4	31%
<i>P. strigosa</i>	13	9	69%	7	54%	7	54%	7	54%
<i>C. natans</i>	8	1	13%	1	13%	1	13%	1	13%
<i>A. cervicornis</i>	15	11	73%	11	73%	7	47%	5	33%
<i>M. meandrites</i>	3	0	0%	0	0%	0	0%	0	0%
<i>I. sinuosa</i>	1	0	0%	0	0%	0	0%	0	0%
<i>P. astreoides</i>	1	1	100%	1	100%	1	100%	1	100%
Totals	210	136	65%	123	59%	114	54%	103	49%
Control									
<i>D. stokesii</i>	5	0	0%	0	0%	0	0%	0	0%
<i>S. bournoni</i>	3	3	100%	3	100%	3	100%	2	67%
<i>P. clivosa</i>	4	2	50%	2	50%	2	50%	2	50%
<i>S. siderea</i>	10	9	90%	9	90%	9	90%	9	90%
<i>S. intersepta</i>	3	3	100%	3	100%	3	100%	3	100%
<i>M. cavernosa</i>	17	15	88%	15	88%	14	82%	13	76%
<i>P. strigosa</i>	3	0	0%	0	0%	0	0%	0	0%
<i>A. cervicornis</i>	2	2	100%	1	50%	1	50%	1	50%
<i>A. agaricites</i>	1	1	100%	1	100%	1	100%	1	100%
<i>P. astreoides</i>	16	16	100%	16	100%	13	81%	13	81%
<i>D. labyrinthiformis</i>	1	0	0%	0	0%	0	0%	0	0%
<i>O. annularis</i>	1	1	100%	1	100%	1	100%	1	100%
Totals	66	52	80%	51	77%	47	71%	45	68%

Table 5. Relocated and control species colony initial summary data by size class (colony diameter cm) and the percent survival by size class during the 24-month event (NA = no colonies in that size class).

Species	Initial Abund					24-Month % Survival				
	10-15	16-30	31-50	>50	Total	10-15	16-30	31-50	>50	Total
Relocated										
<i>D. stokesii</i>	27	17	1	NA	45	11%	6%	0%	NA	9%
<i>S. bournoni</i>	5	18	14	2	39	60%	67%	93%	100%	77%
<i>P. clivosa</i>	3	15	14	3	35	0%	33%	57.1%	67%	43%
<i>S. siderea</i>	18	2	NA	NA	20	94%	100%	NA	NA	95%
<i>S. intersepta</i>	8	9	NA	NA	17	100%	100%	NA	NA	100%
<i>M. cavernosa</i>	1	4	7	1	13	0%	25%	28.6%	100%	31%
<i>P. strigosa</i>	NA	4	5	4	13	NA	75%	20.0%	75%	54%
<i>C. natans</i>	NA	2	6	NA	8	NA	0%	16.7%	NA	12%
<i>A. cervicornis</i>	2	7	5	1	15	50%	57%	0.0%	0%	33%
<i>M. meandrites</i>	NA	3	NA	NA	3	NA	0%	NA	NA	0.0%
<i>I. sinuosa</i>	1	NA	NA	NA	1	0%	NA	NA	NA	0.0%
<i>P. astreoides</i>	1	NA	NA	NA	1	100%	NA	NA	NA	100%
Totals	66	81	52	11	210	50%	46%	48%	73%	49%
Control										
<i>D. stokesii</i>	4	1	NA	NA	5	0%	0%	NA	NA	0%
<i>S. bournoni</i>	1	1	1	NA	3	100%	0%	100%	NA	67%
<i>P. clivosa</i>	NA	3	1	NA	4	NA	33%	100%	NA	50%
<i>S. siderea</i>	2	7	1	NA	10	100%	86%	100%	NA	90%
<i>S. intersepta</i>	2	1	NA	NA	3	100%	100%	NA	NA	100%
<i>M. cavernosa</i>	NA	3	7	7	17	NA	67%	86%	71%	76%
<i>P. strigosa</i>	2	NA	NA	1	3	0%	NA	NA	0%	0.0%
<i>A. cervicornis</i>	NA	1	NA	1	2	NA	0.0%	NA	100%	50%
<i>A. agaricites</i>	NA	1	NA	NA	1	NA	100%	NA	NA	100%
<i>P. astreoides</i>	10	6	NA	NA	16	70.0%	100%	NA	NA	81%
<i>D. labyrinthiformis</i>	NA	NA	NA	1	1	NA	NA	NA	0%	0.0%
<i>O. annularis</i>	NA	1	NA	NA	1	NA	100%	NA	NA	100%
Totals	21	25	10	10	66	57%	72%	90%	60%	68%

Table 6. Relocated and control stony coral percent colony survival and percent colony live tissue by monitoring event and Relocation Site (NA = no control colonies at Site3).

Site	Total Alive	% Alive	% Live Tissue			% Disease
			Mean	±	SD	
Relocated						
Initial						
1	98	100%	89	±	1	17%
2	106	100%	93	±	1	8%
3	6	100%	90	±	3	0%
6-Month						
1	55	56%	48	±	5	15%
2	75	74%	67	±	4	7%
3	6	100%	84	±	5	0%
12-month						
1	45	46%	32	±	4	8%
2	72	68%	61	±	4	3%
3	6	100%	88	±	3	0%
18-Month						
1	41	42%	31	±	4	7%
2	67	63%	49	±	4	2%
3	6	100%	94	±	5	0%
24-Month						
1	34	35%	24	±	4	1%
2	63	59%	47	±	4	2%
3	6	100%	90	±	6	0%
Control						
Initial						
1	35	100%	91	±	13	6%
2	31	100%	82	±	22	10%
3	NA	NA	NA	NA	NA	NA
6-Month						
1	23	66%	61	±	45	17%
2	30	97%	61	±	34	16%
3	NA	NA	NA	NA	NA	NA
12-month						
1	23	66%	59	±	45	6%
2	28	90%	66	±	33	19%
3	NA	NA	NA	NA	NA	NA
18-Month						
1	21	60%	56	±	44	6%
2	26	84%	51	±	40	10%
3	NA	NA	NA	NA	NA	NA
24-Month						
1	21	60%	59	±	44	3%
2	24	77%	48	±	40	6%
3	NA	NA	NA	NA	NA	NA

Ten of the 12 relocated species and eight of the 12 control species experienced a greater than 15% reduction in mean percent colony live tissue (in situ measurements) from the initial event to the 14-month event (Table 7). The remaining two relocated and four control species experienced minimal change. In addition to those species noted above whose colonies suffered 100% tissue loss (0% survival), other relocated and control species with notable reductions (greater than 40%) in mean percent colony live tissue included *D. stokesii*, *P. clivosa*, *M. cavernosa*, *P. strigosa*, *C. natans* (present as a relocated species only), and *A. cervicornis* (Table 7). For both relocated and control colonies, Relocation Sites 1 and 2 experienced a greater than 30% reduction in mean percent colony live tissue.

During the course of this monitoring effort, active tissue loss disease (not including dark spot) was recorded affecting 24% of the relocated and 30% of the control colonies. Disease was recorded at Relocation Sites 1 and 2 during all monitoring events (Table 6). Disease prevalence was greatest for the relocated and control colonies during the 6-month event at 16% and 17%, respectively (Table 7). Tissue loss disease affected eight relocated and seven control species. All of these species had 10% or more of their colonies affected and had less than 85% survival 24 months post-relocation (Table 7). The single relocated *Isophyllia sinuosa* colony and all five control *D. stokesii* colonies were never recorded with disease, but all suffered 100%, likely disease-driven, mortality prior to the 6-month monitoring event.

Predation and the presence of the boring sponge, *Cliona delitrix*, were observed during the course of the monitoring effort, but both conditions were not common. Predation was recorded impacting 20 total colonies; nine relocated colonies of four species and 11 control all of which were *P. astreoides*. In all cases, except one relocated *S. bournoni* colony with snail predation, all recorded predation was recent fish bites that affected less than 10% of the colony. *Cliona delitrix* was only recorded for one colony: a control *M. cavernosa* colony.

Table 8 summarizes the relocated and control stony coral colony percent change in live tissue area (image-traced) for those colonies with live tissue during the 24-month event. The mean percent change in colony live tissue area was calculated utilizing the Initial event colony traced area and the 24-month event colony traced area. Those colonies with live tissue during the 24-month event but whose images were not traced (six relocated and three control colonies) were either *A. cervicornis* colonies (five colonies) or colonies in a growth position that did not allow planar images to be taken. Seven of the nine relocated species with living colonies during the 24-month event had a mean negative percent change in tissue area. Six of the living *P. strigosa* relocated colonies had a mean increase in live tissue area as well as the single *P. astreoides* relocated colony. Eight control species had living colonies during the 24-month event and five of these species had a mean negative percent change in tissue area. *Solenastrea bournoni* had a positive mean increase in control colony live tissue area; however, *S. bournoni* was only represented by two surviving control colonies.

Table 7. Relocated and control stony coral species percent colony live tissue and percent diseased (Dis.) colonies for each monitoring event (A = Initial, 6-month, and 12-month events; B = 18-month and 24-month events).

A Species	Initial			% Dis	6- month			% Dis	12- month			% Dis
	% Live Tissue				% Live Tissue				% Live Tissue			
	Mean	±	SD		Mean	±	SD		Mean	±	SD	
Relocated												
<i>D. stokesii</i>	90%	±	17%	20%	10%	±	29%	20%	7%	±	23%	0%
<i>S. bournoni</i>	86%	±	12%	15%	81%	±	26%	11%	75%	±	30%	3%
<i>P. clivosa</i>	88%	±	18%	14%	49%	±	44%	35%	35%	±	41%	11%
<i>S. siderea</i>	89%	±	12%	0%	94%	±	7%	0%	82%	±	21%	0%
<i>S. intersepta</i>	89%	±	14%	0%	96%	±	4%	0%	93%	±	6%	0%
<i>M. cavernosa</i>	85%	±	12%	0%	64%	±	33%	55%	39%	±	33%	70%
<i>P. strigosa</i>	94%	±	6%	8%	64%	±	45%	11%	51%	±	48%	0%
<i>C. natans</i>	85%	±	20%	25%	11%	±	32%	0%	11%	±	30%	0%
<i>A. cervicornis</i>	89%	±	9%	13%	73%	±	41%	18%	67%	±	39%	9%
<i>M. meandrites</i>	62%	±	53%	33%	0%	±	0%	NA	0%	±	0%	NA
<i>I. sinuosa</i>	100%	±	0%	0%	0%	±	0%	NA	0%	±	0%	NA
<i>P. astreoides</i>	95%	±	0%	0%	95%	±	0%	0%	95%	±	0%	0%
Totals	88%	±	15%	12%	56%	±	45%	16%	48%	±	43%	9%
Control												
<i>D. stokesii</i>	92%	±	9%	0%	0%	±	0%	NA	0%	±	0%	NA
<i>S. bournoni</i>	87%	±	15%	0%	69%	±	47%	33%	70%	±	35%	0%
<i>P. clivosa</i>	92%	±	9%	0%	20%	±	37%	0%	28%	±	41%	0%
<i>S. siderea</i>	89%	±	15%	0%	77%	±	31%	11%	80%	±	17%	11%
<i>S. intersepta</i>	85%	±	22%	0%	79%	±	26%	0%	87%	±	8%	0%
<i>M. cavernosa</i>	77%	±	21%	18%	61%	±	34%	40%	53%	±	38%	47%
<i>P. strigosa</i>	99%	±	1%	0%	0%	±	0%	NA	0%	±	0%	NA
<i>A. cervicornis</i>	58%	±	46%	50%	18%	±	18%	0%	50%	±	0%	0%
<i>A. agaricites</i>	99%	±	0%	0%	100%	±	0%	0%	90%	±	0%	0%
<i>P. astreoides</i>	89%	±	19%	0%	87%	±	22%	6%	93%	±	3%	0%
<i>D. labyrinthiformis</i>	97%	±	0%	100%	0%	±	0%	NA	0%	±	0%	NA
<i>O. annularis</i>	100%	±	0%	0%	70%	±	0%	0%	90%	±	0%	0%
Totals	86%	±	19%	8%	59%	±	40%	17%	61%	±	40%	16%

Table 7. Continued.

B Species	18-month			% Dis	24-month			% Dis
	% Live Tissue				% Live Tissue			
	Mean	±	SD		Mean	±	SD	
Relocated								
<i>D. stokesii</i>	8%	±	25%	25%	7%	±	24%	0%
<i>S. bournoni</i>	62%	±	34%	12%	53%	±	39%	7%
<i>P. clivosa</i>	39%	±	44%	0%	33%	±	42%	0%
<i>S. siderea</i>	77%	±	30%	0%	63%	±	29%	0%
<i>S. intersepta</i>	82%	±	21%	0%	82%	±	23%	0%
<i>M. cavernosa</i>	29%	±	37%	57%	23%	±	37%	25%
<i>P. strigosa</i>	50%	±	47%	0%	52%	±	48%	0%
<i>C. natans</i>	12%	±	33%	0%	12%	±	31%	0%
<i>A. cervicornis</i>	30%	±	40%	0%	40%	±	40%	0%
<i>M. meandrites</i>	0%	±	0%	NA	0%	±	0%	NA
<i>I. sinuosa</i>	0%	±	0%	NA	0%	±	0%	NA
<i>P. astreoides</i>	94%	±	0%	0%	98%	±	0%	0%
Totals	42%	±	43%	8%	38%	±	42%	3%
Control								
<i>D. stokesii</i>	0%	±	0%	NA	0%	±	0%	NA
<i>S. bournoni</i>	65%	±	42%	0%	66%	±	47%	0%
<i>P. clivosa</i>	30%	±	38%	50%	21%	±	31%	0%
<i>S. siderea</i>	85%	±	19%	11%	55%	±	37%	0%
<i>S. intersepta</i>	75%	±	15%	0%	78%	±	20%	0%
<i>M. cavernosa</i>	45%	±	39%	21%	43%	±	42%	23%
<i>P. strigosa</i>	0%	±	0%	NA	0%	±	0%	NA
<i>A. cervicornis</i>	40%	±	0%	0%	20%	±	0%	0%
<i>A. agaricites</i>	95%	±	0%	0%	99%	±	0%	0%
<i>P. astreoides</i>	92%	±	10%	0%	75%	±	31%	0%
<i>D. labyrinthiformis</i>	0%	±	0%	NA	0%	±	0%	NA
<i>O. annularis</i>	90%	±	0%	0%	95%	±	0%	0%
Totals	53%	±	42%	11%	52%	±	41%	7%

Table 8. Relocated and control stony coral colony image-traced species summary data for the 24-month event. The mean percent change in live tissue area was calculated utilizing the Initial event colony traced area and the 24-month event colony traced area for colonies with live tissue during the 24-month event. Of those colonies traced with living tissue, the percent that had an increase, decrease, and no change in traced colony live tissue area 24 months post-relocation are also noted. *Acropora cervicornis* images were not traced. Species with no colonies traced had 0% survival by the 24-month event.

Species	# Colonies Traced	% Change			% of Colonies		
		Mean	±	SD	Increase	Decrease	No Change
Relocated							
<i>D. stokesii</i>	4	-14%	±	0.3	25%	50%	25%
<i>S. bournoni</i>	29	-16%	±	0.3	21%	76%	3%
<i>P. clivosa</i>	15	-8%	±	0.3	53%	40%	7%
<i>S. siderea</i>	19	-28%	±	0.4	21%	74%	5%
<i>S. intersepta</i>	17	-7%	±	0.3	53%	35%	12%
<i>M. cavernosa</i>	4	-24%	±	0.1	0%	100%	0%
<i>P. strigosa</i>	7	10%	±	0.1	86%	14%	0%
<i>C. natans</i>	1	-12%	±	0.0	0%	100%	0%
<i>A. cervicornis</i>	NA	NA	±	NA	NA	NA	NA
<i>M. meandrites</i>	0	NA	±	NA	NA	NA	NA
<i>I. sinuosa</i>	0	NA	±	NA	NA	NA	NA
<i>P. astreoides</i>	1	42%	±	0.0	100%	0%	0%
Total	97	-14%	±	0.3	37%	57%	6%
Control							
<i>D. stokesii</i>	0	NA	±	NA	NA	NA	NA
<i>S. bournoni</i>	2	1%	±	0.1	50%	50%	0%
<i>P. clivosa</i>	2	-35%	±	0.2	0%	100%	0%
<i>S. siderea</i>	8	-7%	±	0.4	38%	63%	0%
<i>S. intersepta</i>	3	-5%	±	0.3	33%	67%	0%
<i>M. cavernosa</i>	12	-46%	±	0.3	8%	92%	0%
<i>P. strigosa</i>	0	NA	±	NA	NA	NA	NA
<i>A. cervicornis</i>	NA	NA	±	NA	NA	NA	NA
<i>A. agaricites</i>	1	-5%	±	0.0	0%	100%	0%
<i>P. astreoides</i>	13	2%	±	0.4	46%	46%	8%
<i>D. labyrinthiformis</i>	0	NA	±	NA	NA	NA	NA
<i>O. annularis</i>	1	2%	±	0.0	100%	0%	0%
Total	42	-16%	±	0.4	31%	67%	2%

Stony coral recruit colonies were identified adjacent to 20 relocated and 12 control colonies during the 24-month event (Table 10). A greater proportion of control colonies had adjacent recruits than relocated colonies during all monitoring events. *Siderastrea siderea* and *P. astreoides* were the only two recruit species identified adjacent to both relocated and control colonies during all monitoring events with *S. siderea* having the greatest abundance.

Table 9. Stony coral recruit summary data for the relocated and control colonies (SSID = *S. siderea*; PAST = *P. astreoides*; MCAV = *M. cavernosa*; DSTO = *D. stokesii*; PPOR = *P. porites*). The table includes the total number of colonies during each monitoring event which had recruits identified within 25cm of the colony, and the proportion (%) these colonies represent the total number of colonies.

	# Colonies W/Recruits	Proportion Colonies W/Recruits	Recruit Abund	# Recruit Species	Recruit Species Abund				
					SSID	PAST	MCAV	DSTO	PPOR
Relocated									
Initial	24	11%	26	4	12	7	6	1	0
6-month	15	7%	27	3	20	6	1	0	0
12-month	14	7%	31	3	25	5	1	0	0
18-month	20	10%	25	3	18	6	1	0	0
24-month	20	10%	29	2	24	5	0	0	0
Control									
Initial	14	21%	28	4	22	3	2	0	1
6-month	9	14%	34	3	28	5	0	0	1
12-month	16	24%	30	3	24	5	1	0	0
18-month	15	23%	28	2	22	6	0	0	0
24-month	12	18%	14	2	13	1	0	0	0

3. DISCUSSION

Stony coral colony relocation occurred between March and September 2016, and 814 colonies of 13 species were relocated from the Broward County Segment II shore protection project surveyed area (Gilliam 2016). The Coral Relocation Plan (CB&I 2015) required a subset (25%) of each relocated species and a set of control colonies, naturally occurring at the relocation sites, to be monitored approximately 6, 12, 18, and 24 months post-relocation. The monitoring effort included 210 relocated colonies representing 12 species and 26% of the total relocated colonies, and 66 control colonies of 12 species. The Coral Relocation Plan states that summary information on colony survival rates, growth rates (here reported as change in colony live tissue area), and general colony condition should be reported. The Plan also states that measures of relocation success include colony attachment, growth (increase in planar tissue area), and measures of stony coral recruitment within 25cm of each relocated colony (recruits were also recorded within 25cm of control colonies in this effort). The Plan (pg. 12) further states, “success

criteria requires at least 85% of the monitored colonies remain securely attached and contain live tissue after two years of monitoring.”

In terms of attachment success, the relocation effort was successful. Only nine of the 210 monitored, relocated colonies became detached during the 24-month event (96% attachment success). In comparison, seven of the 66 (89% ‘attachment success’) control colonies became detached during the effort. The relocated attachment success was great even following the close passing of two hurricanes: Hurricane Matthew in October 2016 and Hurricane Irma in September 2017. Of the missing colonies, nine were *A. cervicornis* colonies, which frequently fragment (Goergen and Gilliam 2018).

The 24-month relocated colony survival rate was 49%, which was below the 85% success criteria defined in Coral Relocation Plan (CB&I 2015). The 24-month control colony survival rate was 67%, which, interestingly, was also below the defined success criteria. High relocated colony attachment success, few observations of colonies impacted by predation or boring sponge, and the high prevalence of disease supports the conclusion that the lower than expected relocated colony survival was driven by disease-related tissue mortality. Additionally, the high prevalence of disease recorded in the control colony population indicates that the disease-related mortality was an event impacting the entire local community.

A region-wide stony coral disease outbreak offshore southeast Florida was first reported in 2014 and continued through 2017 (Precht et al. 2016, Gilliam et al. 2018, Walton et al. 2018). Precht et al. (2016) found greater than 97% mortality of heavily-impacted species offshore Miami-Dade County from 2014-2015. The colonies that they reported as being most impacted were, among others, *D. stokesii*, *M. meandrites*, *C. natans*, *P. strigosa*, and *D. labyrinthiformis*. Gilliam et al. (2018) reported elevated stony coral disease prevalence at multiple sites throughout the region in 2016 (see also Walton et al. 2018), and species determined to experience the greatest impact were *D. stokesii*, *M. meandrites*, *S. bournoni*, and *M. cavernosa*. The species in this project that had the lowest survival rates and high disease prevalence were within the same group of species noted in Precht et al (2016) and Gilliam et al (2018). Additionally, the disease presentation in the current study is similar to that noted Precht et al. (2014), where it was referred to as ‘white-plague’, and Walton et al. (2018)), where it was referred to as ‘white syndrome’. This disease outbreak was evident during the 2016 Segment II relocation activities when a disease prevalence of 14% was recorded for colonies of appropriate size to be relocated (Gilliam 2016). Although no visually active disease was recorded at the Relocation Sites prior to colonies being relocated, these sites, as well as the relocation survey areas, were likely experiencing the same conditions driving the region-wide disease outbreak. This disease outbreak was unprecedented in terms of its longevity, geographic extent, and the number of stony coral species affected (Walton et al. 2018). Multiple diseased species were recorded at two Relocation Sites from the start of the monitoring activities in 2016 until the end of the 24-month monitoring event in April 2018.

Peak disease prevalence for both the relocated and control colonies was recorded during the 6-month monitoring event (November 2016). Although four *M. cavernosa* and two *S. bournoni* disease colonies were recorded, the disease outbreak appears to have weakened by the 24-month event in April 2018. The Southeast Florida Coral Reef Evaluation and Monitoring Project

(SECREMP) reported decreased disease prevalence in the southeast Florida region in 2017 (Gilliam et al 2018) and 2018 (2018 data unpublished). Although overall survival was only 49%, the relocation effort was successful (>85% survival) for three species (*S. siderea*, *S. intersepta*, and *P. astreoides*). Most of the disease susceptible species still had a number of colonies that survived the relocation effort and the disease outbreak. These surviving colonies will likely contribute to overall reef function similarly to the stony coral community that was present at the relocation sites that also survived the disease outbreak. These surviving relocated colonies did, albeit to a lesser extent than expected, minimize the potential impacts to the nearshore hardbottom community associated with the Broward County Segment II shore protection project.

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Appendix

Appendix Table 1. Stony coral species four letter code abbreviations.

Genus species	Letter Code
<i>Acropora cervicornis</i>	ACER
<i>Colpophyllia natans</i>	CNAT
<i>Dichocoenia stokesii</i>	DSTO
<i>Isophyllia sinuosa</i>	ISIN
<i>Meandrina meandrites</i>	MMEA
<i>Montastraea cavernosa</i>	MCAV
<i>Porites astreoides</i>	PAST
<i>Porites porites</i>	PPOR
<i>Pseudodiploria clivosa</i>	DCLI
<i>Pseudodiploria strigosa</i>	DSTR
<i>Siderastrea siderea</i>	SSID
<i>Solenastrea bournoni</i>	SBOU
<i>Stephanocoenia intersepta</i>	SINT

Appendix Table 2. Initial demographic summary data for the relocated colonies at each Relocations Site. Four letter species codes are listed in Appendix Table 1 (N/A= no live tissue measurements due to multiple tissue isolates on colony, %OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	70	ACER	31-50	3/28/16	Y	50	35	N/A	N/A	5	5	D
1	G14	71	ACER	31-50	3/28/16	Y	35	25	N/A	N/A	10	0	
1	G14	72	ACER	31-50	3/28/16	Y	35	15	N/A	N/A	20	0	
1	G15	90	ACER	>50	3/28/16	Y	80	50	N/A	N/A	10	0	
1	G15	96	ACER	10-15	3/28/16	Y	10	4	N/A	N/A	5	0	
1	G14	67	CNAT	16-30	3/28/16	Y	20	19	20	19	5	0	
1	G15	74	CNAT	16-30	3/28/16	Y	30	25	23	22	60	0	
1	G15	83	CNAT	31-50	3/28/16	Y	45	30	45	30	5	0	
1	G14	12	DCLI	16-30	3/28/16	Y	25	22	22	22	10	0	PB
1	G14	18	DCLI	31-50	3/28/16	Y	36	31	30	21	30	5	B
1	G14	19	DCLI	>50	3/28/16	Y	55	45	55	32	40	0	
1	G14	25	DCLI	31-50	3/28/16	Y	50	30	35/3	25/2	40	0	
1	G14	41	DCLI	10-15	3/28/16	Y	12	12	12	12	5	0	
1	G14	49	DCLI	>50	3/28/16	Y	70	40	65	35	20	0	
1	G14	58	DCLI	10-15	3/28/16	Y	12	12	12	12	5	0	
1	G14	59	DCLI	16-30	3/28/16	Y	27	25	27	25	10	5	B
1	G14	61	DCLI	16-30	3/28/16	Y	25	18	24	17	10	0	
1	G14	63	DCLI	31-50	3/28/16	Y	32	23	32	23	5	5	D
1	G14	66	DCLI	10-15	3/28/16	Y	11	10	11	10	5	0	
1	G14	69	DCLI	16-30	3/28/16	Y	20	16	20	16	5	5	D
1	G15	77	DCLI	31-50	3/28/16	Y	40	30	40	30	5	0	
1	G15	84	DCLI	31-50	3/28/16	Y	32	30	32	30	5	0	
1	G15	85	DCLI	16-30	3/28/16	Y	26	25	25	20	10	0	
1	G15	86	DCLI	16-30	3/28/16	Y	27	24	27	24	5	0	
1	G15	91	DCLI	31-50	3/28/16	Y	32	22	32	22	10	5	D

Appendix Table 2.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	4	DSTO	10-15	3/28/16	Y	11	10	11	10	10	0	
1	G14	17	DSTO	16-30	3/28/16	Y	18	18	18	18	5	0	
1	G14	21	DSTO	10-15	3/28/16	Y	15	12	15	12	5	0	
1	G14	22	DSTO	10-15	3/28/16	Y	12	12	12	12	5	0	
1	G14	24	DSTO	10-15	3/28/16	Y	11	11	11	11	5	0	
1	G14	29	DSTO	10-15	3/28/16	Y	13	12	13	12	5	0	
1	G14	30	DSTO	10-15	3/28/16	Y	11	11	11	11	5	0	
1	G14	32	DSTO	16-30	3/28/16	Y	18	16	18	16	10	0	
1	G14	33	DSTO	10-15	3/28/16	Y	12	11	12	11	5	0	
1	G14	34	DSTO	16-30	3/28/16	Y	20	19	20	19	15	0	
1	G14	37	DSTO	10-15	3/28/16	Y	11	10	11	10	0	0	
1	G14	38	DSTO	10-15	3/28/16	Y	11	8	11	8	5	0	
1	G14	39	DSTO	16-30	3/28/16	Y	25	18	25	18	10	0	
1	G14	40	DSTO	10-15	3/28/16	Y	11	10	11	10	5	0	
1	G14	44	DSTO	10-15	3/28/16	Y	13	12	13	12	5	0	
1	G14	45	DSTO	10-15	3/28/16	Y	13	12	13	12	5	0	
1	G14	52	DSTO	16-30	3/28/16	Y	16	13	16	13	0	0	
1	G14	56	DSTO	16-30	3/28/16	Y	17	13	17	13	5	0	
1	G14	57	DSTO	10-15	3/28/16	Y	12	11	11	11	10	0	
1	G14	60	DSTO	10-15	3/28/16	Y	12	10	12	10	0	0	
1	G14	62	DSTO	16-30	3/28/16	Y	16	15	16	15	5	0	
1	G14	65	DSTO	16-30	3/28/16	Y	16	15	15	15	10	0	
1	G15	80	DSTO	31-50	3/28/16	Y	35	30	35	30	40	5	D
1	G15	81	DSTO	10-15	3/28/16	Y	14	13	14	13	5	0	
1	G15	82	DSTO	16-30	3/28/16	Y	20	20	20	20	0	0	
1	G15	87	DSTO	10-15	3/28/16	Y	15	14	15	14	5	0	
1	G15	88	DSTO	16-30	3/28/16	Y	19	15	19	15	5	0	PB
1	G15	92	DSTO	10-15	3/28/16	Y	11	11	11	11	5	5	D
1	G15	93	DSTO	10-15	3/28/16	Y	12	9	12	9	5	0	
1	G15	95	DSTO	10-15	3/28/16	Y	13	13	13	13	5	0	
1	G14	31	DSTR	16-30	3/28/16	Y	21	19	21	19	5	0	

Appendix Table 2. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Whole Colony		Live Tissue			Condition	
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	35	MCAV	16-30	3/28/16	Y	30	25	23	23	30	0	
1	G14	36	MCAV	>50	3/28/16	Y	75	50	75	50	15	0	
1	G14	42	MCAV	16-30	3/28/16	Y	20	18	20	18	10	0	
1	G14	46	MCAV	10-15	3/28/16	Y	11	7	11	7	5	0	
1	G14	53	MCAV	16-30	3/28/16	Y	30	22	29	22	5	0	
1	G15	73	MCAV	31-50	3/28/16	Y	40	25	40	23	20	0	
1	G15	75	MCAV	31-50	3/28/16	Y	33	29	33	29	20	0	
1	G15	76	MCAV	31-50	3/28/16	Y	50	35	50	35	40	0	
1	G15	97	MCAV	31-50	3/28/16	Y	50	20	50	20	20	0	
1	G15	98	MCAV	16-30	3/28/16	Y	30	13	30	13	5	0	
1	G14	50	MMEA	16-30	3/28/16	Y	23	19	23	19	5	0	
1	G14	55	MMEA	16-30	3/28/16	Y	17	14	17	14	10	0	
1	G14	64	PAST	10-15	3/28/16	Y	12	10	12	10	5	0	
1	G14	3	SBOU	10-15	3/28/16	Y	14	12	14	12	5	0	
1	G14	5	SBOU	16-30	3/28/16	Y	20	13	20	13	20	0	PB
1	G14	9	SBOU	10-15	3/28/16	Y	8	7	8	7	5	0	
1	G14	13	SBOU	16-30	3/28/16	Y	16	14	16	14	10	0	
1	G14	14	SBOU	16-30	3/28/16	Y	22	19	21	18	20	2	D, PB
1	G14	16	SBOU	16-30	3/28/16	Y	29	25	28	24	20	10	D,B,PB
1	G14	48	SBOU	16-30	3/28/16	Y	28	22	28	22	15	0	
1	G14	54	SBOU	16-30	3/28/16	Y	30	23	30	23	5	5	D
1	G15	78	SBOU	31-50	3/28/16	Y	42	28	42	28	5	0	
1	G15	79	SBOU	16-30	3/28/16	Y	25	22	24	22	5	0	
1	G15	94	SBOU	16-30	3/28/16	Y	20	16	20	16	5	0	
1	G14	26	SINT	10-15	3/28/16	Y	12	6	12	6	5	0	
1	G14	43	SINT	16-30	3/28/16	Y	18	18	18	18	5	0	
1	G14	68	SINT	10-15	3/28/16	Y	11	10	11	10	5	0	
1	G15	89	SINT	10-15	3/28/16	Y	11	10	11	10	5	0	
1	G14	1	SSID	10-15	3/28/16	Y	7	6	7	6	5	0	
1	G14	2	SSID	10-15	3/28/16	Y	9	7	9	7	30	0	
1	G14	6	SSID	10-15	3/28/16	Y	7	7	7	7	10	0	

Appendix Table 2. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Whole Colony		Live Tissue			Condition	
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	7	SSID	10-15	3/28/16	Y	8	5	7	5	20	0	
1	G14	8	SSID	10-15	3/28/16	Y	7	6	7	6	5	0	
1	G14	10	SSID	10-15	3/28/16	Y	7	6	7	6	5	0	
1	G14	11	SSID	10-15	3/28/16	Y	12	10	10	7	40	5	B
1	G14	15	SSID	10-15	3/28/16	Y	9	8	9	8	10	0	
1	G14	20	SSID	10-15	3/28/16	Y	10	10	10	10	5	0	
1	G14	23	SSID	16-30	3/28/16	Y	19	7	19	7	30	0	
1	G14	27	SSID	10-15	3/28/16	Y	6	6	6	6	5	0	
1	G14	28	SSID	10-15	3/28/16	Y	9	7	9	7	5	10	D
1	G14	47	SSID	10-15	3/28/16	Y	11	11	11	11	5	0	
1	G14	51	SSID	16-30	3/28/16	Y	18	17	18	17	5	0	
2	19	92	ACER	16-30	6/22/16	Y	20	17	20	17	2	0	
2	G18	68	ACER	31-50	6/22/16	Y	40	15	39	15	1	0	
2	G18	69	ACER	16-30	6/22/16	Y	25	15	20	15	25	0	
2	G18	70	ACER	16-30	6/22/16	Y	25	15	20	10	20	0	
2	G18	71	ACER	31-50	6/22/16	Y	33	20	33	15	10	10	D
2	G18	72	ACER	16-30	6/22/16	Y	28	10	25	10	20	0	
2	G18	73	ACER	10-15	6/22/16	Y	15	15	15	14	3	0	
2	G18	74	ACER	16-30	6/22/16	Y	20	20	20	19	3	0	
2	G18	75	ACER	16-30	6/22/16	Y	25	20	24	19	20	0	
2	G18	76	ACER	16-30	6/22/16	Y	22	14	20	14	2	0	
2	G18	6	CNAT	31-50	5/11/16	Y	41	35	30	30	0	20	D
2	G18	22	CNAT	31-50	5/11/16	Y	33	26	33	26	0	0	
2	G18	34	CNAT	31-50	5/11/16	Y	35	26	35	26	0	0	
2	G18	66	CNAT	31-50	6/22/16	Y	32	28	31	27	20	5	D
2	19	77	DCLI	31-50	6/22/16	Y	35	34	34	33	4	0	PB
2	19	79	DCLI	16-30	6/22/16	Y	19	18	18	16	2	0	PB
2	19	120	DCLI	31-50	7/15/16	Y	39	22	39	22	5	0	PB
2	G18	5	DCLI	>50	5/11/16	Y	59	41	0	0	0	100	D
2	G18	7	DCLI	31-50	5/11/16	Y	39	25	35	24	0	10	Unk
2	G18	12	DCLI	31-50	5/11/16	Y	34	29	30	25	0	10	Unk

Appendix Table 2.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Whole Colony		Live Tissue		Condition		
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
2	G18	18	DCLI	16-30	5/11/16	Y	24	14	24	13	0	5	Unk
2	G18	19	DCLI	16-30	5/11/16	Y	19	16	19	15	0	5	Unk
2	G18	21	DCLI	31-50	5/11/16	Y	32	26	32	26	0	1	Unk
2	G18	26	DCLI	31-50	5/11/16	Y	35	28	35	28	0	5	Unk
2	G18	29	DCLI	16-30	5/11/16	Y	20	19	20	19	0	1	Unk
2	G18	30	DCLI	16-30	5/11/16	Y	26	25	26	25	0	1	Unk
2	G18	36	DCLI	31-50	5/11/16	Y	42	30	42	30	0	2	Unk
2	G18	41	DCLI	16-30	5/11/16	Y	20	17	20	17	0	5	Unk
2	G18	47	DCLI	16-30	6/22/16	Y	21	18	21	18	1	0	
2	G18	48	DCLI	16-30	6/22/16	Y	28	19	1	0.5	2	2	Unk
2	G18	53	DCLI	16-30	6/22/16	Y	19	17	19	15	1	10	D
2	G18	61	DCLI	31-50	6/22/16	Y	33	30	32	29	10	0	PB
2	19	98	DSTO	10-15	6/22/16	Y	14	10	14	10	1	0	
2	19	116	DSTO	10-15	7/15/16	Y	13	12	13	12	5	0	PB
2	G18	3	DSTO	10-15	5/11/16	Y	15	10	15	10	0	0	
2	G18	11	DSTO	16-30	5/11/16	Y	19	13	1	1	0	99	D
2	G18	13	DSTO	10-15	5/11/16	Y	11	9	11	9	0	5	D
2	G18	15	DSTO	10-15	5/11/16	Y	12	12	12	12	0	1	Unk
2	G18	17	DSTO	16-30	5/11/16	Y	19	14	10	13	0	50	D
2	G18	28	DSTO	16-30	5/11/16	Y	30	29	30	29	10	1	Unk
2	G18	31	DSTO	10-15	5/11/16	Y	15	14	15	14	0	3	D
2	G18	33	DSTO	16-30	5/11/16	Y	20	17	16	12	10	10	D
2	G18	37	DSTO	10-15	5/11/16	Y	14	10	14	10	0	0	
2	G18	40	DSTO	16-30	5/11/16	Y	29	22	28	22	30	0	
2	G18	46	DSTO	10-15	6/22/16	Y	12	11	12	11	1	5	D
2	G18	52	DSTO	16-30	6/22/16	Y	17	14	17	14	3	0	
2	G18	59	DSTO	16-30	6/22/16	Y	19	17	18	15	5	15	D
2	19	85	DSTR	16-30	6/22/16	Y	23	16	20	14	20	0	PB
2	G18	10	DSTR	16-30	5/11/16	Y	29	20	29	20	0	1	Unk
2	G18	23	DSTR	31-50	5/11/16	Y	34	27	34	27	0	1	Unk
2	G18	32	DSTR	31-50	5/11/16	Y	32	29	32	29	0	5	Unk

Appendix Table 2.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	35	DSTR	31-50	5/11/16	Y	34	25	34	25	0	1	Unk
2	G18	45	DSTR	31-50	6/22/16	Y	31	26	31	26	0	5	D
2	G18	49	DSTR	16-30	6/22/16	Y	20	20	20	20	0	0	
2	G18	55	DSTR	>50	6/22/16	Y	52	40	52	39	4	0	PB
2	G18	64	DSTR	31-50	6/22/16	Y	31	27	30	23	10	0	
2	G18	1	ISIN	10-15	5/11/16	Y	14	9	14	9	0	0	
2	19	91	MCAV	31-50	6/22/16	Y	33	30	33	30	2	0	
2	19	118	MCAV	31-50	7/15/16	Y	34	29	30	23	20	0	
2	G18	51	MCAV	31-50	6/22/16	Y	37	30	37	30	1	0	
2	G18	8	MMEA	16-30	5/11/16	Y	16	15	1	1	0	99	D
2	19	78	SBOU	16-30	6/22/16	Y	25	17	24	17	4	0	PB
2	19	80	SBOU	31-50	6/22/16	Y	32	24	31	23	10	0	PB
2	19	81	SBOU	31-50	6/22/16	Y	37	27	30	24	30	2	D
2	19	82	SBOU	16-30	6/22/16	Y	24	22	21	20	20	0	
2	19	83	SBOU	31-50	6/22/16	Y	37	28	37	27	15	0	
2	19	86	SBOU	16-30	6/22/16	Y	16	11	16	11	0	0	PB
2	19	87	SBOU	10-15	6/22/16	Y	13	12	11	7	10	0	
2	19	88	SBOU	31-50	6/22/16	Y	38	36	35	25	35	0	PB
2	19	90	SBOU	10-15	6/22/16	Y	14	10	13	10	3	0	
2	19	93	SBOU	31-50	6/22/16	Y	43	33	35	32	20	0	PB
2	19	94	SBOU	16-30	6/22/16	Y	16	15	15	14	3	0	PB
2	19	95	SBOU	31-50	6/22/16	Y	37	30	36	29	5	0	
2	19	96	SBOU	16-30	6/22/16	Y	28	28	21	21	25	0	PB
2	19	97	SBOU	31-50	6/22/16	Y	31	21	31	21	0	0	PB
2	19	119	SBOU	16-30	7/15/16	Y	24	18	17	16	35	10	B
2	19	121	SBOU	31-50	7/15/16	Y	35	29	33	29	30	1	Unk
2	G18	4	SBOU	>50	5/11/16	Y	51	34	51	34	0	0	
2	G18	14	SBOU	10-15	5/11/16	Y	10	10	10	10	0	0	
2	G18	16	SBOU	16-30	5/11/16	Y	16	14	16	14	10	0	
2	G18	38	SBOU	16-30	5/11/16	Y	21	20	19	17	20	0	
2	G18	39	SBOU	31-50	5/11/16	Y	33	23	33	23	20	10	D

Appendix Table 2.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Whole Colony		Live Tissue		Condition		
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
2	G18	50	SBOU	31-50	6/22/16	Y	35	25	35	25	1	5	Unk
2	G18	54	SBOU	16-30	6/22/16	Y	22	16	21	16	5	0	PB
2	G18	56	SBOU	>50	6/22/16	Y	70	40	52	39	35	0	PB
2	G18	60	SBOU	16-30	6/22/16	Y	26	26	26	25	5	0	
2	G18	65	SBOU	31-50	6/22/16	Y	40	34	35	24	10	15	D
2	19	115	SINT	16-30	6/22/16	Y	16	16	16	16	1	0	PB
2	19	117	SINT	16-30	7/15/16	Y	29	23	29	23	10	0	PB
2	G18	2	SINT	10-15	5/11/16	Y	15	12	15	11	0	5	Unk
2	G18	24	SINT	16-30	5/11/16	Y	19	17	19	17	0	3	Unk
2	G18	25	SINT	10-15	5/11/16	Y	11	10	11	10	0	0	
2	G18	27	SINT	16-30	5/11/16	Y	17	17	17	17	0	1	Unk
2	G18	42	SINT	16-30	5/11/16	Y	29	25	28	25	15	5	Unk
2	G18	44	SINT	10-15	6/22/16	Y	14	13	14	13	3	0	
2	G18	57	SINT	16-30	6/22/16	Y	23	21	18	16	40	10	B
2	G18	58	SINT	16-30	6/22/16	Y	22	15	21	13	10	0	PB
2	G18	62	SINT	10-15	6/22/16	Y	15	14	11	13	20	0	
2	G18	63	SINT	10-15	6/22/16	Y	14	11	10	10	40	0	
2	G18	67	SINT	16-30	6/22/16	Y	22	20	21	19	5	2	Unk
2	19	84	SSID	10-15	6/22/16	Y	10	7	9	7	5	0	D, PB
2	19	89	SSID	10-15	6/22/16	Y	11	10	10	9	3	0	D, PB
2	19	99	SSID	10-15	6/22/16	Y	9	7	8	7	0	0	D, PB
2	G18	9	SSID	10-15	5/11/16	Y	15	14	15	14	0	2	Unk
2	G18	20	SSID	10-15	5/11/16	Y	11	9	11	9	0	3	Unk
2	G18	43	SSID	10-15	6/22/16	Y	12	12	12	12	2	2	B
3	99	137	CNAT	31-50	9/30/16	Y	45	25	43	20	5	0	
3	99	136	DSTR	>50	9/30/16	Y	67	63	67	63	10	0	
3	99	139	DSTR	>50	9/30/16	Y	75	70	75	70	2	0	
3	99	140	DSTR	>50	9/30/16	Y	56	45	50	41	10	0	PB
3	99	135	SBOU	31-50	9/30/16	Y	35	33	30	22	25	0	
3	99	138	SBOU	31-50	9/30/16	Y	40	33	40	33	10	0	

Appendix Table 3. Initial demographic summary data for the control colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Whole Colony		Live Tissue		Condition		D, B, PB
						L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	121	AAGA	16-30	3/28/16	20	12	20	12	1	0	
1	G14	117	DCLI	16-30	3/28/16	16	16	16	16	1	0	
1	G15	105	DCLI	31-50	3/28/16	46	31	34	24	20	0	
1	G15	109	DCLI	16-30	3/28/16	16	16	16	16	10	0	
1	G14	124	DLAB	>50	3/28/16	77	75	77	75	1	2	D
1	G14	128	DSTO	10-15	3/28/16	13	11	13	11	15	0	
1	G15	104	DSTO	10-15	3/28/16	12	10	10	10	20	0	
1	G15	108	DSTO	16-30	3/28/16	20	15	20	15	5	0	
1	G15	113	DSTO	10-15	3/28/16	11	10	11	10	1	0	
1	G14	130	DSTR	10-15	3/28/16	73	52	73	52	2	0	
1	G15	100	DSTR	10-15	3/28/16	10	8	10	8	1	0	
1	G15	106	DSTR	10-15	3/28/16	12	12	12	12	0	0	
1	G14	118	MCAV	16-30	3/28/16	26	18	26	8	30	0	
1	G14	119	MCAV	>50	3/28/16	84	62	84	62	30	5	D
1	G14	125	MCAV	31-50	3/28/16	43	25	43	25	2	0	
1	G14	126	MCAV	>50	3/28/16	95	74	95	74	10	5	<i>Cliona</i>
1	G14	129	MCAV	>50	3/28/16	57	32	35	20	60	0	
1	G14	132	MCAV	16-30	3/28/16	24	18	24	18	5	0	
1	G14	133	MCAV	31-50	3/28/16	40	30	40	30	2	0	
1	G15	107	MCAV	31-50	3/28/16	33	32	3	32	5	0	
1	G15	114	MCAV	31-50	3/28/16	39	27	39	27	1	0	
1	G14	115	PAST	10-15	3/28/16	11	9	11	6	40	0	
1	G14	116	PAST	10-15	3/28/16	10	8	10	8	15	5	B
1	G14	120	PAST	16-30	3/28/16	20	14	20	14	1	0	
1	G14	123	PAST	16-30	3/28/16	19	15	19	15	1	0	

Appendix Table 3. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Whole Colony		Live Tissue		Condition		D, B, PB
						L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	127	PAST	10-15	3/28/16	14	10	14	10	1	0	
1	G14	134	PAST	16-30	3/28/16	17	10	17	10	0	0	B
1	G15	101	PAST	10-15	3/28/16	11	10	11	10	10	0	
1	G15	102	PAST	10-15	3/28/16	10	10	9	8	20	0	
1	G15	111	PAST	10-15	3/28/16	13	8	13	8	1	0	
1	G14	122	SINT	16-30	3/28/16	21	19	21	19	2	0	
1	G15	112	SINT	10-15	3/28/16	15	15	15	15	2	0	
1	G14	131	SSID	16-30	3/28/16	19	18	19	18	5	0	D
1	G15	103	SSID	16-30	3/28/16	25	17	25	17	2	0	
1	G15	110	SSID	16-30	3/28/16	21	14	21	14	1	0	
2	19	167	ACER	>50	6/22/16	70	62	70	62	5	5	D
2	19	172	ACER	16-30	6/22/16	22	20	9	7	75	0	
2	G18	100	DCLI	16-30	5/11/16	20	15	20	15	0	0	
2	G18	103	DSTO	10-15	5/11/16	12	11	12	11	0	0	
2	G18	106	MANN	16-30	5/11/16	30	25	30	25	0	0	
2	19	169	MCAV	>50	6/22/16	75	50	N/A	N/A	50	0	
2	19	171	MCAV	16-30	6/22/16	21	17	15	11	50	0	
2	19	176	MCAV	>50	6/22/16	58	49	58	49	10	0	
2	19	178	MCAV	31-50	6/22/16	31	30	31	30	10	0	
2	19	181	MCAV	31-50	6/22/16	35	31	35	31	1	0	
2	G18	104	MCAV	31-50	5/11/16	48	45	48	45	10	10	D
2	G18	113	MCAV	>50	5/11/16	72	68	69	65	30	0	
2	G18	114	MCAV	>50	5/11/16	101	80	101	80	40	20	D
2	19	166	PAST	10-15	6/22/16	13	12	N/A	N/A	70	0	
2	19	168	PAST	10-15	6/22/16	14	11	14	11	2	0	
2	19	170	PAST	10-15	6/22/16	9	6	9	6	1	0	
2	19	175	PAST	16-30	6/22/16	25	18	25	18	10	0	
2	19	180	PAST	16-30	6/22/16	30	25	30	25	5	0	
2	G18	105	PAST	10-15	5/11/16	13	11	13	11	0	0	
2	G18	107	PAST	16-30	5/11/16	20	15	20	15	2	0	
2	19	173	SBOU	16-30	6/22/16	26	26	19	15	30	0	

Appendix Table 3.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Whole Colony		Live Tissue			Condition		D, B, PB
						L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM		
2	19	174	SBOU	10-15	6/22/16	15	11	15	11	0	0		
2	G18	110	SBOU	31-50	5/11/16	36	31	36	31	10	0		
2	G18	102	SINT	10-15	5/11/16	13	10	9	9	40	0		
2	19	177	SSID	10-15	6/22/16	12	10	12	10	10	0	PB	
2	19	179	SSID	16-30	6/22/16	21	16	21	16	0	0	PB	
2	G18	101	SSID	16-30	5/11/16	26	20	26	20	5	0		
2	G18	108	SSID	31-50	5/11/16	31	26	31	26	5	0		
2	G18	109	SSID	10-15	5/11/16	15	7	15	7	15	0		
2	G18	111	SSID	16-30	5/11/16	30	25	30	25	50	0		
2	G18	112	SSID	16-30	5/11/16	20	18	20	18	15	0		

Appendix Table 4. Six-month demographic summary data for the relocated colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	70	ACER	31-50	11/4/16	Y	N	20	12	0	0	100	0	
1	G14	71	ACER	31-50	11/4/16	Y	N	22	20	N/A	N/A	80	2	D
1	G14	72	ACER	31-50	11/4/16	Y	Y	13	8	13	8	0	0	
1	G15	90	ACER	>50	11/4/16	Y	N	25	18	25	18	0	0	
1	G15	96	ACER	10-15	11/4/16	Y	N	20	13	20	13	0	0	
1	G14	67	CNAT	16-30	11/4/16	Y	N	20	19	0	0	100	0	
1	G15	74	CNAT	16-30	11/4/16	Y	N	31	25	0	0	100	0	
1	G15	83	CNAT	31-50	11/4/16	Y	N	40	38	0	0	100	0	
1	G14	12	DCLI	16-30	11/4/16	Y	N	24	21	12	10	5	70	D
1	G14	18	DCLI	31-50	11/4/16	Y	N	35	29	8	3	25	65	D
1	G14	19	DCLI	>50	11/4/16	Y	N	50	40	50	30	15	5	D
1	G14	25	DCLI	31-50	11/4/16	Y	N	43	23	32	20	25	0	
1	G14	41	DCLI	10-15	11/4/16	Y	N	13	12	0	0	100	0	
1	G14	49	DCLI	>50	11/4/16	Y	N	67	37	62	36	15	0	
1	G14	58	DCLI	10-15	11/4/16	Y	N	12	12	0	0	100	0	
1	G14	59	DCLI	16-30	11/4/16	Y	N	25	20	0	0	100	0	
1	G14	61	DCLI	16-30	11/4/16	Y	N	22	15	0	0	100	0	
1	G14	63	DCLI	31-50	11/4/16	Y	N	32	23	32	23	0	0	
1	G14	66	DCLI	10-15	11/4/16	Y	N	10	9	0	0	100	0	
1	G14	69	DCLI	16-30	11/4/16	Y	N	20	14	N/A	N/A	20	70	D
1	G15	77	DCLI	31-50	11/4/16	Y	N	36	27	0	0	100	0	
1	G15	84	DCLI	31-50	11/4/16	Y	N	30	28	25	25	5	15	D
1	G15	85	DCLI	16-30	11/4/16	Y	N	25	25	25	20	10	0	
1	G15	86	DCLI	16-30	11/4/16	Y	N	24	21	8	3	25	70	D
1	G15	91	DCLI	31-50	11/4/16	Y	N	30	23	20	11	40	0	

Appendix Table 4. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	4	DSTO	10-15	11/4/16	Y	N	11	10	0	0	100	0	
1	G14	17	DSTO	16-30	11/4/16	Y	N	19	16	0	0	100	0	
1	G14	21	DSTO	10-15	11/4/16	Y	N	15	11	0	0	100	0	
1	G14	22	DSTO	10-15	11/4/16	Y	N	13	11	0	0	100	0	
1	G14	24	DSTO	10-15	11/4/16	Y	N	11	11	0	0	100	0	
1	G14	29	DSTO	10-15	11/4/16	Y	N	13	13	0	0	100	0	
1	G14	30	DSTO	10-15	11/4/16	Y	N	11	11	0	0	100	0	
1	G14	32	DSTO	16-30	11/4/16	Y	N	18	15	0	0	100	0	
1	G14	33	DSTO	10-15	11/4/16	Y	N	11	7	0	0	100	0	
1	G14	34	DSTO	16-30	11/4/16	Y	N	22	22	0	0	100	0	
1	G14	37	DSTO	10-15	11/4/16	Y	N	11	10	0	0	100	0	
1	G14	38	DSTO	10-15	11/4/16	Y	N	10	8	0	0	100	0	
1	G14	39	DSTO	16-30	11/4/16	Y	N	24	20	0	0	0	0	
1	G14	40	DSTO	10-15	11/4/16	Y	N	10	9	0	0	100	0	
1	G14	44	DSTO	10-15	11/4/16	Y	N	13	9	0	0	100	0	
1	G14	45	DSTO	10-15	11/4/16	Y	N	12	12	0	0	100	0	
1	G14	52	DSTO	16-30	11/4/16	Y	N	15	13	0	0	100	0	
1	G14	56	DSTO	16-30	11/4/16	Y	N	17	12	0	0	100	0	
1	G14	57	DSTO	10-15	11/4/16	Y	N	11	10	8	6	60	10	D
1	G14	60	DSTO	10-15	11/4/16	Y	N	12	10	0	0	100	0	
1	G14	62	DSTO	16-30	11/4/16	Y	N	15	15	0	0	100	0	
1	G14	65	DSTO	16-30	11/4/16	Y	N	17	14	0	0	100	0	
1	G15	80	DSTO	31-50	11/4/16	Y	N	32	30	0	0	100	0	
1	G15	81	DSTO	10-15	11/4/16	Y	N	14	13	0	0	100	0	
1	G15	82	DSTO	16-30	11/4/16	Y	N	20	19	0	0	100	0	
1	G15	87	DSTO	10-15	11/4/16	Y	N	18	16	0	0	100	0	
1	G15	88	DSTO	16-30	11/4/16	Y	N	16	16	0	0	100	0	
1	G15	92	DSTO	10-15	11/4/16	Y	N	11	11	0	0	100	0	
1	G15	93	DSTO	10-15	11/4/16	Y	N	12	10	0	0	100	0	
1	G15	95	DSTO	10-15	11/4/16	Y	N	13	11	0	0	100	0	
1	G14	31	DSTR	16-30	11/4/16	Y	N	19	19	19	19	0	0	

Appendix Table 4. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	35	MCAV	16-30	11/4/16	Y	N	30	21	22	15	20	25	D
1	G14	36	MCAV	>50	11/4/16	Y	N	80	42	80	42	5	0	
1	G14	42	MCAV	16-30	11/4/16	Y	N	19	16	0	0	100	0	
1	G14	46	MCAV	10-15	11/4/16	Y	N	11	7	0	0	100	0	
1	G14	53	MCAV	16-30	11/4/16	Y	N	30	20	22	16	15	10	D
1	G15	73	MCAV	31-50	11/4/16	Y	N	36	26	33	24	15	2	D
1	G15	75	MCAV	31-50	11/4/16	Y	N	36	27	19	15	50	10	D
1	G15	76	MCAV	31-50	11/4/16	Y	N	47	32	47	25	25	0	PB
1	G15	97	MCAV	31-50	11/4/16	Y	N	52	31	32	17	25	5	D
1	G15	98	MCAV	16-30	11/4/16	Y	N	30	16	30	16	5	0	
1	G14	50	MMEA	16-30	11/4/16	Y	N	26	18	0	0	100	0	
1	G14	55	MMEA	16-30	11/4/16	Y	N	16	12	0	0	100	0	
1	G14	64	PAST	10-15	11/4/16	Y	N	14	11	14	10	5	0	
1	G14	3	SBOU	10-15	11/4/16	Y	Y	15	14	15	14	5	0	
1	G14	5	SBOU	16-30	11/4/16	Y	N	21	14	21	14	10	0	
1	G14	9	SBOU	10-15	11/4/16	Y	Y	9	9	9	9	0	0	
1	G14	13	SBOU	16-30	11/4/16	Y	N	18	13	12	8	60	1	Unk
1	G14	14	SBOU	16-30	11/4/16	Y	N	23	20	13	8	80	10	Unk
1	G14	16	SBOU	16-30	11/4/16	Y	N	27	24	7	1	85	10	D
1	G14	48	SBOU	16-30	11/4/16	Y	N	27	20	27	20	5	0	
1	G14	54	SBOU	16-30	11/4/16	Y	N	27	22	27	22	0	0	
1	G15	78	SBOU	31-50	11/4/16	Y	N	39	36	0	0	100	0	
1	G15	79	SBOU	16-30	11/4/16	Y	N	23	21	23	21	0	0	
1	G15	94	SBOU	16-30	11/4/16	Y	N	18	17	18	17	1	0	
1	G14	26	SINT	10-15	11/4/16	Y	N	12	6	12	6	0	0	
1	G14	43	SINT	16-30	11/4/16	Y	N	20	18	20	18	10	0	
1	G14	68	SINT	10-15	11/4/16	Y	N	11	9	11	9	0	0	
1	G15	89	SINT	10-15	11/4/16	Y	N	11	9	11	9	5	0	
1	G14	1	SSID	10-15	11/4/16	Y	N	7	6	7	6	0	0	
1	G14	2	SSID	10-15	11/4/16	Y	N	10	7	10	7	10	0	
1	G14	6	SSID	10-15	11/4/16	Y	Y	7	6	7	6	0	0	

Appendix Table 4. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	7	SSID	10-15	11/4/16	Y	N	7	4	7	4	0	0	
1	G14	8	SSID	10-15	11/4/16	Y	Y	9	7	7	7	10	0	
1	G14	10	SSID	10-15	11/4/16	Y	Y	9	7	9	7	1	0	
1	G14	11	SSID	10-15	11/4/16	Y	N	10	9	7	7	10	0	
1	G14	15	SSID	10-15	11/4/16	Y	Y	10	9	10	9	10	0	
1	G14	20	SSID	10-15	11/4/16	Y	N	10	10	10	10	0	0	
1	G14	23	SSID	16-30	11/4/16	Y	N	16	8	16	8	5	0	
1	G14	27	SSID	10-15	11/4/16	Y	N	6	5	5	5	20	0	
1	G14	28	SSID	10-15	11/4/16	Y	N	8	6	8	6	0	0	
1	G14	47	SSID	10-15	11/4/16	Y	N	12	10	12	10	1	0	
1	G14	51	SSID	16-30	11/4/16	Y	N	17	15	17	15	0	0	
2	19	92	ACER	16-30	11/9/16	Y	Y	24	21	24	21	2	0	
2	G18	68	ACER	31-50	11/9/16	N	N	N/A	N/A	0	0	0	0	
2	G18	69	ACER	16-30	11/9/16	Y	N	22	20	16	20	10	0	
2	G18	70	ACER	16-30	11/9/16	N	N	7	2	0	0	100	0	
2	G18	71	ACER	31-50	11/9/16	Y	N	31	26	31	24	10	40	D
2	G18	72	ACER	16-30	11/9/16	Y	N	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	73	ACER	10-15	11/9/16	Y	Y	20	20	20	20	0	0	
2	G18	74	ACER	16-30	11/9/16	Y	Y	28	19	28	19	0	0	
2	G18	75	ACER	16-30	11/9/16	Y	Y	15	16	15	13	5	0	
2	G18	76	ACER	16-30	11/9/16	Y	Y	20	15	16	15	5	0	
2	G18	6	CNAT	31-50	11/9/16	Y	N	42	32	0	0	100	0	
2	G18	22	CNAT	31-50	11/9/16	Y	N	29	26	0	0	100	0	
2	G18	34	CNAT	31-50	11/9/16	Y	N	31	31	0	0	100	0	
2	G18	66	CNAT	31-50	11/9/16	Y	N	29	24	0	0	100	0	
2	19	77	DCLI	31-50	11/9/16	Y	N	32	29	32	29	0	0	
2	19	79	DCLI	16-30	11/9/16	Y	N	17	15	17	15	0	0	
2	19	120	DCLI	31-50	11/9/16	Y	N	40	27	40	24	10	0	
2	G18	5	DCLI	>50	11/9/16	Y	N	59	41	0	0	100	0	
2	G18	7	DCLI	31-50	11/9/16	Y	N	35	30	35	30	0	0	
2	G18	12	DCLI	31-50	11/9/16	Y	N	36	29	0	0	100	0	

Appendix Table 4. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	18	DCLI	16-30	11/9/16	Y	N	21	18	0	0	100	0	
2	G18	19	DCLI	16-30	11/9/16	Y	N	20	18	19	18	5	0	
2	G18	21	DCLI	31-50	11/9/16	Y	N	30	26	0	0	0	0	
2	G18	26	DCLI	31-50	11/9/16	Y	N	31	28	31	28	5	0	
2	G18	29	DCLI	16-30	11/9/16	Y	N	20	16	16	16	0	10	D
2	G18	30	DCLI	16-30	11/9/16	Y	N	26	17	22	17	0	10	D
2	G18	36	DCLI	31-50	11/9/16	Y	N	41	32	0	0	100	0	
2	G18	41	DCLI	16-30	11/9/16	Y	N	33	21	19	19	45	0	
2	G18	47	DCLI	16-30	11/9/16	Y	Y	26	21	26	20	5	0	
2	G18	48	DCLI	16-30	11/9/16	Y	N	28	20	0	0	100	0	
2	G18	53	DCLI	16-30	11/9/16	Y	N	26	23	0	0	100	0	
2	G18	61	DCLI	31-50	11/9/16	Y	Y	31	30	31	30	1	0	
2	19	98	DSTO	10-15	11/9/16	Y	N	10	8	0	0	100	0	
2	19	116	DSTO	10-15	11/9/16	Y	N	11	10	0	0	100	0	
2	G18	3	DSTO	10-15	11/9/16	Y	Y	15	13	15	13	0	0	
2	G18	11	DSTO	16-30	11/9/16	Y	N	16	11	0	0	100	0	
2	G18	13	DSTO	10-15	11/9/16	Y	N	10	8	0	0	100	0	
2	G18	15	DSTO	10-15	11/9/16	Y	N	11	11	0	0	100	0	
2	G18	17	DSTO	16-30	11/9/16	Y	N	15	15	0	0	100	0	
2	G18	28	DSTO	16-30	11/9/16	Y	N	18	16	0	0	100	0	
2	G18	31	DSTO	10-15	11/9/16	Y	Y	16	12	16	12	0	0	
2	G18	33	DSTO	16-30	11/9/16	Y	N	19	14	0	0	100	0	
2	G18	37	DSTO	10-15	11/9/16	Y	N	10	10	0	0	100	0	
2	G18	40	DSTO	16-30	11/9/16	Y	N	25	23	0	0	100	0	
2	G18	46	DSTO	10-15	11/9/16	Y	N	13	11	0	0	100	0	
2	G18	52	DSTO	16-30	11/9/16	Y	Y	17	16	17	16	0	0	
2	G18	59	DSTO	16-30	11/9/16	Y	N	16	15	0	0	100	0	
2	19	85	DSTR	16-30	11/9/16	Y	N	19	16	18	13	10	0	
2	G18	10	DSTR	16-30	11/9/16	Y	N	25	26	0	0	100	0	
2	G18	23	DSTR	31-50	11/9/16	Y	N	28	25	28	25	100	0	
2	G18	32	DSTR	31-50	11/9/16	Y	N	32	26	0	0	100	0	

Appendix Table 4. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	35	DSTR	31-50	11/9/16	Y	N	29	25	29	25	0	1	Unk
2	G18	45	DSTR	31-50	11/9/16	Y	N	32	23	0	0	100	0	
2	G18	49	DSTR	16-30	11/9/16	Y	N	21	19	21	19	0	0	
2	G18	55	DSTR	>50	11/9/16	Y	N	50	48	50	45	10	10	D
2	G18	64	DSTR	31-50	11/9/16	Y	N	28	22	27	21	0	0	
2	G18	1	ISIN	10-15	11/9/16	Y	N	11	8	0	0	100	0	
2	19	91	MCAV	31-50	11/9/16	Y	N	30	28	30	23	20	0	
2	19	118	MCAV	31-50	11/9/16	Y	N	35	30	30	30	30	10	D
2	G18	51	MCAV	31-50	11/9/16	Y	N	36	28	36	28	0	0	
2	G18	8	MMEA	10-15	11/9/16	Y	N	15	14	0	0	100	0	
2	19	78	SBOU	16-30	11/9/16	Y	N	17	16	17	16	5	0	
2	19	80	SBOU	31-50	11/9/16	Y	N	26	16	26	16	10	0	
2	19	81	SBOU	31-50	11/9/16	Y	N	25	22	24	19	25	0	
2	19	82	SBOU	16-30	11/9/16	Y	N	21	17	21	17	10	0	
2	19	83	SBOU	31-50	11/9/16	Y	N	31	25	31	25	5	0	
2	19	86	SBOU	16-30	11/9/16	Y	N	15	9	15	9	0	0	
2	19	87	SBOU	10-15	11/9/16	Y	N	12	10	11	10	15	0	
2	19	88	SBOU	31-50	11/9/16	Y	N	34	32	31	27	15	0	
2	19	90	SBOU	10-15	11/9/16	Y	Y	11	9	11	9	0	0	
2	19	93	SBOU	31-50	11/9/16	Y	N	40	31	32	30	10	0	
2	19	94	SBOU	16-30	11/9/16	Y	Y	13	12	13	12	2	0	
2	19	95	SBOU	31-50	11/9/16	Y	N	33	28	33	28	5	0	
2	19	96	SBOU	16-30	11/9/16	Y	N	26	26	20	19	20	0	
2	19	97	SBOU	31-50	11/9/16	Y	Y	30	20	30	20	0	0	
2	19	119	SBOU	16-30	11/9/16	Y	N	24	20	20	19	40	2	B
2	19	121	SBOU	31-50	11/9/16	Y	N	36	30	30	30	40	5	D
2	G18	4	SBOU	>50	11/9/16	Y	N	55	40	54	30	10	0	
2	G18	14	SBOU	10-15	11/9/16	Y	Y	11	10	11	10	5	0	
2	G18	16	SBOU	16-30	11/9/16	Y	Y	15	16	15	16	5	0	
2	G18	38	SBOU	16-30	11/9/16	Y	N	18	17	15	15	30	0	
2	G18	39	SBOU	31-50	11/9/16	Y	N	35	25	29	25	15	0	

Appendix Table 4. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	50	SBOU	31-50	11/9/16	Y	N	36	26	36	26	5	0	D
2	G18	54	SBOU	16-30	11/9/16	Y	Y	18	15	18	15	1	0	
2	G18	56	SBOU	>50	11/9/16	Y	Y	50	36	48	36	10	0	
2	G18	60	SBOU	16-30	11/9/16	Y	N	23	23	23	23	5	5	
2	G18	65	SBOU	31-50	11/9/16	Y	N	37	30	37	30	0	0	
2	19	115	SINT	16-30	11/9/16	Y	N	16	12	14	12	1	0	
2	19	117	SINT	16-30	11/9/16	Y	N	29	22	29	22	5	0	
2	G18	2	SINT	10-15	11/9/16	Y	Y	14	13	14	13	10	0	
2	G18	24	SINT	16-30	11/9/16	Y	N	19	16	19	16	1	0	
2	G18	25	SINT	10-15	11/9/16	Y	Y	10	9	10	9	0	0	
2	G18	27	SINT	16-30	11/9/16	Y	N	17	16	17	16	1	0	
2	G18	42	SINT	16-30	11/9/16	Y	N	26	25	24	24	10	0	
2	G18	44	SINT	10-15	11/9/16	Y	Y	15	12	15	12	5	0	
2	G18	57	SINT	16-30	11/9/16	Y	N	18	15	18	15	10	0	
2	G18	58	SINT	16-30	11/9/16	Y	N	20	12	20	12	2	0	
2	G18	62	SINT	10-15	11/9/16	Y	N	12	11	11	11	5	0	
2	G18	63	SINT	10-15	11/9/16	Y	N	10	8	10	8	10	0	
2	G18	67	SINT	16-30	11/9/16	Y	Y	18	17	18	17	1	0	
2	19	84	SSID	10-15	11/9/16	Y	N	8	5	8	5	25	0	
2	19	89	SSID	10-15	11/9/16	Y	N	11	9	11	9	5	0	
2	19	99	SSID	10-15	11/9/16	Y	N	8	6	7	6	10	0	
2	G18	9	SSID	10-15	11/9/16	Y	N	17	13	17	13	1	0	
2	G18	20	SSID	10-15	11/9/16	Y	N	10	10	10	10	1	0	
2	G18	43	SSID	10-15	11/9/16	Y	N	11	11	11	11	5	5	Unk
3	99	137	CNAT	31-50	11/4/16	Y	N	50	37	50	35	10	0	PB
3	99	136	DSTR	>50	11/4/16	Y	N	66	65	66	65	20	0	
3	99	139	DSTR	>50	11/4/16	Y	N	80	79	80	79	3	0	
3	99	140	DSTR	>50	11/4/16	Y	N	60	40	50	40	10	0	
3	99	135	SBOU	31-50	11/4/16	Y	N	40	31	30	25	35	0	PB
3	99	138	SBOU	31-50	11/4/16	Y	N	40	35	40	35	20	0	PB

Appendix Table 5. Six-month demographic summary data for the control colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	121	AAGA	16-30	11/4/16	Y	20	13	20	13	0	0	
1	G14	117	DCLI	16-30	11/4/16	Y	17	15	0	0	100	0	
1	G15	105	DCLI	31-50	11/4/16	Y	40	36	35	24	25	0	
1	G15	109	DCLI	16-30	11/4/16	Y	17	15	0	0	100	0	
1	G14	124	DLAB	>50	11/4/16	Y	80	75	0	0	100	0	
1	G14	128	DSTO	10-15	11/4/16	N	17	15	0	0	100	0	
1	G15	104	DSTO	10-15	11/4/16	Y	15	12	0	0	100	0	
1	G15	108	DSTO	16-30	11/4/16	Y	23	18	0	0	100	0	
1	G15	113	DSTO	10-15	11/4/16	Y	15	14	0	0	100	0	
1	G14	130	DSTR	>50	11/4/16	Y	80	30	0	0	100	0	
1	G15	100	DSTR	10-15	11/4/16	Y	12	10	0	0	100	0	
1	G15	106	DSTR	10-15	11/4/16	Y	13	11	0	0	100	0	
1	G14	118	MCAV	16-30	11/4/16	Y	27	25	0	0	80	20	D
1	G14	119	MCAV	>50	11/4/16	Y	82	60	0	0	90	10	Unk
1	G14	125	MCAV	31-50	11/4/16	Y	45	35	45	35	2	0	
1	G14	126	MCAV	>50	11/4/16	Y	90	70	90	60	40	2	D
1	G14	129	MCAV	>50	11/4/16	Y	50	35	35	22	60	0	
1	G14	132	MCAV	16-30	11/4/16	Y	25	23	24	23	10	5	D
1	G14	133	MCAV	31-50	11/4/16	Y	43	41	43	41	2	0	
1	G15	107	MCAV	31-50	11/4/16	Y	45	40	45	40	8	3	D
1	G15	114	MCAV	31-50	11/4/16	Y	45	38	45	38	1	0	
1	G14	115	PAST	10-15	11/4/16	Y	10	5	10	5	0	0	PB
1	G14	116	PAST	10-15	11/4/16	Y	10	8	10	8	5	1	B
1	G14	120	PAST	16-30	11/4/16	Y	20	15	20	15	10	0	
1	G14	123	PAST	16-30	11/4/16	Y	23	17	23	17	1	0	

Appendix Table 5. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	127	PAST	10-15	11/4/16	Y	15	10	15	10	0	0	
1	G14	134	PAST	16-30	11/4/16	Y	15	14	15	14	0	0	
1	G15	101	PAST	10-15	11/4/16	Y	15	13	15	13	0	0	
1	G15	102	PAST	10-15	11/4/16	Y	10	8	10	8	0	0	
1	G15	111	PAST	10-15	11/4/16	Y	14	9	14	9	1	5	D
1	G14	122	SINT	16-30	11/4/16	Y	23	20	23	20	10	0	
1	G15	112	SINT	10-15	11/4/16	Y	16	15	16	15	2	0	
1	G14	131	SSID	16-30	11/4/16	Y	22	21	22	21	20	0	
1	G15	103	SSID	16-30	11/4/16	Y	30	16	30	16	1	3	Unk
1	G15	110	SSID	16-30	11/4/16	Y	25	18	25	18	2	0	
2	19	167	ACER	>50	11/9/16	Y	48	40	40	35	70	0	
2	19	172	ACER	16-30	11/9/16	Y	15	10	3	1	95	0	
2	G18	100	DCLI	16-30	11/9/16	Y	60	50	15	13	95	0	
2	G18	103	DSTO	10-15	11/9/16	Y	15	12	0	0	100	0	
2	G18	106	MANN	16-30	11/9/16	Y	35	30	35	30	30	0	
2	19	169	MCAV	>50	11/9/16	Y	70	52	60	38	70	0	
2	19	171	MCAV	16-30	11/9/16	Y	27	22	20	15	75	0	
2	19	176	MCAV	>50	11/9/16	Y	72	50	72	50	10	0	
2	19	178	MCAV	31-50	11/9/16	Y	33	30	33	30	0	0	
2	19	181	MCAV	31-50	11/9/16	Y	35	32	35	28	5	15	D
2	G18	104	MCAV	31-50	11/9/16	Y	65	52	65	40	55	15	D
2	G18	113	MCAV	>50	11/9/16	Y	80	75	80	73	30	0	
2	G18	114	MCAV	>50	11/9/16	Y	95	75	95	73	60	3	D
2	19	166	PAST	10-15	11/9/16	Y	18	13	11	10	80	1	B
2	19	168	PAST	10-15	11/9/16	Y	20	16	18	13	30	0	
2	19	170	PAST	10-15	11/9/16	Y	10	8	10	8	0	1	B
2	19	175	PAST	16-30	11/9/16	Y	32	25	29	25	20	1	B
2	19	180	PAST	16-30	11/9/16	Y	33	25	33	24	10	1	B
2	G18	105	PAST	10-15	11/9/16	Y	15	13	15	13	0	0	
2	G18	107	PAST	16-30	11/9/16	Y	20	20	17	11	45	1	B
2	19	173	SBOU	16-30	11/9/16	Y	30	25	20	15	70	15	D

Appendix Table 5.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	19	174	SBOU	10-15	11/9/16	Y	16	12	16	12	0	0	
2	G18	110	SBOU	31-50	11/9/16	Y	36	32	36	32	8	0	
2	G18	102	SINT	10-15	11/9/16	Y	15	10	10	10	50	0	
2	19	177	SSID	10-15	11/9/16	Y	13	12	13	12	5	0	
2	19	179	SSID	16-30	11/9/16	Y	22	17	22	17	0	5	
2	G18	101	SSID	16-30	11/9/16	Y	27	25	27	25	20	0	
2	G18	108	SSID	31-50	11/9/16	Y	30	29	30	29	5	0	
2	G18	109	SSID	10-15	11/9/16	Y	15	7	8	2	90	2	D
2	G18	111	SSID	16-30	11/9/16	Y	30	29	30	29	55	0	
2	G18	112	SSID	16-30	11/9/16	N	N/A	N/A	0	0	N/A	0	

Appendix Table 6. Twelve-month demographic summary data for the relocated colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	70	ACER	31-50	4/24/17	Y	N	20	12	0	0	100	0	
1	G14	71	ACER	31-50	4/24/17	Y	Y	25	20	N/A	N/A	50	10	D
1	G14	72	ACER	31-50	4/24/17	Y	N	10	8	10	8	90	0	
1	G15	90	ACER	>50	4/24/17	Y	Y	80	27	80	27	3	0	
1	G15	96	ACER	10-15	4/24/17	Y	Y	22	20	22	20	5	0	
1	G14	67	CNAT	16-30	4/24/17	Y	N	20	19	0	0	100	0	
1	G15	74	CNAT	16-30	4/24/17	Y	N	31	25	0	0	100	0	
1	G15	83	CNAT	31-50	4/24/17	Y	N	40	38	0	0	100	0	
1	G14	12	DCLI	16-30	4/24/17	Y	N	26	25	N/A	N/A	92	3	D
1	G14	18	DCLI	31-50	4/24/17	Y	N	19	16	0	0	100	0	
1	G14	19	DCLI	>50	4/24/17	Y	N	55	44	50	35	35	0	
1	G14	25	DCLI	31-50	4/24/17	Y	N	45	30	32	23	40	0	
1	G14	41	DCLI	10-15	4/24/17	Y	N	13	12	0	0	100	0	
1	G14	49	DCLI	>50	4/24/17	Y	N	16	14	0	0	100	0	
1	G14	58	DCLI	10-15	4/24/17	Y	N	12	12	0	0	100	0	
1	G14	59	DCLI	16-30	4/24/17	Y	N	25	20	0	0	100	0	
1	G14	61	DCLI	16-30	4/24/17	Y	N	22	15	0	0	100	0	
1	G14	63	DCLI	31-50	4/24/17	Y	N	35	25	15	9	70	10	D
1	G14	66	DCLI	10-15	4/24/17	Y	N	10	9	0	0	100	0	
1	G14	69	DCLI	16-30	4/24/17	Y	N	30	16	0	0	100	0	
1	G15	77	DCLI	31-50	4/24/17	Y	N	36	27	0	0	100	0	
1	G15	84	DCLI	31-50	4/24/17	Y	N	36	30	0	0	100	0	
1	G15	85	DCLI	16-30	4/24/17	Y	Y	28	28	28	22	30	0	
1	G15	86	DCLI	16-30	4/24/17	Y	N	23	20	0	0	100	0	
1	G15	91	DCLI	31-50	4/24/17	Y	N	31	22	23	11	60	0	

Appendix Table 6. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	4	DSTO	10-15	4/24/17	Y	N	11	10	0	0	100	0	
1	G14	17	DSTO	16-30	4/24/17	Y	N	19	16	0	0	100	0	
1	G14	21	DSTO	10-15	4/24/17	Y	N	15	11	0	0	100	0	
1	G14	22	DSTO	10-15	4/24/17	Y	N	15	11	0	0	100	0	
1	G14	24	DSTO	10-15	4/24/17	Y	N	11	11	0	0	100	0	
1	G14	29	DSTO	10-15	4/24/17	Y	N	13	13	0	0	100	0	
1	G14	30	DSTO	10-15	4/24/17	Y	N	11	11	0	0	100	0	
1	G14	32	DSTO	16-30	4/24/17	Y	N	18	15	0	0	100	0	
1	G14	33	DSTO	10-15	4/24/17	Y	N	11	7	0	0	100	0	
1	G14	34	DSTO	16-30	4/24/17	Y	N	22	22	0	0	100	0	
1	G14	37	DSTO	10-15	4/24/17	Y	N	11	10	0	0	100	0	
1	G14	38	DSTO	10-15	4/24/17	Y	N	10	9	0	0	100	0	
1	G14	39	DSTO	16-30	4/24/17	Y	N	27	22	0	0	100	0	
1	G14	40	DSTO	10-15	4/24/17	Y	N	10	9	0	0	100	0	
1	G14	44	DSTO	10-15	4/24/17	Y	N	13	9	0	0	100	0	
1	G14	45	DSTO	10-15	4/24/17	Y	N	12	12	0	0	100	0	
1	G14	52	DSTO	16-30	4/24/17	Y	N	15	13	0	0	100	0	
1	G14	56	DSTO	16-30	4/24/17	Y	N	17	12	0	0	100	0	
1	G14	57	DSTO	10-15	4/24/17	Y	N	11	11	9	7	60	0	
1	G14	60	DSTO	10-15	4/24/17	Y	N	12	10	0	0	100	0	
1	G14	62	DSTO	16-30	4/24/17	Y	N	15	15	0	0	100	0	
1	G14	65	DSTO	16-30	4/24/17	Y	N	17	14	0	0	100	0	
1	G15	80	DSTO	31-50	4/24/17	Y	N	32	30	0	0	100	0	
1	G15	81	DSTO	10-15	4/24/17	Y	N	14	13	0	0	100	0	
1	G15	82	DSTO	16-30	4/24/17	Y	N	20	19	0	0	100	0	
1	G15	87	DSTO	10-15	4/24/17	Y	N	18	16	0	0	100	0	
1	G15	88	DSTO	16-30	4/24/17	Y	N	16	16	0	0	100	0	
1	G15	92	DSTO	10-15	4/24/17	Y	N	11	11	0	0	100	0	
1	G15	93	DSTO	10-15	4/24/17	Y	N	12	10	0	0	100	0	
1	G15	95	DSTO	10-15	4/24/17	Y	N	13	11	0	0	100	0	
1	G14	31	DSTR	16-30	4/24/17	Y	Y	25	21	25	21	0	0	

Appendix Table 6. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	35	MCAV	16-30	4/24/17	Y	N	30	25	8	5	90	5	D
1	G14	36	MCAV	>50	4/24/17	Y	Y	88	50	88	48	20	0	
1	G14	42	MCAV	16-30	4/24/17	Y	N	19	16	0	0	100	0	
1	G14	46	MCAV	10-15	4/24/17	Y	N	11	7	0	0	100	0	
1	G14	53	MCAV	16-30	4/24/17	Y	N	35	25	18	11	75	2	D
1	G15	73	MCAV	31-50	4/24/17	Y	Y	40	34	35	20	60	2	D
1	G15	75	MCAV	31-50	4/24/17	Y	N	30	20	0	0	100	0	
1	G15	76	MCAV	31-50	4/24/17	Y	N	60	38	60	24	50	5	D
1	G15	97	MCAV	31-50	4/24/17	Y	Y	50	35	N/A	N/A	60	10	D
1	G15	98	MCAV	16-30	4/24/17	Y	Y	34	23	29	21	15	0	
1	G14	50	MMEA	16-30	4/24/17	Y	N	26	18	0	0	100	0	
1	G14	55	MMEA	16-30	4/24/17	Y	N	16	12	0	0	100	0	
1	G14	64	PAST	10-15	4/24/17	Y	Y	15	15	15	15	5	0	
1	G14	3	SBOU	10-15	4/24/17	Y	Y	16	12	15	12	30	0	
1	G14	5	SBOU	16-30	4/24/17	Y	N	22	13	19	10	40	0	
1	G14	9	SBOU	10-15	4/24/17	Y	N	9	8	8	8	10	0	
1	G14	13	SBOU	16-30	4/24/17	Y	N	18	13	0	0	100	0	
1	G14	14	SBOU	16-30	4/24/17	Y	N	23	20	0	0	100	0	
1	G14	16	SBOU	16-30	4/24/17	Y	N	27	24	0	0	100	0	
1	G14	48	SBOU	16-30	4/24/17	Y	Y	30	26	28	26	40	0	
1	G14	54	SBOU	16-30	4/24/17	Y	Y	32	27	32	27	0	0	
1	G15	78	SBOU	31-50	4/24/17	Y	N	39	36	0	0	100	0	
1	G15	79	SBOU	16-30	4/24/17	Y	Y	26	25	26	25	0	0	
1	G15	94	SBOU	16-30	4/24/17	Y	Y	19	17	19	17	5	0	
1	G14	26	SINT	10-15	4/24/17	Y	Y	14	8	13	6	20	0	
1	G14	43	SINT	16-30	4/24/17	Y	Y	22	20	22	20	2	0	
1	G14	68	SINT	10-15	4/24/17	Y	Y	11	10	11	10	0	0	
1	G15	89	SINT	10-15	4/24/17	Y	Y	11	11	11	11	15	0	
1	G14	1	SSID	10-15	4/24/17	Y	N	8	6	8	6	10	0	D
1	G14	2	SSID	10-15	4/24/17	Y	N	11	7	11	7	20	0	
1	G14	6	SSID	10-15	4/24/17	Y	N	7	7	7	7	20	0	

Appendix Table 6. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	7	SSID	10-15	4/24/17	Y	N	10	6	7	5	30	0	
1	G14	8	SSID	10-15	4/24/17	Y	Y	10	9	9	7	20	0	
1	G14	10	SSID	10-15	4/24/17	Y	Y	9	7	8	7	10	0	D
1	G14	11	SSID	10-15	4/24/17	Y	Y	10	9	9	7	40	0	D
1	G14	15	SSID	10-15	4/24/17	Y	N	11	9	9	7	30	0	D
1	G14	20	SSID	10-15	4/24/17	Y	Y	13	10	12	10	10	0	D
1	G14	23	SSID	16-30	4/24/17	Y	N	19	10	18	8	20	0	D
1	G14	27	SSID	10-15	4/24/17	Y	N	6	5	0	0	100	0	
1	G14	28	SSID	10-15	4/24/17	Y	N	10	7	10	7	5	0	D
1	G14	47	SSID	10-15	4/24/17	Y	Y	15	13	15	13	3	0	
1	G14	51	SSID	16-30	4/24/17	Y	Y	21	16	21	16	3	0	
2	19	92	ACER	16-30	4/25/17	Y	Y	34	30	34	30	0	0	
2	G18	68	ACER	31-50	4/25/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	69	ACER	16-30	4/25/17	Y	Y	30	20	30	20	5	0	
2	G18	70	ACER	16-30	4/25/17	Y	N	7	2	0	0	100	0	
2	G18	71	ACER	31-50	4/25/17	Y	N	35	27	35	27	40	0	
2	G18	72	ACER	16-30	4/25/17	Y	N	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	73	ACER	10-15	4/25/17	Y	Y	30	25	30	25	5	0	
2	G18	74	ACER	16-30	4/25/17	Y	Y	35	22	35	22	5	0	
2	G18	75	ACER	16-30	4/25/17	Y	Y	24	16	24	16	5	0	
2	G18	76	ACER	16-30	4/25/17	Y	Y	22	20	20	5	5	0	
2	G18	6	CNAT	31-50	4/25/17	Y	N	42	32	0	0	100	0	
2	G18	22	CNAT	31-50	4/25/17	Y	N	29	26	0	0	100	0	
2	G18	34	CNAT	31-50	4/25/17	Y	N	31	31	0	0	100	0	
2	G18	66	CNAT	31-50	4/25/17	Y	N	29	24	0	0	100	0	
2	19	77	DCLI	31-50	4/25/17	Y	Y	34	29	34	29	3	0	
2	19	79	DCLI	16-30	4/25/17	Y	Y	19	15	19	15	3	0	
2	19	120	DCLI	31-50	4/25/17	Y	Y	42	25	42	23	5	0	
2	G18	5	DCLI	>50	4/25/17	Y	N	59	41	0	0	100	0	
2	G18	7	DCLI	31-50	4/25/17	Y	Y	37	30	37	30	0	0	
2	G18	12	DCLI	31-50	4/25/17	Y	N	36	29	0	0	100	0	

Appendix Table 6. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	18	DCLI	16-30	4/25/17	Y	N	21	18	0	0	100	0	
2	G18	19	DCLI	16-30	4/25/17	Y	Y	21	18	21	15	15	0	
2	G18	21	DCLI	31-50	4/25/17	Y	Y	33	25	33	25	3	0	
2	G18	26	DCLI	31-50	4/25/17	Y	Y	35	29	35	29	10	0	
2	G18	29	DCLI	16-30	4/25/17	Y	N	21	16	13	7	60	0	
2	G18	30	DCLI	16-30	4/25/17	Y	N	26	17	0	0	100	0	
2	G18	36	DCLI	31-50	4/25/17	Y	N	41	32	0	0	100	0	
2	G18	41	DCLI	16-30	4/25/17	Y	Y	32	25	24	20	4	0	
2	G18	47	DCLI	16-30	4/25/17	Y	Y	25	21	25	21	5	0	
2	G18	48	DCLI	16-30	4/25/17	Y	N	28	20	0	0	100	0	
2	G18	53	DCLI	16-30	4/25/17	Y	N	26	23	0	0	100	0	
2	G18	61	DCLI	31-50	4/25/17	Y	Y	32	30	32	30	5	0	
2	19	98	DSTO	10-15	4/25/17	Y	N	10	8	0	0	100	0	
2	19	116	DSTO	10-15	4/25/17	Y	N	11	10	0	0	100	0	
2	G18	3	DSTO	10-15	4/25/17	Y	Y	15	13	15	10	20	0	
2	G18	11	DSTO	16-30	4/25/17	Y	N	16	11	0	0	100	0	
2	G18	13	DSTO	10-15	4/25/17	Y	N	10	8	0	0	100	0	
2	G18	15	DSTO	10-15	4/25/17	Y	N	11	11	0	0	100	0	
2	G18	17	DSTO	16-30	4/25/17	Y	N	15	15	0	0	100	0	
2	G18	28	DSTO	16-30	4/25/17	Y	N	18	16	0	0	100	0	
2	G18	31	DSTO	10-15	4/25/17	Y	Y	17	15	17	15	0	0	
2	G18	33	DSTO	16-30	4/25/17	Y	N	19	14	0	0	100	0	
2	G18	37	DSTO	10-15	4/25/17	Y	N	10	10	0	0	100	0	
2	G18	40	DSTO	16-30	4/25/17	Y	N	25	23	0	0	100	0	
2	G18	46	DSTO	10-15	4/25/17	Y	N	13	11	0	0	100	0	
2	G18	52	DSTO	16-30	4/25/17	Y	Y	20	14	19	13	5	0	
2	G18	59	DSTO	16-30	4/25/17	Y	N	16	15	0	0	100	0	
2	19	85	DSTR	16-30	4/25/17	Y	Y	20	14	20	14	5	0	
2	G18	10	DSTR	16-30	4/25/17	Y	N	25	26	0	0	100	0	
2	G18	23	DSTR	31-50	4/25/17	Y	N	28	25	0	0	100	0	
2	G18	32	DSTR	31-50	4/25/17	Y	N	32	26	0	0	100	0	

Appendix Table 6.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	35	DSTR	31-50	4/25/17	Y	Y	34	32	34	32	0	0	
2	G18	45	DSTR	31-50	4/25/17	Y	N	32	23	0	0	100	0	
2	G18	49	DSTR	16-30	4/25/17	Y	Y	25	22	25	22	0	0	
2	G18	55	DSTR	>50	4/25/17	Y	N	50	48	0	0	100	0	
2	G18	64	DSTR	31-50	4/25/17	Y	N	28	22	0	0	100	0	
2	G18	1	ISIN	10-15	4/25/17	Y	N	11	8	0	0	100	0	
2	19	91	MCAV	31-50	4/25/17	Y	N	28	30	24	20	20	10	D
2	19	118	MCAV	31-50	4/25/17	Y	N	34	30	25	15	60	5	D
2	G18	51	MCAV	31-50	4/25/17	Y	Y	38	32	38	32	5	0	
2	G18	8	MMEA	10-15	4/25/17	Y	N	16	15	0	0	100	0	
2	19	78	SBOU	16-30	4/25/17	Y	Y	21	15	21	15	5	0	
2	19	80	SBOU	31-50	4/25/17	Y	Y	31	20	31	20	5	0	
2	19	81	SBOU	31-50	4/25/17	Y	N	32	20	32	20	20	0	
2	19	82	SBOU	16-30	4/25/17	Y	Y	21	15	21	15	15	0	
2	19	83	SBOU	31-50	4/25/17	Y	Y	35	25	35	24	10	0	
2	19	86	SBOU	16-30	4/25/17	Y	Y	16	12	16	12	0	0	
2	19	87	SBOU	10-15	4/25/17	Y	Y	12	10	12	10	20	0	
2	19	88	SBOU	31-50	4/25/17	Y	Y	37	30	30	29	15	0	
2	19	90	SBOU	10-15	4/25/17	Y	Y	14	9	14	9	2	0	
2	19	93	SBOU	31-50	4/25/17	Y	Y	41	38	41	32	15	0	
2	19	94	SBOU	16-30	4/25/17	Y	Y	15	14	15	14	5	0	
2	19	95	SBOU	31-50	4/25/17	Y	Y	35	31	35	31	3	0	
2	19	96	SBOU	16-30	4/25/17	Y	N	21	19	21	19	2	0	
2	19	97	SBOU	31-50	4/25/17	Y	Y	33	25	33	25	0	0	
2	19	119	SBOU	16-30	4/25/17	Y	N	25	15	17	15	40	0	
2	19	121	SBOU	31-50	4/25/17	Y	N	32	28	30	26	30	0	
2	G18	4	SBOU	>50	4/25/17	Y	Y	54	40	54	35	20	0	
2	G18	14	SBOU	10-15	4/25/17	Y	N	13	11	10	7	60	10	D
2	G18	16	SBOU	16-30	4/25/17	Y	Y	17	14	17	14	0	0	
2	G18	38	SBOU	16-30	4/25/17	Y	N	19	18	17	14	50	0	
2	G18	39	SBOU	31-50	4/25/17	Y	N	35	23	30	21	20	0	

Appendix Table 6. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	50	SBOU	31-50	4/25/17	Y	Y	38	30	38	30	10	0	
2	G18	54	SBOU	16-30	4/25/17	Y	Y	16	15	16	15	0	0	
2	G18	56	SBOU	>50	4/25/17	Y	Y	58	38	50	38	20	0	
2	G18	60	SBOU	16-30	4/25/17	Y	N	25	25	20	17	50	0	
2	G18	65	SBOU	31-50	4/25/17	Y	Y	35	33	35	33	5	0	
2	19	115	SINT	16-30	4/25/17	Y	Y	16	12	16	12	3	0	
2	19	117	SINT	16-30	4/25/17	Y	Y	34	27	34	27	10	0	
2	G18	2	SINT	10-15	4/25/17	Y	Y	15	15	15	15	3	0	
2	G18	24	SINT	16-30	4/25/17	Y	Y	21	17	21	17	3	0	
2	G18	25	SINT	10-15	4/25/17	Y	Y	12	10	12	10	0	0	
2	G18	27	SINT	16-30	4/25/17	Y	Y	21	20	21	20	3	0	
2	G18	42	SINT	16-30	4/25/17	Y	Y	29	27	26	25	10	0	
2	G18	44	SINT	10-15	4/25/17	Y	Y	18	13	18	13	5	0	
2	G18	57	SINT	16-30	4/25/17	Y	N	28	26	N/A	N/A	20	0	
2	G18	58	SINT	16-30	4/25/17	Y	N	22	15	22	15	5	0	
2	G18	62	SINT	10-15	4/25/17	Y	Y	13	12	12	12	10	0	
2	G18	63	SINT	10-15	4/25/17	Y	Y	11	10	10	10	10	0	
2	G18	67	SINT	16-30	4/25/17	Y	Y	21	19	20	18	5	0	
2	19	84	SSID	10-15	4/25/17	Y	Y	9	7	7	5	20	0	
2	19	89	SSID	10-15	4/25/17	Y	N	12	8	12	8	3	0	
2	19	99	SSID	10-15	4/25/17	Y	Y	9	7	9	7	5	0	
2	G18	9	SSID	10-15	4/25/17	Y	Y	15	14	15	14	3	0	
2	G18	20	SSID	10-15	4/25/17	Y	N	11	10	11	10	5	0	
2	G18	43	SSID	10-15	4/25/17	Y	Y	14	13	13	13	15	0	
3	99	137	CNAT	31-50	4/25/17	Y	Y	45	40	45	35	10	0	
3	99	136	DSTR	>50	4/25/17	Y	Y	75	65	75	65	5	0	
3	99	139	DSTR	>50	4/25/17	Y	Y	90	90	90	90	5	0	
3	99	140	DSTR	>50	4/25/17	Y	N	55	50	45	40	20	0	
3	99	135	SBOU	31-50	4/25/17	Y	N	37	30	30	27	20	0	
3	99	138	SBOU	31-50	4/25/17	Y	Y	50	40	50	40	10	0	

Appendix Table 7. Twelve-month demographic summary data for the control colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	121	AAGA	16-30	4/24/17	Y	21	15	21	15	0	0	
1	G14	117	DCLI	16-30	4/24/17	Y	17	15	0	0	100	0	
1	G15	105	DCLI	31-50	4/24/17	Y	34	25	34	25	2	0	
1	G15	109	DCLI	16-30	4/24/17	Y	17	15	0	0	100	0	
1	G14	124	DLAB	>50	4/24/17	Y	80	75	0	0	100	0	
1	G14	128	DSTO	10-15	4/24/17	Y	17	15	0	0	100	0	
1	G15	104	DSTO	10-15	4/24/17	Y	15	12	0	0	100	0	
1	G15	108	DSTO	16-30	4/24/17	Y	23	18	0	0	100	0	
1	G15	113	DSTO	10-15	4/24/17	Y	15	14	0	0	100	0	
1	G14	130	DSTR	>50	4/24/17	Y	80	30	0	0	100	0	
1	G15	100	DSTR	10-15	4/24/17	Y	12	10	0	0	100	0	
1	G15	106	DSTR	10-15	4/24/17	Y	13	11	0	0	100	0	
1	G14	118	MCAV	16-30	4/24/17	Y	27	15	0	0	100	0	
1	G14	119	MCAV	>50	4/24/17	Y	82	60	0	0	100	0	
1	G14	125	MCAV	31-50	4/24/17	Y	45	38	45	38	2	0	
1	G14	126	MCAV	>50	4/24/17	Y	95	84	80	70	30	20	D
1	G14	129	MCAV	>50	4/24/17	Y	75	30	36	23	70	5	D
1	G14	132	MCAV	16-30	4/24/17	Y	26	20	26	20	25	0	
1	G14	133	MCAV	31-50	4/24/17	Y	35	30	35	30	5	0	
1	G15	107	MCAV	31-50	4/24/17	Y	40	35	40	35	2	0	
1	G15	114	MCAV	31-50	4/24/17	Y	40	38	40	38	5	0	
1	G14	115	PAST	10-15	4/24/17	Y	12	6	12	6	0	0	
1	G14	116	PAST	10-15	4/24/17	Y	11	7	11	7	5	0	
1	G14	120	PAST	16-30	4/24/17	Y	23	14	23	14	10	0	
1	G14	123	PAST	16-30	4/24/17	Y	20	16	20	16	5	0	

Appendix Table 7. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	127	PAST	10-15	4/24/17	Y	15	11	15	11	5	0	
1	G14	134	PAST	16-30	4/24/17	Y	15	13	15	13	10	0	
1	G15	101	PAST	10-15	4/24/17	Y	14	9	14	9	5	0	
1	G15	102	PAST	10-15	4/24/17	Y	10	7	10	7	0	0	
1	G15	111	PAST	10-15	4/24/17	Y	15	6	15	6	5	0	
1	G14	122	SINT	16-30	4/24/17	Y	21	20	21	20	10	0	
1	G15	112	SINT	10-15	4/24/17	Y	17	14	17	14	5	0	
1	G14	131	SSID	16-30	4/24/17	Y	21	20	20	20	20	0	
1	G15	103	SSID	16-30	4/24/17	Y	24	16	24	16	10	0	
1	G15	110	SSID	16-30	4/24/17	Y	24	15	24	15	5	0	
2	19	167	ACER	>50	4/25/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	19	172	ACER	16-30	4/25/17	Y	45	40	40	30	50	0	
2	G18	100	DCLI	16-30	4/25/17	Y	67	50	14	13	85	0	
2	G18	103	DSTO	10-15	4/25/17	Y	15	12	0	0	100	0	
2	G18	106	MANN	16-30	4/25/17	Y	33	30	30	30	10	0	
2	19	169	MCAV	>50	4/25/17	Y	65	55	N/A	N/A	70	5	D
2	19	171	MCAV	16-30	4/25/17	Y	20	20	N/A	N/A	80	5	D
2	19	176	MCAV	>50	4/25/17	Y	58	50	58	50	10	0	
2	19	178	MCAV	31-50	4/25/17	Y	35	30	35	30	0	0	
2	19	181	MCAV	31-50	4/25/17	Y	37	35	18	15	80	0	
2	G18	104	MCAV	31-50	4/25/17	Y	58	45	N/A	N/A	90	5	D
2	G18	113	MCAV	>50	4/25/17	Y	69	58	58	52	15	5	D
2	G18	114	MCAV	>50	4/25/17	Y	98	70	N/A	N/A	60	5	D
2	19	166	PAST	10-15	4/25/17	Y	7	7	7	6	10	0	
2	19	168	PAST	10-15	4/25/17	Y	16	13	16	13	5	0	
2	19	170	PAST	10-15	4/25/17	Y	9	8	8	7	10	0	
2	19	175	PAST	16-30	4/25/17	Y	28	21	28	21	10	0	
2	19	180	PAST	16-30	4/25/17	Y	33	28	33	28	10	0	
2	G18	105	PAST	10-15	4/25/17	Y	14	12	14	12	5	0	
2	G18	107	PAST	16-30	4/25/17	Y	20	15	20	15	10	0	
2	19	173	SBOU	16-30	4/25/17	Y	30	25	15	10	80	0	

Appendix Table 7. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	19	174	SBOU	10-15	4/25/17	Y	15	12	15	12	5	0	D
2	G18	110	SBOU	31-50	4/25/17	Y	32	30	32	30	5	0	
2	G18	102	SINT	10-15	4/25/17	Y	14	10	N/A	N/A	25	0	
2	19	177	SSID	10-15	4/25/17	Y	12	12	10	10	40	5	
2	19	179	SSID	16-30	4/25/17	Y	23	15	23	15	5	0	
2	G18	101	SSID	16-30	4/25/17	Y	27	24	26	21	20	0	
2	G18	108	SSID	31-50	4/25/17	Y	30	27	30	27	5	0	
2	G18	109	SSID	10-15	4/25/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	111	SSID	16-30	4/25/17	Y	32	25	32	25	50	0	
2	G18	112	SSID	16-30	4/25/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

Appendix Table 8. Eighteen-month demographic summary data for the relocated colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	70	ACER	31-50	10/26/17	Y	N	20	12	0	0	100	0	
1	G14	71	ACER	31-50	10/26/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G14	72	ACER	31-50	10/26/17	Y	N	10	6	2	2	98	0	
1	G15	90	ACER	>50	10/26/17	N	N	N/A	N/A	N/A	N/A	100	0	
1	G15	96	ACER	10-15	10/26/17	Y	N	15	7	1	1	95	0	
1	G14	67	CNAT	16-30	10/26/17	Y	N	20	19	0	0	100	0	
1	G15	74	CNAT	16-30	10/26/17	Y	N	31	25	0	0	100	0	
1	G15	83	CNAT	31-50	10/26/17	Y	N	40	38	0	0	100	0	
1	G14	12	DCLI	16-30	10/26/17	Y	N	26	25	3	2	95	0	
1	G14	18	DCLI	31-50	10/26/17	Y	N	19	16	0	0	100	0	
1	G14	19	DCLI	>50	10/26/17	Y	Y	55	35	50	35	15	0	
1	G14	25	DCLI	31-50	10/26/17	Y	Y	45	29	34	23	30	0	
1	G14	41	DCLI	10-15	10/26/17	Y	N	13	12	0	0	100	0	
1	G14	49	DCLI	>50	10/26/17	Y	Y	70	43	61	43	10	0	
1	G14	58	DCLI	10-15	10/26/17	Y	N	12	12	0	0	100	0	
1	G14	59	DCLI	16-30	10/26/17	Y	N	25	20	0	0	100	0	
1	G14	61	DCLI	16-30	10/26/17	Y	N	N/A	N/A	N/A	N/A	N/A	N/A	
1	G14	63	DCLI	31-50	10/26/17	Y	N	35	25	0	0	100	0	
1	G14	66	DCLI	10-15	10/26/17	Y	N	10	9	0	0	100	0	
1	G14	69	DCLI	16-30	10/26/17	Y	N	30	16	0	0	100	0	
1	G15	77	DCLI	31-50	10/26/17	Y	N	36	27	0	0	100	0	
1	G15	84	DCLI	31-50	10/26/17	Y	N	36	30	0	0	100	0	
1	G15	85	DCLI	16-30	10/26/17	Y	Y	28	21	26	20	30	0	
1	G15	86	DCLI	16-30	10/26/17	Y	N	23	20	0	0	100	0	
1	G15	91	DCLI	31-50	10/26/17	Y	N	31	27	20	12	60	0	

Appendix Table 8.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	4	DSTO	10-15	10/26/17	Y	N	11	10	0	0	100	0	
1	G14	17	DSTO	16-30	10/26/17	Y	N	19	16	0	0	100	0	
1	G14	21	DSTO	10-15	10/26/17	Y	N	15	11	0	0	100	0	
1	G14	22	DSTO	10-15	10/26/17	Y	N	15	11	0	0	100	0	
1	G14	24	DSTO	10-15	10/26/17	Y	N	11	11	0	0	100	0	
1	G14	29	DSTO	10-15	10/26/17	Y	N	13	13	0	0	100	0	
1	G14	30	DSTO	10-15	10/26/17	Y	N	11	11	0	0	100	0	
1	G14	32	DSTO	16-30	10/26/17	Y	N	18	15	0	0	100	0	
1	G14	33	DSTO	10-15	10/26/17	Y	N	11	7	0	0	100	0	
1	G14	34	DSTO	16-30	10/26/17	Y	N	22	22	0	0	100	0	
1	G14	37	DSTO	10-15	10/26/17	Y	N	11	10	0	0	100	0	
1	G14	38	DSTO	10-15	10/26/17	Y	N	10	9	0	0	100	0	
1	G14	39	DSTO	16-30	10/26/17	Y	N	27	22	0	0	100	0	
1	G14	40	DSTO	10-15	10/26/17	Y	N	10	9	0	0	100	0	
1	G14	44	DSTO	10-15	10/26/17	Y	N	13	9	0	0	100	0	
1	G14	45	DSTO	10-15	10/26/17	Y	N	12	12	0	0	100	0	
1	G14	52	DSTO	16-30	10/26/17	Y	N	15	13	0	0	100	0	
1	G14	56	DSTO	16-30	10/26/17	Y	N	17	12	0	0	100	0	
1	G14	57	DSTO	10-15	10/26/17	Y	N	13	11	8	7	35	0	
1	G14	60	DSTO	10-15	10/26/17	Y	N	12	10	0	0	100	0	
1	G14	62	DSTO	16-30	10/26/17	Y	N	15	15	0	0	100	0	
1	G14	65	DSTO	16-30	10/26/17	Y	N	17	14	0	0	100	0	
1	G15	80	DSTO	31-50	10/26/17	Y	N	32	30	0	0	100	0	
1	G15	81	DSTO	10-15	10/26/17	Y	N	14	13	0	0	100	0	
1	G15	82	DSTO	16-30	10/26/17	Y	N	20	19	0	0	100	0	
1	G15	87	DSTO	10-15	10/26/17	Y	N	18	16	0	0	100	0	
1	G15	88	DSTO	16-30	10/26/17	Y	N	16	16	0	0	100	0	
1	G15	92	DSTO	10-15	10/26/17	Y	N	11	11	0	0	100	0	
1	G15	93	DSTO	10-15	10/26/17	Y	N	12	10	0	0	100	0	
1	G15	95	DSTO	10-15	10/26/17	Y	N	13	11	0	0	100	0	
1	G14	31	DSTR	16-30	10/26/17	Y	Y	25	21	25	21	1	0	

Appendix Table 8.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue			Condition	
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	35	MCAV	16-30	10/26/17	Y	N	30	25	0	0	100	0	
1	G14	36	MCAV	>50	10/26/17	Y	Y	88	45	88	45	5	0	
1	G14	42	MCAV	16-30	10/26/17	Y	N	19	16	0	0	100	0	
1	G14	46	MCAV	10-15	10/26/17	Y	N	11	7	0	0	100	0	
1	G14	53	MCAV	16-30	10/26/17	Y	N	35	25	0	0	100	0	
1	G15	73	MCAV	31-50	10/26/17	Y	N	40	30	16	10	80	5	D
1	G15	75	MCAV	31-50	10/26/17	Y	N	30	20	0	0	100	0	
1	G15	76	MCAV	31-50	10/26/17	Y	N	60	40	35	12	35	10	D
1	G15	97	MCAV	31-50	10/26/17	Y	N	50	20	N/A	N/A	60	15	D
1	G15	98	MCAV	16-30	10/26/17	Y	Y	34	20	31	20	15	0	
1	G14	50	MMEA	16-30	10/26/17	Y	N	26	18	0	0	100	0	
1	G14	55	MMEA	16-30	10/26/17	Y	N	16	12	0	0	100	0	
1	G14	64	PAST	10-15	10/26/17	Y	Y	16	14	16	14	5	1	
1	G14	3	SBOU	10-15	10/26/17	Y	Y	16	13	15	13	30	10	Snail pred
1	G14	5	SBOU	16-30	10/26/17	Y	N	22	15	13	10	85	3	D
1	G14	9	SBOU	10-15	10/26/17	Y	N	9	9	9	9	10	5	D
1	G14	13	SBOU	16-30	10/26/17	Y	N	18	13	0	0	100	0	
1	G14	14	SBOU	16-30	10/26/17	Y	N	23	20	0	0	100	0	
1	G14	16	SBOU	16-30	10/26/17	Y	N	27	24	0	0	100	0	
1	G14	48	SBOU	16-30	10/26/17	Y	N	30	23	11	11	50	0	
1	G14	54	SBOU	16-30	10/26/17	Y	Y	32	24	32	24	5	0	
1	G15	78	SBOU	31-50	10/26/17	Y	N	39	36	0	0	100	0	
1	G15	79	SBOU	16-30	10/26/17	N	N	26	24	26	24	5	2	D
1	G15	94	SBOU	16-30	10/26/17	Y	N	19	17	18	15	20	10	D
1	G14	26	SINT	10-15	10/26/17	Y	Y	15	6	15	6	5	0	
1	G14	43	SINT	16-30	10/26/17	Y	Y	22	20	22	20	1	0	
1	G14	68	SINT	10-15	10/26/17	Y	N	15	12	11	9	50	0	
1	G15	89	SINT	10-15	10/26/17	Y	Y	12	11	12	11	10	0	
1	G14	1	SSID	10-15	10/26/17	Y	Y	9	6	6	2	2	0	D
1	G14	2	SSID	10-15	10/26/17	Y	Y	11	9	11	9	20	0	
1	G14	6	SSID	10-15	10/26/17	Y	Y	8	8	8	8	0	0	

Appendix Table 8.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	7	SSID	10-15	10/26/17	Y	N	10	8	8	5	30	0	D
1	G14	8	SSID	10-15	10/26/17	Y	Y	10	8	9	8	15	0	
1	G14	10	SSID	10-15	10/26/17	Y	Y	9	7	9	7	10	0	D
1	G14	11	SSID	10-15	10/26/17	Y	N	10	9	7	7	40	0	D
1	G14	15	SSID	10-15	10/26/17	Y	Y	12	7	12	7	20	0	D
1	G14	20	SSID	10-15	10/26/17	Y	Y	13	11	13	11	3	0	D
1	G14	23	SSID	16-30	10/26/17	Y	N	19	8	17	8	5	0	
1	G14	27	SSID	10-15	10/26/17	Y	N	6	5	N/A	N/A	80	0	
1	G14	28	SSID	10-15	10/26/17	Y	N	10	6	10	6	5	0	
1	G14	47	SSID	10-15	10/26/17	Y	Y	13	12	11	11	1	1	
1	G14	51	SSID	16-30	10/26/17	Y	N	21	15	18	15	10	0	
2	19	92	ACER	16-30	10/24/17	Y	Y	33	20	33	20	0	0	
2	G18	68	ACER	31-50	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	69	ACER	16-30	10/24/17	Y	Y	30	19	30	2	55	0	
2	G18	70	ACER	16-30	10/24/17	Y	N	7	2	0	0	100	0	
2	G18	71	ACER	31-50	10/24/17	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	72	ACER	16-30	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	73	ACER	10-15	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	74	ACER	16-30	10/24/17	Y	N	23	17	1	1	99	0	
2	G18	75	ACER	16-30	10/24/17	Y	Y	19	15	19	15	0	0	
2	G18	76	ACER	16-30	10/24/17	Y	Y	20	10	1	1	85	0	
2	G18	6	CNAT	31-50	10/24/17	Y	N	42	32	0	0	100	0	
2	G18	22	CNAT	31-50	10/24/17	Y	N	29	26	0	0	100	0	
2	G18	34	CNAT	31-50	10/24/17	Y	N	31	31	0	0	100	0	
2	G18	66	CNAT	31-50	10/24/17	Y	N	29	24	0	0	100	0	
2	19	77	DCLI	31-50	10/24/17	Y	N	33	30	33	30	5	0	
2	19	79	DCLI	16-30	10/24/17	Y	N	16	14	16	14	0	0	
2	19	120	DCLI	31-50	10/24/17	Y	Y	42	25	40	25	2	0	
2	G18	5	DCLI	>50	10/24/17	Y	N	59	41	0	0	100	0	
2	G18	7	DCLI	31-50	10/24/17	Y	N	36	19	36	19	5	0	
2	G18	12	DCLI	31-50	10/24/17	Y	N	36	29	0	0	100	0	

Appendix Table 8.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	18	DCLI	16-30	10/24/17	Y	N	21	18	0	0	100	0	
2	G18	19	DCLI	16-30	10/24/17	Y	N	20	15	20	15	1	0	
2	G18	21	DCLI	31-50	10/24/17	Y	N	31	26	31	26	0	0	
2	G18	26	DCLI	31-50	10/24/17	Y	N	37	34	37	33	5	0	
2	G18	29	DCLI	16-30	10/24/17	Y	N	21	15	11	8	75	0	
2	G18	30	DCLI	16-30	10/24/17	Y	N	26	17	0	0	100	0	
2	G18	36	DCLI	31-50	10/24/17	Y	N	41	32	0	0	100	0	
2	G18	41	DCLI	16-30	10/24/17	Y	N	32	21	19	19	50	0	
2	G18	47	DCLI	16-30	10/24/17	Y	Y	25	21	25	21	1	0	
2	G18	48	DCLI	16-30	10/24/17	Y	N	28	20	0	0	100	0	
2	G18	53	DCLI	16-30	10/24/17	Y	N	26	23	0	0	100	0	
2	G18	61	DCLI	31-50	10/24/17	Y	Y	32	31	32	31	2	0	
2	19	98	DSTO	10-15	10/24/17	Y	N	10	8	0	0	100	0	
2	19	116	DSTO	10-15	10/24/17	Y	N	11	10	0	0	100	0	
2	G18	3	DSTO	10-15	10/24/17	Y	N	15	13	15	11	15	0	
2	G18	11	DSTO	16-30	10/24/17	Y	N	16	11	0	0	100	0	
2	G18	13	DSTO	10-15	10/24/17	Y	N	10	8	0	0	100	0	
2	G18	15	DSTO	10-15	10/24/17	Y	N	11	11	0	0	100	0	
2	G18	17	DSTO	16-30	10/24/17	Y	N	15	15	0	0	100	0	
2	G18	28	DSTO	16-30	10/24/17	Y	N	18	16	0	0	100	0	
2	G18	31	DSTO	10-15	10/24/17	Y	Y	16	14	16	14	2	0	
2	G18	33	DSTO	16-30	10/24/17	Y	N	19	14	0	0	100	0	
2	G18	37	DSTO	10-15	10/24/17	Y	N	10	10	0	0	100	0	
2	G18	40	DSTO	16-30	10/24/17	Y	N	25	23	0	0	100	0	
2	G18	46	DSTO	10-15	10/24/17	Y	N	13	11	0	0	100	0	
2	G18	52	DSTO	16-30	10/24/17	Y	Y	20	14	20	13	5	20	D
2	G18	59	DSTO	16-30	10/24/17	Y	N	16	15	0	0	100	0	
2	19	85	DSTR	16-30	10/24/17	Y	N	20	16	17	14	20	0	
2	G18	10	DSTR	16-30	10/24/17	Y	N	25	26	0	0	100	0	
2	G18	23	DSTR	31-50	10/24/17	Y	N	28	25	0	0	100	0	
2	G18	32	DSTR	31-50	10/24/17	Y	N	32	26	0	0	100	0	

Appendix Table 8.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	35	DSTR	31-50	1/9/18	Y	N	41	35	35	28	25	0	
2	G18	45	DSTR	31-50	10/24/17	Y	N	32	23	0	0	100	0	
2	G18	49	DSTR	16-30	10/24/17	Y	Y	23	23	23	23	1	0	
2	G18	55	DSTR	>50	10/24/17	Y	N	50	48	0	0	100	0	
2	G18	64	DSTR	31-50	10/24/17	Y	N	28	22	0	0	100	0	
2	G18	1	ISIN	10-15	10/24/17	Y	N	11	8	0	0	100	0	
2	19	91	MCAV	31-50	10/24/17	Y	N	32	26	11	11	85	5	D
2	19	118	MCAV	31-50	10/24/17	Y	N	34	28	0	0	100	0	
2	G18	51	MCAV	31-50	10/24/17	Y	Y	39	35	39	35	10	0	
2	G18	8	MMEA	10-15	10/24/17	Y	N	16	15	0	0	100	0	
2	19	78	SBOU	16-30	10/24/17	Y	N	21	14	17	4	15	0	
2	19	80	SBOU	31-50	10/24/17	Y	N	28	20	26	19	10	0	
2	19	81	SBOU	31-50	10/24/17	Y	N	32	20	23	21	60	0	PB
2	19	82	SBOU	16-30	10/24/17	Y	Y	22	17	20	17	50	0	PB
2	19	83	SBOU	31-50	10/24/17	Y	N	33	31	24	29	35	0	
2	19	86	SBOU	16-30	10/24/17	Y	Y	16	11	16	11	0	0	
2	19	87	SBOU	10-15	10/24/17	Y	N	12	9	6	4	80	0	
2	19	88	SBOU	31-50	10/24/17	Y	Y	37	34	32	25	30	0	
2	19	90	SBOU	10-15	10/24/17	Y	N	11	10	8	8	20	0	
2	19	93	SBOU	31-50	10/24/17	Y	N	41	34	25	22	20	0	
2	19	94	SBOU	16-30	10/24/17	Y	N	15	12	0	0	100	0	
2	19	95	SBOU	31-50	10/24/17	Y	N	35	29	35	29	10	0	
2	19	96	SBOU	16-30	10/24/17	Y	N	23	21	18	17	35	0	
2	19	97	SBOU	31-50	10/24/17	Y	N	33	21	27	21	25	0	
2	19	119	SBOU	16-30	10/24/17	Y	N	28	19	18	18	40	0	
2	19	121	SBOU	31-50	10/24/17	Y	N	32	32	32	29	35	0	
2	G18	4	SBOU	>50	10/24/17	Y	Y	56	45	56	36	15	0	
2	G18	14	SBOU	10-15	10/24/17	Y	N	11	11	0	0	100	0	
2	G18	16	SBOU	16-30	10/24/17	Y	N	17	15	17	15	0	0	
2	G18	38	SBOU	16-30	10/24/17	Y	N	19	15	12	12	60	0	
2	G18	39	SBOU	31-50	10/24/17	Y	N	35	25	26	22	45	0	

Appendix Table 8.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	G18	50	SBOU	31-50	10/24/17	Y	Y	38	30	37	30	10	0	
2	G18	54	SBOU	16-30	10/24/17	Y	Y	17	15	17	15	1	0	
2	G18	56	SBOU	>50	10/24/17	Y	Y	58	50	56	45	25	0	
2	G18	60	SBOU	16-30	10/24/17	Y	Y	25	23	N/A	N/A	55	0	
2	G18	65	SBOU	31-50	10/24/17	Y	Y	39	32	39	32	0	0	
2	19	115	SINT	16-30	10/24/17	Y	Y	15	14	15	14	2	0	
2	19	117	SINT	16-30	10/24/17	Y	Y	34	28	34	28	10	0	
2	G18	2	SINT	10-15	10/24/17	Y	Y	15	14	15	14	5	0	
2	G18	24	SINT	16-30	10/24/17	Y	Y	19	17	19	17	60	0	
2	G18	25	SINT	10-15	10/24/17	Y	Y	11	10	11	10	1	0	
2	G18	27	SINT	16-30	1/9/18	Y	N	22	17	17	17	10	0	
2	G18	42	SINT	16-30	10/24/17	Y	Y	28	26	N/A	N/A	20	0	
2	G18	44	SINT	10-15	10/24/17	Y	Y	18	14	18	11	70	0	
2	G18	57	SINT	16-30	10/24/17	Y	N	28	19	N/A	N/A	30	0	
2	G18	58	SINT	16-30	10/24/17	Y	Y	22	15	22	15	5	0	
2	G18	62	SINT	10-15	10/24/17	Y	Y	13	12	12	12	10	0	
2	G18	63	SINT	10-15	10/24/17	Y	Y	11	9	N/A	N/A	20	0	
2	G18	67	SINT	16-30	10/24/17	Y	Y	20	19	20	19	5	0	
2	19	84	SSID	10-15	10/24/17	Y	N	8	6	N/A	N/A	98	0	
2	19	89	SSID	10-15	10/24/17	Y	N	11	10	10	10	10	0	PB
2	19	99	SSID	10-15	10/24/17	Y	Y	8	7	7	7	10	0	
2	G18	9	SSID	10-15	10/24/17	Y	Y	15	14	15	14	3	0	
2	G18	20	SSID	10-15	10/24/17	Y	N	11	9	11	9	5	0	
2	G18	43	SSID	10-15	10/24/17	Y	Y	17	16	6	4	90	0	
3	99	137	CNAT	31-50	10/26/17	Y	Y	43	38	43	38	1	0	
3	99	136	DSTR	>50	10/26/17	Y	Y	74	63	74	60	5	0	
3	99	139	DSTR	>50	10/26/17	Y	Y	80	70	80	70	0	0	
3	99	140	DSTR	>50	10/26/17	Y	Y	51	41	45	41	1	0	
3	99	135	SBOU	31-50	10/26/17	Y	Y	36	28	31	26	30	0	
3	99	138	SBOU	31-50	10/26/17	Y	Y	45	42	45	41	1	0	

Appendix Table 9. Eighteen-month demographic summary data for the control colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	121	AAGA	16-30	10/26/17	Y	21	11	21	11	5	0	
1	G14	117	DCLI	16-30	10/26/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G15	105	DCLI	31-50	10/26/17	Y	34	27	33	25	15	2	D
1	G15	109	DCLI	16-30	10/26/17	Y	17	15	0	0	100	0	
1	G14	124	DLAB	>50	10/26/17	Y	80	75	0	0	100	0	
1	G14	128	DSTO	10-15	10/26/17	Y	17	15	0	0	100	0	
1	G15	104	DSTO	10-15	10/26/17	Y	15	12	0	0	100	0	
1	G15	108	DSTO	16-30	10/26/17	Y	23	18	0	0	100	0	
1	G15	113	DSTO	10-15	10/26/17	Y	15	14	0	0	100	0	
1	G14	130	DSTR	>50	10/26/17	Y	80	30	0	0	100	0	
1	G15	100	DSTR	10-15	10/26/17	Y	12	10	0	0	100	0	
1	G15	106	DSTR	10-15	10/26/17	Y	13	11	0	0	100	0	
1	G14	118	MCAV	16-30	10/26/17	Y	27	15	0	0	100	0	
1	G14	119	MCAV	>50	10/26/17	Y	82	60	0	0	100	0	
1	G14	125	MCAV	31-50	10/26/17	Y	45	39	45	39	1	0	
1	G14	126	MCAV	>50	10/26/17	Y	96	76	N/A	N/A	30	0	
1	G14	129	MCAV	>50	10/26/17	Y	61	35	37	25	60	0	
1	G14	132	MCAV	16-30	10/26/17	Y	25	15	22	15	10	1	
1	G14	133	MCAV	31-50	10/26/17	Y	36	28	36	28	1	0	
1	G15	107	MCAV	31-50	10/26/17	Y	40	30	40	30	25	0	
1	G15	114	MCAV	31-50	10/26/17	Y	40	20	40	20	10	0	
1	G14	115	PAST	10-15	10/26/17	Y	13	7	13	7	0	0	
1	G14	116	PAST	10-15	10/26/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G14	120	PAST	16-30	10/26/17	Y	23	13	23	13	2	0	
1	G14	123	PAST	16-30	10/26/17	Y	22	28	N/A	N/A	30	0	

Appendix Table 9. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	127	PAST	10-15	10/26/17	Y	14	11	14	11	0	0	
1	G14	134	PAST	16-30	10/26/17	Y	15	15	15	15	3	5	B
1	G15	101	PAST	10-15	10/26/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G15	102	PAST	10-15	10/26/17	Y	10	9	10	9	5	0	
1	G15	111	PAST	10-15	10/26/17	Y	15	9	15	7	30	0	
1	G14	122	SINT	16-30	10/26/17	Y	21	19	21	19	20	0	
1	G15	112	SINT	10-15	10/26/17	Y	17	15	17	15	10	0	
1	G14	131	SSID	16-30	10/26/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G15	103	SSID	16-30	10/26/17	Y	25	20	25	20	5	2	D
1	G15	110	SSID	16-30	10/26/17	Y	24	17	24	17	2	0	
2	19	167	ACER	>50	10/24/17	Y	45	38	40	32	60	0	
2	19	172	ACER	16-30	10/24/17	Y	16	13	0	0	100	0	
2	G18	100	DCLI	16-30	10/24/17	Y	63	45	12	11	93	0	
2	G18	103	DSTO	10-15	10/24/17	Y	15	12	0	0	100	0	
2	G18	106	MANN	16-30	10/24/17	Y	32	30	32	30	10	0	
2	19	169	MCAV	>50	10/24/17	Y	67	46	N/A	N/A	65	1	D
2	19	171	MCAV	16-30	10/24/17	Y	20	19	N/A	N/A	70	0	
2	19	176	MCAV	>50	10/24/17	Y	58	27	0	0	100	0	
2	19	178	MCAV	31-50	10/24/17	Y	35	29	35	29	5	0	
2	19	181	MCAV	31-50	10/24/17	Y	37	32	9	7	90	2	D
2	G18	104	MCAV	31-50	1/9/18	Y	58	56	12	5	95	0	
2	G18	113	MCAV	>50	1/9/18	Y	60	56	54	43	80	0	
2	G18	114	MCAV	>50	10/24/17	Y	98	75	N/A	N/A	95	1	D
2	19	166	PAST	10-15	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	19	168	PAST	10-15	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	19	170	PAST	10-15	10/24/17	N	10	9	10	9	2	0	
2	19	175	PAST	16-30	10/24/17	Y	28	21	28	19	2	3	
2	19	180	PAST	16-30	10/24/17	Y	33	27	33	27	10	0	
2	G18	105	PAST	10-15	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	107	PAST	16-30	10/24/17	Y	20	13	20	13	5	0	
2	19	173	SBOU	16-30	10/24/17	Y	30	23	6	6	95	0	

Appendix Table 9. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	19	174	SBOU	10-15	10/24/17	Y	17	13	17	13	1	0	PB
2	G18	110	SBOU	31-50	10/24/17	Y	33	33	N/A	N/A	10	0	
2	G18	102	SINT	10-15	10/24/17	Y	14	11	N/A	N/A	45	0	
2	19	177	SSID	10-15	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	19	179	SSID	16-30	10/24/17	Y	23	17	23	17	5	0	
2	G18	101	SSID	16-30	10/24/17	Y	30	24	23	22	40	0	
2	G18	108	SSID	31-50	10/24/17	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	109	SSID	10-15	10/24/17	Y	18	12	N/A	N/A	0	0	
2	G18	111	SSID	16-30	10/24/17	Y	32	26	N/A	N/A	50	0	
2	G18	112	SSID	16-30	10/24/17	N	N/A	N/A	N/A	N/A	N/A	N/A	

Appendix Table 10. Twenty-four-month demographic summary data for the relocated colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	70	ACER	31-50	4/19/18	Y	N	20	12	0	0	100	0	
1	G14	71	ACER	31-50	4/19/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G14	72	ACER	31-50	4/19/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G15	90	ACER	>50	4/19/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G15	96	ACER	10-15	4/19/18	Y	N	15	8	2	2	95	0	
1	G14	67	CNAT	16-30	4/19/18	Y	N	20	19	0	0	100	0	
1	G15	74	CNAT	16-30	4/19/18	Y	N	31	25	0	0	100	0	
1	G15	83	CNAT	31-50	4/19/18	Y	N	40	38	0	0	100	0	
1	G14	12	DCLI	16-30	4/19/18	Y	N	26	25	0	0	100	0	
1	G14	18	DCLI	31-50	4/19/18	Y	N	19	16	0	0	100	0	
1	G14	19	DCLI	>50	4/19/18	Y	N	55	45	52	37	40	0	
1	G14	25	DCLI	31-50	4/19/18	Y	N	48	30	34	24	55	0	
1	G14	41	DCLI	10-15	4/19/18	Y	N	13	12	0	0	100	0	
1	G14	49	DCLI	>50	4/19/18	Y	N	70	48	65	45	20	0	
1	G14	58	DCLI	10-15	4/19/18	Y	N	12	12	0	0	100	0	
1	G14	59	DCLI	16-30	4/19/18	Y	N	25	20	0	0	100	0	
1	G14	61	DCLI	16-30	4/19/18	Y	N	22	15	0	0	100	0	
1	G14	63	DCLI	31-50	4/19/18	Y	N	35	25	0	0	100	0	
1	G14	66	DCLI	10-15	4/19/18	Y	N	10	9	0	0	100	0	
1	G14	69	DCLI	16-30	4/19/18	Y	N	30	16	0	0	100	0	
1	G15	77	DCLI	31-50	4/19/18	Y	N	36	27	0	0	100	0	
1	G15	84	DCLI	31-50	4/19/18	Y	N	36	30	0	0	100	0	
1	G15	85	DCLI	16-30	4/19/18	Y	Y	28	26	26	22	20	0	
1	G15	86	DCLI	16-30	4/19/18	Y	N	23	20	0	0	100	0	
1	G15	91	DCLI	31-50	4/19/18	Y	N	33	25	21	11	70	0	

Appendix Table 10. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
1	G14	4	DSTO	10-15	4/19/18	Y	N	11	10	0	0	100	0	
1	G14	17	DSTO	16-30	4/19/18	Y	N	19	16	0	0	100	0	
1	G14	21	DSTO	10-15	4/19/18	Y	N	15	11	0	0	100	0	
1	G14	22	DSTO	10-15	4/19/18	Y	N	15	11	0	0	100	0	
1	G14	24	DSTO	10-15	4/19/18	Y	N	11	11	0	0	100	0	
1	G14	29	DSTO	10-15	4/19/18	Y	N	13	13	0	0	100	0	
1	G14	30	DSTO	10-15	4/19/18	Y	N	11	11	0	0	100	0	
1	G14	32	DSTO	16-30	4/19/18	Y	N	18	15	0	0	100	0	
1	G14	33	DSTO	10-15	4/19/18	Y	N	11	7	0	0	100	0	
1	G14	34	DSTO	16-30	4/19/18	Y	N	22	22	0	0	100	0	
1	G14	37	DSTO	10-15	4/19/18	Y	N	11	10	0	0	100	0	
1	G14	38	DSTO	10-15	4/19/18	Y	N	10	9	0	0	100	0	
1	G14	39	DSTO	16-30	4/19/18	Y	N	27	22	0	0	100	0	
1	G14	40	DSTO	10-15	4/19/18	Y	N	10	9	0	0	100	0	
1	G14	44	DSTO	10-15	4/19/18	Y	N	13	9	0	0	100	0	
1	G14	45	DSTO	10-15	4/19/18	Y	N	12	12	0	0	100	0	
1	G14	52	DSTO	16-30	4/19/18	Y	N	15	13	0	0	100	0	
1	G14	56	DSTO	16-30	4/19/18	Y	N	17	12	0	0	100	0	
1	G14	57	DSTO	10-15	4/19/18	Y	N	11	11	9	7	75	0	
1	G14	60	DSTO	10-15	4/19/18	Y	N	12	10	0	0	100	0	
1	G14	62	DSTO	16-30	4/19/18	Y	N	15	15	0	0	100	0	
1	G14	65	DSTO	16-30	4/19/18	Y	N	17	14	0	0	100	0	
1	G15	80	DSTO	31-50	4/19/18	Y	N	32	30	0	0	100	0	
1	G15	81	DSTO	10-15	4/19/18	Y	N	14	13	0	0	100	0	
1	G15	82	DSTO	16-30	4/19/18	Y	N	20	19	0	0	100	0	
1	G15	87	DSTO	10-15	4/19/18	Y	N	18	16	0	0	100	0	
1	G15	88	DSTO	16-30	4/19/18	Y	N	16	16	0	0	100	0	
1	G15	92	DSTO	10-15	4/19/18	Y	N	11	11	0	0	100	0	
1	G15	93	DSTO	10-15	4/19/18	Y	N	12	10	0	0	100	0	
1	G15	95	DSTO	10-15	4/19/18	Y	N	13	11	0	0	100	0	
1	G14	31	DSTR	16-30	4/19/18	Y	N	25	21	25	21	1	0	

Appendix Table 10. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	35	MCAV	16-30	4/19/18	Y	N	30	25	0	0	100	0	
1	G14	36	MCAV	>50	4/19/18	Y	N	84	49	83	46	15	0	
1	G14	42	MCAV	16-30	4/19/18	Y	N	19	16	0	0	100	0	
1	G14	46	MCAV	10-15	4/19/18	Y	N	11	7	0	0	100	0	
1	G14	53	MCAV	16-30	4/19/18	Y	N	35	25	0	0	100	0	
1	G15	73	MCAV	31-50	4/19/18	Y	N	40	34	0	0	100	0	
1	G15	75	MCAV	31-50	4/19/18	Y	N	30	20	0	0	100	0	
1	G15	76	MCAV	31-50	4/19/18	Y	N	50	39	23	21	67	3	D
1	G15	97	MCAV	31-50	4/19/18	Y	N	50	22	0	0	100	0	
1	G15	98	MCAV	16-30	4/19/18	Y	Y	34	22	30	22	15	0	
1	G14	50	MMEA	16-30	4/19/18	Y	N	26	18	0	0	100	0	
1	G14	55	MMEA	16-30	4/19/18	Y	N	16	12	0	0	100	0	
1	G14	64	PAST	10-15	4/19/18	Y	Y	20	15	20	15	2	0	
1	G14	3	SBOU	10-15	4/19/18	Y	N	15	15	13	9	70	0	
1	G14	5	SBOU	16-30	4/19/18	Y	N	22	15	0	0	100	0	
1	G14	9	SBOU	10-15	4/19/18	Y	N	9	9	0	0	100	0	
1	G14	13	SBOU	16-30	4/19/18	Y	N	18	13	0	0	100	0	
1	G14	14	SBOU	16-30	4/19/18	Y	N	23	20	0	0	100	0	
1	G14	16	SBOU	16-30	4/19/18	Y	N	27	24	0	0	100	0	
1	G14	48	SBOU	16-30	4/19/18	Y	N	30	21	30	21	15	0	
1	G14	54	SBOU	16-30	4/19/18	Y	N	30	24	30	22	15	0	
1	G15	78	SBOU	31-50	4/19/18	Y	N	39	36	0	0	100	0	
1	G15	79	SBOU	16-30	4/19/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
1	G15	94	SBOU	16-30	4/19/18	Y	N	19	17	18	16	20	0	
1	G14	26	SINT	10-15	4/19/18	Y	N	14	8	12	5	30	0	
1	G14	43	SINT	16-30	4/19/18	Y	N	22	20	22	20	3	0	
1	G14	68	SINT	10-15	4/19/18	Y	N	15	15	13	10	45	0	
1	G15	89	SINT	10-15	4/19/18	Y	Y	11	11	11	11	15	0	
1	G14	1	SSID	10-15	4/19/18	Y	N	9	6	6	6	10	0	D
1	G14	2	SSID	10-15	4/19/18	Y	N	10	8	10	8	25	0	
1	G14	6	SSID	10-15	4/19/18	Y	N	7	7	7	6	20	0	D

Appendix Table 10. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		D, B, PB
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	7	SSID	10-15	4/19/18	Y	N	10	6	6	4	55	0	D
1	G14	8	SSID	10-15	4/19/18	Y	N	10	8	7	6	35	0	
1	G14	10	SSID	10-15	4/19/18	Y	N	9	7	8	7	20	0	D
1	G14	11	SSID	10-15	4/19/18	Y	N	10	8	7	6	65	0	D
1	G14	15	SSID	10-15	4/19/18	Y	N	11	8	9	7	30	0	D
1	G14	20	SSID	10-15	4/19/18	Y	N	14	13	10	10	25	0	D
1	G14	23	SSID	16-30	4/19/18	Y	N	19	8	19	7	15	0	
1	G14	27	SSID	10-15	4/19/18	Y	N	7	6	4	5	60	0	
1	G14	28	SSID	10-15	4/19/18	Y	N	10	8	8	6	50	0	
1	G14	47	SSID	10-15	4/19/18	Y	N	14	13	14	13	2	0	
1	G14	51	SSID	16-30	4/19/18	Y	N	20	15	20	15	5	0	
2	19	92	ACER	16-30	4/18/18	Y	Y	35	31	35	31	5	0	
2	G18	68	ACER	31-50	4/18/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	69	ACER	16-30	4/18/18	Y	Y	25	19	N/A	N/A	60	0	
2	G18	70	ACER	16-30	4/18/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	71	ACER	31-50	4/18/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	72	ACER	16-30	4/18/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	73	ACER	10-15	4/18/18	N	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	74	ACER	16-30	4/18/18	Y	N	23	17	0	0	100	0	
2	G18	75	ACER	16-30	4/18/18	Y	Y	22	18	22	18	1	0	
2	G18	76	ACER	16-30	4/18/18	Y	Y	12	9	9	7	60	0	
2	G18	6	CNAT	31-50	4/18/18	Y	N	42	32	0	0	100	0	
2	G18	22	CNAT	31-50	4/18/18	Y	N	29	26	0	0	100	0	
2	G18	34	CNAT	31-50	4/18/18	Y	N	31	31	0	0	100	0	
2	G18	66	CNAT	31-50	4/18/18	Y	N	29	24	0	0	100	0	
2	19	77	DCLI	31-50	4/18/18	Y	Y	34	32	34	30	3	0	
2	19	79	DCLI	16-30	4/18/18	Y	N	16	14	0	0	100	0	
2	19	120	DCLI	31-50	4/18/18	Y	Y	43	25	43	25	2	0	PB
2	G18	5	DCLI	>50	4/18/18	Y	N	59	41	0	0	100	0	
2	G18	7	DCLI	31-50	4/18/18	Y	N	40	30	40	30	2	0	PB
2	G18	12	DCLI	31-50	4/18/18	Y	N	36	29	0	0	100	0	

Appendix Table 10. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue		Condition		
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
2	G18	18	DCLI	16-30	4/18/18	Y	N	21	18	0	0	100	0	
2	G18	19	DCLI	16-30	4/18/18	Y	Y	25	19	25	19	5	0	
2	G18	21	DCLI	31-50	4/18/18	Y	Y	33	28	33	28	1	0	
2	G18	26	DCLI	31-50	4/18/18	Y	Y	34	30	33	30	3	0	
2	G18	29	DCLI	16-30	4/18/18	Y	Y	22	19	13	7	80	0	
2	G18	30	DCLI	16-30	4/18/18	Y	N	26	17	0	0	100	0	
2	G18	36	DCLI	31-50	4/18/18	Y	N	41	32	0	0	100	0	
2	G18	41	DCLI	16-30	4/18/18	Y	Y	32	25	22	19	25	0	
2	G18	47	DCLI	16-30	4/18/18	Y	Y	25	21	25	21	2	0	
2	G18	48	DCLI	16-30	4/18/18	Y	N	28	20	0	0	100	0	
2	G18	53	DCLI	16-30	4/18/18	Y	N	26	23	0	0	100	0	
2	G18	61	DCLI	31-50	4/18/18	Y	Y	33	25	33	25	2	0	
2	19	98	DSTO	10-15	4/18/18	Y	N	10	8	0	0	100	0	
2	19	116	DSTO	10-15	4/18/18	Y	N	11	10	0	0	100	0	
2	G18	3	DSTO	10-15	4/18/18	Y	N	17	13	17	11	10	0	
2	G18	11	DSTO	16-30	4/18/18	Y	N	16	11	0	0	100	0	
2	G18	13	DSTO	10-15	4/18/18	Y	N	10	8	0	0	100	0	
2	G18	15	DSTO	10-15	4/18/18	Y	N	11	11	0	0	100	0	
2	G18	17	DSTO	16-30	4/18/18	Y	N	15	15	0	0	100	0	
2	G18	28	DSTO	16-30	4/18/18	Y	N	18	16	0	0	100	0	
2	G18	31	DSTO	10-15	4/18/18	Y	Y	15	13	15	13	1	0	
2	G18	33	DSTO	16-30	4/18/18	Y	N	19	14	0	0	100	0	
2	G18	37	DSTO	10-15	4/18/18	Y	N	10	10	0	0	100	0	
2	G18	40	DSTO	16-30	4/18/18	Y	N	25	23	0	0	100	0	
2	G18	46	DSTO	10-15	4/18/18	Y	N	13	11	0	0	100	0	
2	G18	52	DSTO	16-30	4/18/18	Y	Y	20	15	20	15	2	0	
2	G18	59	DSTO	16-30	4/18/18	Y	N	16	15	0	0	100	0	
2	19	85	DSTR	16-30	4/18/18	Y	N	20	17	18	15	15	0	
2	G18	10	DSTR	16-30	4/18/18	Y	N	26	25	0	0	100	0	
2	G18	23	DSTR	31-50	4/18/18	Y	N	28	25	0	0	100	0	
2	G18	32	DSTR	31-50	4/18/18	Y	N	32	26	0	0	100	0	

Appendix Table 10. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue			Condition	
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
2	G18	35	DSTR	31-50	4/18/18	Y	Y	34	31	34	31	1	0	
2	G18	45	DSTR	31-50	4/18/18	Y	N	32	23	0	0	100	0	
2	G18	49	DSTR	16-30	4/18/18	Y	Y	25	24	24	23	5	0	
2	G18	55	DSTR	>50	4/18/18	Y	N	50	48	0	0	100	0	
2	G18	64	DSTR	31-50	4/18/18	Y	N	28	22	0	0	100	0	
2	G18	1	ISIN	10-15	4/18/18	Y	N	11	8	0	0	100	0	
2	19	91	MCAV	31-50	4/18/18	Y	N	32	26	0	0	100	0	
2	19	118	MCAV	31-50	4/18/18	Y	N	34	28	0	0	100	0	
2	G18	51	MCAV	31-50	4/18/18	Y	Y	39	36	39	36	1	0	
2	G18	8	MMEA	10-15	4/18/18	Y	N	16	15	0	0	100	0	
2	19	78	SBOU	16-30	4/18/18	Y	N	21	15	21	15	1	0	PB
2	19	80	SBOU	31-50	4/18/18	Y	N	30	21	26	17	35	0	
2	19	81	SBOU	31-50	4/18/18	Y	N	29	24	26	20	45	0	PB
2	19	82	SBOU	16-30	4/18/18	Y	N	21	17	21	17	25	0	
2	19	83	SBOU	31-50	4/18/18	Y	N	35	28	22	21	80	0	
2	19	86	SBOU	16-30	4/18/18	Y	N	16	11	16	11	5	0	
2	19	87	SBOU	10-15	4/18/18	Y	N	11	11	6	3	95	0	
2	19	88	SBOU	31-50	4/18/18	Y	N	35	35	34	25	15	0	
2	19	90	SBOU	10-15	4/18/18	Y	N	15	15	6	5	90	0	
2	19	93	SBOU	31-50	4/18/18	Y	N	41	37	38	26	10	0	
2	19	94	SBOU	16-30	4/18/18	Y	N	15	12	0	0	100	0	
2	19	95	SBOU	31-50	4/18/18	Y	N	35	31	35	31	5	0	
2	19	96	SBOU	16-30	4/18/18	Y	N	25	25	16	15	65	0	
2	19	97	SBOU	31-50	4/18/18	Y	N	28	20	20	20	60	0	
2	19	119	SBOU	16-30	4/18/18	Y	Y	25	15	19	15	50	2	D
2	19	121	SBOU	31-50	4/18/18	Y	Y	35	30	35	30	15	0	
2	G18	4	SBOU	>50	4/18/18	Y	Y	54	38	50	35	15	0	
2	G18	14	SBOU	10-15	4/18/18	Y	N	11	11	0	0	100	0	
2	G18	16	SBOU	16-30	4/18/18	Y	N	17	15	17	15	5	0	
2	G18	38	SBOU	16-30	4/18/18	Y	N	20	16	2	1	99	1	D
2	G18	39	SBOU	31-50	4/18/18	Y	N	35	30	27	19	55	0	

Appendix Table 10. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached Y/N	Edge Growth	Whole Colony		Live Tissue			Condition	
								L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	D, B, PB
2	G18	50	SBOU	31-50	4/18/18	Y	Y	40	25	40	25	2	0	PB
2	G18	54	SBOU	16-30	4/18/18	Y	Y	17	15	17	15	1	0	
2	G18	56	SBOU	>50	4/18/18	Y	Y	56	40	56	40	5	0	
2	G18	60	SBOU	16-30	4/18/18	Y	N	25	23	11	8	95	0	
2	G18	65	SBOU	31-50	4/18/18	Y	Y	35	32	35	32	5	0	
2	19	115	SINT	16-30	4/18/18	Y	Y	16	13	16	13	1	0	
2	19	117	SINT	16-30	4/18/18	Y	Y	34	25	34	25	5	0	
2	G18	2	SINT	10-15	4/18/18	Y	Y	16	13	16	13	2	0	
2	G18	24	SINT	16-30	4/18/18	Y	N	21	18	21	18	60	0	
2	G18	25	SINT	10-15	4/18/18	Y	N	12	10	11	10	7	0	
2	G18	27	SINT	16-30	4/18/18	Y	N	20	20	20	20	1	0	
2	G18	42	SINT	16-30	4/18/18	Y	Y	30	24	30	24	10	0	
2	G18	44	SINT	10-15	4/18/18	Y	Y	19	14	19	5	80	0	
2	G18	57	SINT	16-30	4/18/18	Y	Y	25	23	20	18	20	0	
2	G18	58	SINT	16-30	4/18/18	Y	Y	25	16	25	16	2	0	
2	G18	62	SINT	10-15	4/18/18	Y	Y	15	11	15	11	5	0	
2	G18	63	SINT	10-15	4/18/18	Y	Y	11	10	11	10	1	0	
2	G18	67	SINT	16-30	4/18/18	Y	Y	23	19	23	19	10	0	
2	19	84	SSID	10-15	4/18/18	Y	N	8	6	0	0	100	0	
2	19	89	SSID	10-15	4/18/18	Y	N	10	10	4	4	85	0	
2	19	99	SSID	10-15	4/18/18	Y	Y	9	6	9	6	10	0	
2	G18	9	SSID	10-15	4/18/18	Y	Y	16	15	16	15	2	0	
2	G18	20	SSID	10-15	4/18/18	Y	N	10	9	9	8	30	0	
2	G18	43	SSID	10-15	4/18/18	Y	N	14	11	5	2	90	0	
3	99	137	CNAT	31-50	4/18/18	Y	Y	43	35	43	30	7	0	
3	99	136	DSTR	>50	4/18/18	Y	Y	71	70	71	70	2	0	
3	99	139	DSTR	>50	4/18/18	Y	Y	90	85	90	85	1	0	
3	99	140	DSTR	>50	4/18/18	Y	Y	55	45	55	45	5	0	
3	99	135	SBOU	31-50	4/18/18	Y	N	35	30	30	25	40	0	
3	99	138	SBOU	31-50	4/18/18	Y	N	50	40	50	40	5	0	

Appendix Table 11. Twenty-four-month demographic summary data for the control colonies. Four letter species codes are listed in Appendix Table 1 (%OM = percent of colony with old mortality; %RM = percent of colony with recent mortality; D = presence of disease; B = presence of fish bites; PB = presence of colony partial bleaching).

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	121	AAGA	16-30	4/19/18	Y	30	15	30	15	1	0	
1	G14	117	DCLI	16-30	4/19/18	Y	17	15	0	0	100	0	
1	G15	105	DCLI	31-50	4/19/18	Y	39	32	32	29	25	0	
1	G15	109	DCLI	16-30	4/19/18	Y	17	15	0	0	100	0	
1	G14	124	DLAB	>50	4/19/18	Y	80	75	0	0	100	0	
1	G14	128	DSTO	10-15	4/19/18	Y	17	15	0	0	100	0	
1	G15	104	DSTO	10-15	4/19/18	Y	15	12	0	0	100	0	
1	G15	108	DSTO	16-30	4/19/18	Y	23	18	0	0	100	0	
1	G15	113	DSTO	10-15	4/19/18	Y	15	14	0	0	100	0	
1	G14	130	DSTR	>50	4/19/18	Y	80	30	0	0	100	0	
1	G15	100	DSTR	10-15	4/19/18	Y	12	10	0	0	100	0	
1	G15	106	DSTR	10-15	4/19/18	Y	13	11	0	0	100	0	
1	G14	118	MCAV	16-30	4/19/18	Y	27	15	0	0	100	0	
1	G14	119	MCAV	>50	4/19/18	Y	82	60	0	0	100	0	
1	G14	125	MCAV	31-50	4/19/18	Y	45	32	45	32	1	0	
1	G14	126	MCAV	>50	4/19/18	Y	95	80	95	65	60	0	
1	G14	129	MCAV	>50	4/19/18	Y	60	30	33	17	75	5	D
1	G14	132	MCAV	16-30	4/19/18	Y	28	26	28	26	10	0	
1	G14	133	MCAV	31-50	4/19/18	N	40	34	40	34	2	2	
1	G15	107	MCAV	31-50	4/19/18	Y	40	33	40	33	5	0	
1	G15	114	MCAV	31-50	4/19/18	Y	40	39	40	39	5	0	
1	G14	115	PAST	10-15	4/19/18	Y	11	7	11	7	1	0	
1	G14	116	PAST	10-15	4/19/18	N	N/A	N/A	N/A	N/A	N/A	N/A	
1	G14	120	PAST	16-30	4/19/18	Y	25	15	25	15	5	0	
1	G14	123	PAST	16-30	4/19/18	Y	22	17	22	17	1	5	

Appendix Table 11.Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
1	G14	127	PAST	10-15	4/19/18	Y	14	11	14	11	0	0	
1	G14	134	PAST	16-30	4/19/18	Y	15	11	11	10	40	0	
1	G15	101	PAST	10-15	4/19/18	N	N/A	N/A	N/A	N/A	N/A	N/A	
1	G15	102	PAST	10-15	4/19/18	Y	10	9	10	9	5	5	B
1	G15	111	PAST	10-15	4/19/18	Y	15	9	10	8	40	0	
1	G14	122	SINT	16-30	4/19/18	Y	21	20	21	20	5	0	
1	G15	112	SINT	10-15	4/19/18	Y	18	16	18	16	10	0	
1	G14	131	SSID	16-30	4/19/18	Y	20	20	20	19	5	0	
1	G15	103	SSID	16-30	4/19/18	Y	26	19	26	19	10	3	
1	G15	110	SSID	16-30	4/19/18	N	25	18	25	18	3	70	
2	19	167	ACER	>50	4/18/18	Y	46	41	46	41	80	0	
2	19	172	ACER	16-30	4/18/18	N	N/A	N/A	N/A	N/A	N/A	N/A	
2	G18	100	DCLI	16-30	4/18/18	Y	65	45	14	11	90	0	
2	G18	103	DSTO	10-15	4/18/18	Y	15	12	0	0	100	0	
2	G18	106	MANN	16-30	4/18/18	Y	33	31	33	31	5	0	
2	19	169	MCAV	>50	4/18/18	Y	65	55	N/A	N/A	80	5	D
2	19	171	MCAV	16-30	4/18/18	Y	20	20	11	10	80	0	
2	19	176	MCAV	>50	4/18/18	Y	58	27	0	0	100	0	
2	19	178	MCAV	31-50	4/18/18	Y	35	31	35	31	0	0	
2	19	181	MCAV	31-50	4/18/18	Y	37	32	0	0	100	0	
2	G18	104	MCAV	31-50	4/18/18	Y	61	48	12	7	95	0	
2	G18	113	MCAV	>50	4/18/18	Y	70	69	N/A	N/A	75	4	D
2	G18	114	MCAV	>50	4/18/18	Y	97	65	N/A	N/A	97	0	
2	19	166	PAST	10-15	4/18/18	Y	16	13	6	7	85	0	
2	19	168	PAST	10-15	4/18/18	Y	17	13	17	13	30	0	
2	19	170	PAST	10-15	4/18/18	Y	10	9	0	0	100	0	
2	19	175	PAST	16-30	4/18/18	Y	32	18	32	18	5	0	
2	19	180	PAST	16-30	4/18/18	Y	35	24	35	24	5	2	B
2	G18	105	PAST	10-15	4/18/18	Y	16	13	16	13	1	0	
2	G18	107	PAST	16-30	4/18/18	Y	19	17	16	14	25	0	
2	19	173	SBOU	16-30	4/18/18	Y	30	23	0	0	100	0	

Appendix Table 11. Continued.

Site #	Pin #	Colony Tag	Species	Size Class (cm)	Date Monitored	Attached	Whole Colony		Live Tissue		Condition		D, B, PB
							L(cm)	W(cm)	L(cm)	W(cm)	% OM	% RM	
2	19	174	SBOU	10-15	4/18/18	Y	17	11	17	11	0	0	
2	G18	110	SBOU	31-50	4/18/18	Y	35	30	35	30	2	0	
2	G18	102	SINT	10-15	4/18/18	Y	14	11	11	10	50	0	
2	19	177	SSID	10-15	4/18/18	Y	12	12	10	8	60	0	
2	19	179	SSID	16-30	4/18/18	Y	25	16	25	16	1	0	
2	G18	101	SSID	16-30	4/18/18	Y	20	17	23	17	30	0	
2	G18	108	SSID	31-50	4/18/18	N	30	28	30	28	15	0	
2	G18	109	SSID	10-15	4/18/18	Y	15	8	15	8	2	0	
2	G18	111	SSID	16-30	4/18/18	Y	32	26	32	26	50	0	
2	G18	112	SSID	16-30	4/18/18	N	N/A	N/A	N/A	N/A	N/A	N/A	

Appendix Table 12. Recruitment summary data for the relocated colonies. Only colonies, which had recruits within 25 cm of the colony during the monitoring program, are included in the table. Four letter species codes are listed in Appendix Table 1.

Site #	Pin #	Colony Tag	Relocated Species	Date Monitored	Monitoring Event	Recruit Species	Size (Dia cm)
1	G14	2	SSID	3/28/2016	Initial	PAST	1
1	G14	12	DCLI	3/28/2016	Initial	SSID	3
1	G14	19	DCLI	3/28/2016	Initial	SSID	1
1	G14	36	MCAV	3/28/2016	Initial	SSID	1
1	G14	36	MCAV	3/28/2016	Initial	SSID	1
1	G14	38	DSTO	3/28/2016	Initial	SSID	0.5
1	G14	39	DSTO	3/28/2016	Initial	MCAV	3
1	G14	45	DSTO	3/28/2016	Initial	PAST	4
1	G14	46	MCAV	3/28/2016	Initial	SSID	1
1	G14	49	DCLI	3/28/2016	Initial	SSID	0.5
1	G14	50	MMEA	3/28/2016	Initial	SSID	3
1	G14	53	MCAV	3/28/2016	Initial	SSID	1
1	G14	62	DSTO	3/28/2016	Initial	PAST	3
1	G14	62	DSTO	3/28/2016	Initial	PAST	2
1	G14	69	DCLI	3/28/2016	Initial	MCAV	4
1	G14	70	ACER	3/28/2016	Initial	SSID	3
1	G15	77	DCLI	3/28/2016	Initial	PAST	3
1	G15	79	SBOU	3/28/2016	Initial	DSTO	2
1	G15	82	DSTO	3/28/2016	Initial	PAST	4
1	G15	88	SINT	3/28/2016	Initial	MCAV	4
1	G15	95	DSTO	3/28/2016	Initial	MCAV	4
2	G18	4	SBOU	5/11/2016	Initial	PAST	4
2	G18	14	SBOU	5/11/2016	Initial	MCAV	4
2	G18	28	DSTO	5/11/2016	Initial	SSID	4
2	G18	37	DSTO	5/11/2016	Initial	MCAV	2
2	G18	47	DCLI	6/22/2016	Initial	SSID	0.5
1	G14	2	SSID	11/4/2016	6-month	PAST	2
1	G14	12	DCLI	11/4/2016	6-month	SSID	3
1	G14	12	DCLI	11/4/2016	6-month	SSID	2

Appendix Table 12. Continued.

Site #	Pin #	Colony Tag	Relocated Species	Date Monitored	Monitoring Event	Recruit Species	Size (Dia cm)
1	G14	14	SBOU	11/4/2016	6-month	SSID	1
1	G14	14	SBOU	11/4/2016	6-month	SSID	1
1	G14	14	SBOU	11/4/2016	6-month	SSID	1
1	G14	14	SBOU	11/4/2016	6-month	SSID	1
1	G14	14	SBOU	11/4/2016	6-month	SSID	1
1	G14	14	SBOU	11/4/2016	6-month	SSID	2
1	G14	14	SBOU	11/4/2016	6-month	SSID	0.5
1	G14	14	SBOU	11/4/2016	6-month	SSID	0.5
1	G14	14	SBOU	11/4/2016	6-month	SSID	0.5
1	G14	14	SBOU	11/4/2016	6-month	SSID	0.5
1	G14	14	SBOU	11/4/2016	6-month	SSID	0.5
1	G14	19	DCLI	11/4/2016	6-month	SSID	2
1	G14	39	DSTO	11/4/2016	6-month	MCAV	2
1	G14	53	MCAV	11/4/2016	6-month	SSID	1
1	G14	70	ACER	11/4/2016	6-month	SSID	2.5
1	G15	74	CNAT	11/4/2016	6-month	PAST	2
1	G15	82	DSTO	11/4/2016	6-month	PAST	4
2	19	81	SBOU	11/9/2016	6-month	SSID	2
2	19	97	SBOU	11/9/2016	6-month	SSID	0.5
2	G18	43	SSID	11/9/2016	6-month	PAST	1.5
2	G18	47	DCLI	11/9/2016	6-month	PAST	3
2	G18	47	DCLI	11/9/2016	6-month	SSID	2
2	G18	53	DCLI	11/9/2016	6-month	SSID	3.5
2	G18	61	DCLI	11/9/2016	6-month	PAST	1

Appendix Table 12. Continued.

Site #	Pin #	Colony Tag	Relocated Species	Date Monitored	Monitoring Event	Recruit Species	Size (Dia cm)
1	G14	2	SSID	4/24/2017	12-month	PAST	3
1	G14	14	SBOU	4/24/2017	12-month	SSID	0.5
1	G14	14	SBOU	4/24/2017	12-month	SSID	0.5
1	G14	14	SBOU	4/24/2017	12-month	SSID	0.5
1	G14	14	SBOU	4/24/2017	12-month	SSID	0.5
1	G14	14	SBOU	4/24/2017	12-month	SSID	0.5
1	G14	14	SBOU	4/24/2017	12-month	SSID	1
1	G14	14	SBOU	4/24/2017	12-month	SSID	1
1	G14	14	SBOU	4/24/2017	12-month	SSID	1
1	G14	14	SBOU	4/24/2017	12-month	SSID	1
1	G14	14	SBOU	4/24/2017	12-month	SSID	1
1	G14	14	SBOU	4/24/2017	12-month	SSID	2
1	G14	14	SBOU	4/24/2017	12-month	SSID	2
1	G14	14	SBOU	4/24/2017	12-month	SSID	2
1	G14	14	SBOU	4/24/2017	12-month	SSID	2
1	G14	14	SBOU	4/24/2017	12-month	SSID	2
1	G14	14	SBOU	4/24/2017	12-month	SSID	3
1	G14	18	DCLI	4/24/2017	12-month	SSID	1
1	G14	34	DSTO	4/24/2017	12-month	SSID	3
1	G15	77	DCLI	4/24/2017	12-month	PAST	4
2	19	81	SBOU	4/25/2017	12-month	SSID	2
2	19	81	SBOU	4/25/2017	12-month	SSID	3
2	19	81	SBOU	4/25/2017	12-month	MCAV	3
2	19	115	SINT	4/25/2017	12-month	PAST	2
2	19	121	SBOU	4/25/2017	12-month	SSID	1
2	G18	4	SBOU	4/25/2017	12-month	PAST	5
2	G18	6	CNAT	4/25/2017	12-month	SSID	4
2	G18	43	SSID	4/25/2017	12-month	PAST	2
2	G18	47	DCLI	4/25/2017	12-month	SSID	2
2	G18	54	SBOU	4/25/2017	12-month	SSID	4
2	G18	71	ACER	4/25/2017	12-month	SSID	3

Appendix Table 12. Continued.

Site #	Pin #	Colony Tag	Relocated Species	Date Monitored	Monitoring Event	Recruit Species	Size (Dia cm)
2	G18	71	ACER	4/25/2017	12-month	SSID	1
1	G14	2	SSID	10/26/2017	18-month	PAST	3.5
1	G14	8	SSID	10/26/2017	18-month	SSID	2
1	G14	10	SSID	10/26/2017	18-month	SSID	1
1	G14	12	DCLI	10/26/2017	18-month	SSID	4
1	G14	12	DCLI	10/26/2017	18-month	SSID	2
1	G14	34	DSTO	10/26/2017	18-month	SSID	1
1	G14	34	DSTO	10/26/2017	18-month	SSID	1
1	G14	68	SINT	10/26/2017	18-month	SSID	3
1	G14	119	MCAV	10/26/2017	18-month	SSID	4
1	G14	119	MCAV	10/26/2017	18-month	SSID	2
1	G15	77	DCLI	10/26/2017	18-month	PAST	4
1	G15	88	DSTO	10/26/2017	18-month	PAST	1
2	19	81	SBOU	10/24/2017	18-month	SSID	3
2	19	81	SBOU	10/24/2017	18-month	MCAV	3
2	19	115	SINT	10/24/2017	18-month	PAST	2
2	G18	4	SBOU	10/24/2017	18-month	SSID	2
2	G18	5	DCLI	10/24/2017	18-month	SSID	4
2	G18	6	CNAT	10/24/2017	18-month	SSID	4
2	G18	28	DSTO	10/24/2017	18-month	SSID	1
2	G18	30	DCLI	10/24/2017	18-month	SSID	1
2	G18	30	DCLI	10/24/2017	18-month	SSID	4
2	G18	35	DSTR	10/24/2017	18-month	PAST	2
2	G18	39	SBOU	10/24/2017	18-month	PAST	2
2	G18	43	SSID	10/24/2017	18-month	SSID	3
2	G18	47	DCLI	1/9/2018	18-month	SSID	3
1	G14	8	SSID	4/19/2018	24-month	SSID	2
1	G14	17	DSTO	4/19/2018	24-month	SSID	3

Appendix Table 12. Continued.

Site #	Pin #	Colony Tag	Relocated Species	Date Monitored	Monitoring Event	Recruit Species	Size (Dia cm)
1	G14	18	DCLI	4/19/2018	24-month	SSID	3
1	G14	23	SSID	4/19/2018	24-month	SSID	1
1	G14	34	DSTO	4/19/2018	24-month	SSID	4
1	G14	50	MMEA	4/19/2018	24-month	SSID	4
1	G15	77	DCLI	4/19/2018	24-month	PAST	4
1	G15	78	SBOU	4/19/2018	24-month	SSID	2
1	G15	80	DSTO	4/19/2018	24-month	SSID	2
1	G15	80	DSTO	4/19/2018	24-month	SSID	1
1	G15	80	DSTO	4/19/2018	24-month	SSID	1
1	G15	80	DSTO	4/19/2018	24-month	SSID	1
1	G15	80	DSTO	4/19/2018	24-month	SSID	0.5
1	G15	80	DSTO	4/19/2018	24-month	SSID	0.5
1	G15	80	DSTO	4/19/2018	24-month	SSID	1
1	G15	80	DSTO	4/19/2018	24-month	SSID	2
1	G15	80	DSTO	4/19/2018	24-month	SSID	2
1	G15	82	DSTO	4/19/2018	24-month	SSID	4
1	G15	84	DCLI	4/19/2018	24-month	SSID	3
1	G15	84	DCLI	4/19/2018	24-month	SSID	2
1	G15	91	DCLI	4/19/2018	24-month	PAST	2
1	G15	92	DSTO	4/19/2018	24-month	PAST	3
1	G15	97	MCAV	4/19/2018	24-month	SSID	3
2	19	81	SBOU	4/18/2018	24-month	SSID	3
2	19	115	SINT	4/18/2018	24-month	PAST	3
2	19	181	MCAV	4/18/2018	24-month	SSID	2
2	G18	47	DCLI	4/18/2018	24-month	PAST	3
2	G18	51	MCAV	4/18/2018	24-month	SSID	1
2	G18	54	SBOU	4/18/2018	24-month	SSID	4

Appendix Table 13. Recruitment summary data for the control colonies. Only colonies, which had recruits within 25 cm of the colony during the monitoring program, are included in the table. Four letter species codes are listed in Appendix Table 1.

Site #	Pin #	Colony Tag	Control Species	Date Monitored	Monitoring Event	Species	L(cm)
1	G14	121	AAGA	3/28/2016	Initial	SSID	4
1	G14	124	DLAB	3/28/2016	Initial	SSID	1
1	G14	124	DLAB	3/28/2016	Initial	SSID	1.5
1	G14	124	DLAB	3/28/2016	Initial	SSID	1.5
1	G14	124	DLAB	3/28/2016	Initial	SSID	2
1	G14	124	DLAB	3/28/2016	Initial	SSID	2
1	G14	124	DLAB	3/28/2016	Initial	SSID	2.5
1	G14	124	DLAB	3/28/2016	Initial	SSID	4
1	G14	125	MCAV	3/28/2016	Initial	SSID	2
1	G14	126	MCAV	3/28/2016	Initial	SSID	1
1	G14	126	MCAV	3/28/2016	Initial	SSID	2.5
1	G14	126	MCAV	3/28/2016	Initial	PAST	3.5
1	G14	127	PAST	3/28/2016	Initial	SSID	0.5
1	G14	127	PAST	3/28/2016	Initial	SSID	1.5
1	G14	127	PAST	3/28/2016	Initial	SSID	3
1	G14	127	PAST	3/28/2016	Initial	SSID	3.5
1	G14	127	PAST	3/28/2016	Initial	SSID	3.5
1	G14	133	MCAV	3/28/2016	Initial	SSID	1.5
1	G14	133	MCAV	3/28/2016	Initial	SSID	2
1	G15	102	PAST	3/28/2016	Initial	SSID	2
1	G15	103	SSID	3/28/2016	Initial	MCAV	4
1	G15	107	MCAV	3/28/2016	Initial	MCAV	2
1	G15	109	DCLI	3/28/2016	Initial	SSID	0.5
1	G15	109	DCLI	3/28/2016	Initial	SSID	1.5
1	G15	111	PAST	3/28/2016	Initial	PAST	4
1	G15	114	MCAV	3/28/2016	Initial	PAST	1
2	G18	110	SBOU	5/11/2016	Initial	PPOR	3
2	G18	113	MCAV	5/11/2016	Initial	SSID	2
1	G14	119	MCAV	11/4/2016	6-month	SSID	1
1	G14	119	MCAV	11/4/2016	6-month	SSID	1

Appendix Table 13. Continued

Site #	Pin #	Colony Tag	Control Species	Date Monitored	Monitoring Event	Species	L(cm)
1	G14	119	MCAV	11/4/2016	6-month	SSID	4
1	G14	124	DLAB	11/4/2016	6-month	SSID	1
1	G14	124	DLAB	11/4/2016	6-month	SSID	1
1	G14	124	DLAB	11/4/2016	6-month	SSID	1
1	G14	124	DLAB	11/4/2016	6-month	SSID	3
1	G14	124	DLAB	11/4/2016	6-month	SSID	4
1	G14	124	DLAB	11/4/2016	6-month	SSID	4
1	G14	126	MCAV	11/4/2016	6-month	SSID	0.5
1	G14	126	MCAV	11/4/2016	6-month	SSID	0.5
1	G14	126	MCAV	11/4/2016	6-month	SSID	0.5
1	G14	126	MCAV	11/4/2016	6-month	SSID	0.5
1	G14	126	MCAV	11/4/2016	6-month	SSID	0.5
1	G14	126	MCAV	11/4/2016	6-month	SSID	0.5
1	G14	126	MCAV	11/4/2016	6-month	SSID	1
1	G14	126	MCAV	11/4/2016	6-month	SSID	1
1	G14	126	MCAV	11/4/2016	6-month	SSID	1
1	G14	126	MCAV	11/4/2016	6-month	SSID	2
1	G14	126	MCAV	11/4/2016	6-month	PAST	2
1	G14	126	MCAV	11/4/2016	6-month	SSID	3
1	G14	126	MCAV	11/4/2016	6-month	SSID	3
1	G14	127	PAST	11/4/2016	6-month	SSID	0.5
1	G14	127	PAST	11/4/2016	6-month	SSID	1
1	G14	127	PAST	11/4/2016	6-month	SSID	2
1	G14	127	PAST	11/4/2016	6-month	PAST	2
1	G14	127	PAST	11/4/2016	6-month	SSID	4
1	G14	128	DSTO	11/4/2016	6-month	PAST	2
1	G14	129	MCAV	11/4/2016	6-month	PAST	3
1	G14	129	MCAV	11/4/2016	6-month	PAST	4
1	G14	133	MCAV	11/4/2016	6-month	SSID	4
1	G15	102	PAST	11/4/2016	6-month	SSID	2
2	G18	110	SBOU	11/9/2016	6-month	PPOR	2.5

Appendix Table 13. Continued

Site #	Pin #	Colony Tag	Control Species	Date Monitored	Monitoring Event	Species	L(cm)
1	G14	119	MCAV	4/24/2017	12-month	SSID	1
1	G14	119	MCAV	4/24/2017	12-month	SSID	1
1	G14	119	MCAV	4/24/2017	12-month	SSID	2
1	G14	119	MCAV	4/24/2017	12-month	SSID	2
1	G14	124	DLAB	4/24/2017	12-month	SSID	1
1	G14	124	DLAB	4/24/2017	12-month	SSID	1
1	G14	124	DLAB	4/24/2017	12-month	SSID	1
1	G14	124	DLAB	4/24/2017	12-month	SSID	2
1	G14	125	MCAV	4/24/2017	12-month	SSID	2
1	G14	126	MCAV	4/24/2017	12-month	SSID	1
1	G14	126	MCAV	4/24/2017	12-month	SSID	1
1	G14	126	MCAV	4/24/2017	12-month	SSID	1
1	G14	126	MCAV	4/24/2017	12-month	SSID	3
1	G14	127	PAST	4/24/2017	12-month	SSID	1
1	G14	127	PAST	4/24/2017	12-month	SSID	2
1	G14	127	PAST	4/24/2017	12-month	SSID	4
1	G14	127	PAST	4/24/2017	12-month	PAST	2
1	G14	128	DSTO	4/24/2017	12-month	PAST	2
1	G14	129	MCAV	4/24/2017	12-month	PAST	3
1	G14	129	MCAV	4/24/2017	12-month	PAST	4
1	G15	89	SINT	4/24/2017	12-month	SSID	2
1	G15	102	PAST	4/24/2017	12-month	SSID	3
1	G15	103	SSID	4/24/2017	12-month	SSID	2
1	G15	105	DCLI	4/24/2017	12-month	SSID	2
1	G15	109	DCLI	4/24/2017	12-month	SSID	1
1	G15	109	DCLI	4/24/2017	12-month	SSID	2
1	G15	113	DSTO	4/24/2017	12-month	SSID	3
1	G15	114	MCAV	4/24/2017	12-month	PAST	3

Appendix Table 13. Continued

Site #	Pin #	Colony Tag	Control Species	Date Monitored	Monitoring Event	Species	L(cm)
2	19	166	PAST	4/25/2017	12-month	SSID	2
2	19	176	MCAV	4/25/2017	12-month	MCAV	1
1	G14	29	DSTO	10/26/2017	18-month	SSID	1
1	G14	124	DLAB	10/26/2017	18-month	SSID	2
1	G14	124	DLAB	10/26/2017	18-month	SSID	2
1	G14	124	DLAB	10/26/2017	18-month	SSID	3
1	G14	124	DLAB	10/26/2017	18-month	SSID	4
1	G14	126	MCAV	11/7/2017	18-month	SSID	3
1	G14	126	MCAV	11/7/2017	18-month	SSID	3
1	G14	126	MCAV	11/7/2017	18-month	SSID	3
1	G14	126	MCAV	11/7/2017	18-month	SSID	2
1	G14	126	MCAV	11/7/2017	18-month	SSID	2
1	G14	126	MCAV	11/7/2017	18-month	SSID	0.5
1	G14	127	PAST	10/26/2017	18-month	SSID	1
1	G14	127	PAST	10/26/2017	18-month	SSID	2
1	G14	127	PAST	10/26/2017	18-month	SSID	4
1	G14	129	MCAV	10/26/2017	18-month	PAST	3
1	G14	129	MCAV	10/26/2017	18-month	SSID	1
1	G14	130	DSTR	10/26/2017	18-month	PAST	4
1	G15	102	PAST	11/7/2017	18-month	SSID	3
1	G15	105	DCLI	10/26/2017	18-month	PAST	2
1	G15	108	DSTO	10/26/2017	18-month	PAST	2
1	G15	108	DSTO	10/26/2017	18-month	SSID	1
1	G15	110	SSID	10/26/2017	18-month	SSID	1
2	19	175	PAST	10/24/2017	18-month	SSID	1
2	19	176	MCAV	10/26/2017	18-month	PAST	1
2	19	179	SSID	10/26/2017	18-month	SSID	3
2	G18	107	PAST	10/26/2017	18-month	PAST	1
2	G18	113	MCAV	10/24/2017	18-month	SSID	1
2	G18	113	MCAV	10/24/2017	18-month	SSID	2
1	G14	29	DSTO	4/19/2018	24-month	SSID	3
1	G14	120	PAST	4/19/2018	24-month	SSID	3

Appendix Table 13. Continued

Site #	Pin #	Colony Tag	Control Species	Date Monitored	Monitoring Event	Species	L(cm)
1	G14	120	PAST	4/19/2018	24-month	SSID	3
1	G14	120	PAST	4/19/2018	24-month	SSID	4
1	G14	124	DLAB	4/19/2018	24-month	SSID	2
1	G14	125	MCAV	4/19/2018	24-month	SSID	3
1	G14	126	MCAV	4/19/2018	24-month	SSID	3
1	G14	129	MCAV	4/19/2018	24-month	PAST	4
1	G14	134	PAST	4/19/2018	24-month	SSID	3
1	G15	102	PAST	4/19/2018	24-month	SSID	2
1	G15	105	DCLI	4/19/2018	24-month	SSID	3
1	G15	107	MCAV	4/19/2018	24-month	SSID	2
1	G15	113	DSTO	4/19/2018	24-month	SSID	3
2	19	166	PAST	4/18/2018	24-month	SSID	4

Appendix Table 14. Final (24 month vs initial) relocated coral colony percent change in tissue areas based on traced images. A positive value indicates a measurable increase in colony tissue area and a negative value indicates a decrease in tissue area. NA indicates colonies whose images were not traced. Four letter species codes are listed in Appendix Table 1.

Site #	Pin #	Tag	Species	Size Class (cm)	% Change	Site #	Pin #	Tag	Species	Size Class (cm)	% Change
1	G14	1	SSID	10-15	-30.2	1	G14	31	DSTR	16-30	18.7
1	G14	2	SSID	10-15	-21.9	1	G14	32	DSTO	16-30	-100.0
1	G14	3	SBOU	10-15	-51.0	1	G14	33	DSTO	10-15	-100.0
1	G14	4	DSTO	10-15	-100.0	1	G14	34	DSTO	16-30	-100.0
1	G14	5	SBOU	16-30	-100.0	1	G14	35	MCAV	16-30	-100.0
1	G14	6	SSID	10-15	34.1	1	G14	36	MCAV	>50	-20.7
1	G14	7	SSID	10-15	-41.0	1	G14	37	DSTO	10-15	-100.0
1	G14	8	SSID	10-15	-42.0	1	G14	38	DSTO	10-15	-100.0
1	G14	9	SBOU	10-15	-100.0	1	G14	39	DSTO	16-30	-100.0
1	G14	10	SSID	10-15	-21.4	1	G14	40	DSTO	10-15	-100.0
1	G14	11	SSID	10-15	-34.0	1	G14	41	DCLI	10-15	-100.0
1	G14	12	DCLI	16-30	-100.0	1	G14	42	MCAV	16-30	-100.0
1	G14	13	SBOU	16-30	-100.0	1	G14	43	SINT	16-30	-4.9
1	G14	14	SBOU	16-30	-100.0	1	G14	44	DSTO	10-15	-100.0
1	G14	15	SSID	10-15	-33.0	1	G14	45	DSTO	10-15	-100.0
1	G14	16	SBOU	16-30	-100.0	1	G14	46	MCAV	10-15	-100.0
1	G14	17	DSTO	16-30	-100.0	1	G14	47	SSID	10-15	25.6
1	G14	18	DCLI	31-50	-100.0	1	G14	48	SBOU	16-30	-3.1
1	G14	19	DCLI	>50	-26.62	1	G14	49	DCLI	>50	-21.35
1	G14	20	SSID	10-15	-18.42	1	G14	50	MMEA	16-30	-100.0
1	G14	21	DSTO	10-15	-100.0	1	G14	51	SSID	16-30	8.4
1	G14	22	DSTO	10-15	-100.0	1	G14	52	DSTO	16-30	-100.0
1	G14	23	SSID	16-30	7.72	1	G14	53	MCAV	16-30	-100.0
1	G14	24	DSTO	10-15	-100.0	1	G14	54	SBOU	16-30	14.5
1	G14	25	DCLI	31-50	2.27	1	G14	55	MMEA	16-30	-100.0
1	G14	26	SINT	10-15	18.5	1	G14	56	DSTO	16-30	-100.0
1	G14	27	SSID	10-15	-84.8	1	G14	57	DSTO	10-15	-57.1
1	G14	28	SSID	10-15	-33.3	1	G14	58	DCLI	10-15	-100.0
1	G14	29	DSTO	10-15	-100.0	1	G14	59	DCLI	16-30	-100.0
1	G14	30	DSTO	10-15	-100.0	1	G14	60	DSTO	10-15	-100.0

Appendix Table 14. Continued.

Site #	Pin #	Tag	Species	Size Class (cm)	% Change	Site #	Pin #	Tag	Species	Size Class (cm)	% Change
1	G14	61	DCLI	16-30	-100.0	1	G15	94	SBOU	16-30	-21.4
1	G14	62	DSTO	16-30	-100.0	1	G15	95	DSTO	10-15	-100.0
1	G14	63	DCLI	31-50	-100.0	1	G15	96	ACER	10-15	NA
1	G14	64	PAST	10-15	42.3	1	G15	97	MCAV	31-50	-100.0
1	G14	65	DSTO	16-30	-100.0	1	G15	98	MCAV	16-30	-4.3
1	G14	66	DCLI	10-15	-100.0	2	19	77	DCLI	31-50	15.2
1	G14	67	CNAT	16-30	-100.0	2	19	78	SBOU	16-30	3.1
1	G14	68	SINT	10-15	-5.28	2	19	79	DCLI	16-30	-100.0
1	G14	69	DCLI	16-30	-100.0	2	19	80	SBOU	31-50	-7.9
1	G14	70	ACER	31-50	NA	2	19	81	SBOU	31-50	-10.7
1	G14	71	ACER	31-50	NA	2	19	82	SBOU	16-30	-4.8
1	G14	72	ACER	31-50	NA	2	19	83	SBOU	31-50	-63.9
1	G15	73	MCAV	31-50	-100.0	2	19	84	SSID	10-15	-100.0
1	G15	74	CNAT	16-30	-100.0	2	19	85	DSTR	16-30	8.5
1	G15	75	MCAV	31-50	-100.0	2	19	86	SBOU	16-30	2.7
1	G15	76	MCAV	31-50	-44.2	2	19	87	SBOU	10-15	-100.0
1	G15	77	DCLI	31-50	-100.0	2	19	88	SBOU	31-50	-2.6
1	G15	78	SBOU	31-50	-100.0	2	19	89	SSID	10-15	-95.6
1	G15	79	SBOU	16-30	-4.3	2	19	90	SBOU	10-15	-76.3
1	G15	80	DSTO	31-50	-100.0	2	19	91	MCAV	31-50	-100.0
1	G15	81	DSTO	10-15	-100.0	2	19	92	ACER	16-30	NA
1	G15	82	DSTO	16-30	-100.0	2	19	93	SBOU	31-50	-3.5
1	G15	83	CNAT	31-50	-100.0	2	19	94	SBOU	16-30	-100.0
1	G15	84	DCLI	31-50	-100.0	2	19	95	SBOU	31-50	-3.5
1	G15	85	DCLI	16-30	-19.4	2	19	96	SBOU	16-30	-25.2
1	G15	86	DCLI	16-30	-100.0	2	19	97	SBOU	31-50	-24.2
1	G15	87	DSTO	10-15	-100.0	2	19	98	DSTO	10-15	-100.0
1	G15	88	DSTO	16-30	-100.0	2	19	99	SSID	10-15	-26.2
1	G15	89	SINT	10-15	-5.1	2	19	115	SINT	16-30	6.9
1	G15	90	ACER	>50	NA	2	19	116	DSTO	10-15	-100.0
1	G15	91	DCLI	31-50	-51.0	2	19	117	SINT	16-30	4.9
1	G15	92	DSTO	10-15	-100.0	2	19	118	MCAV	31-50	-100.0
1	G15	93	DSTO	10-15	-100.0	2	19	119	SBOU	16-30	5.2

Appendix Table 14. Continued.

Site #	Pin #	Tag	Species	Size Class (cm)	% Change	Site #	Pin #	Tag	Species	Size Class (cm)	% Change
2	19	120	DCLI	31-50	4.6	2	G18	31	DSTO	10-15	9.7
2	19	121	SBOU	31-50	-3.0	2	G18	32	DSTR	31-50	-100.0
2	G18	1	ISIN	10-15	-100.0	2	G18	33	DSTO	16-30	-100.0
2	G18	2	SINT	10-15	1.6	2	G18	34	CNAT	31-50	-100.0
2	G18	3	DSTO	10-15	-10.4	2	G18	35	DSTR	31-50	7.4
2	G18	4	SBOU	>50	-4.2	2	G18	36	DCLI	31-50	-100.0
2	G18	5	DCLI	>50	-100.0	2	G18	37	DSTO	10-15	-100.0
2	G18	6	CNAT	31-50	-100.0	2	G18	38	SBOU	16-30	-96.9
2	G18	7	DCLI	31-50	6.2	2	G18	39	SBOU	31-50	-18.0
2	G18	8	MMEA	16-30	-100.0	2	G18	40	DSTO	16-30	-100.0
2	G18	9	SSID	10-15	0.3	2	G18	41	DCLI	16-30	9.9
2	G18	10	DSTR	16-30	-100.0	2	G18	42	SINT	16-30	-2.1
2	G18	11	DSTO	16-30	-100.0	2	G18	43	SSID	10-15	-97.2
2	G18	12	DCLI	31-50	-100.0	2	G18	44	SINT	10-15	-95.8
2	G18	13	DSTO	10-15	-100.0	2	G18	45	DSTR	31-50	-100.0
2	G18	14	SBOU	10-15	-100.0	2	G18	46	DSTO	10-15	-100.0
2	G18	15	DSTO	10-15	-100.0	2	G18	47	DCLI	16-30	13.4
2	G18	16	SBOU	16-30	5.3	2	G18	48	DCLI	16-30	-100.0
2	G18	17	DSTO	16-30	-100.0	2	G18	49	DSTR	16-30	21.9
2	G18	18	DCLI	16-30	-100.0	2	G18	50	SBOU	31-50	-1.0
2	G18	19	DCLI	16-30	23.9	2	G18	51	MCAV	31-50	-25.7
2	G18	20	SSID	10-15	-35.3	2	G18	52	DSTO	16-30	1.0
2	G18	21	DCLI	31-50	-1.2	2	G18	53	DCLI	16-30	-100.0
2	G18	22	CNAT	31-50	-100.0	2	G18	54	SBOU	16-30	1.2
2	G18	23	DSTR	31-50	-100.0	2	G18	55	DSTR	>50	-100.0
2	G18	24	SINT	16-30	-89.6	2	G18	56	SBOU	>50	-8.7
2	G18	25	SINT	10-15	14.6	2	G18	57	SINT	16-30	10.4
2	G18	26	DCLI	31-50	2.3	2	G18	58	SINT	16-30	-0.4
2	G18	27	SINT	16-30	1.7	2	G18	59	DSTO	16-30	-100.0
2	G18	28	DSTO	16-30	-100.0	2	G18	60	SBOU	16-30	-91.7
2	G18	29	DCLI	16-30	-71.7	2	G18	61	DCLI	31-50	-2.9
2	G18	30	DCLI	16-30	-100.0	2	G18	62	SINT	10-15	-1.0

Appendix Table 14. Continued.

Site #	Pin #	Tag	Species	Size Class (cm)	% Change
2	G18	63	SINT	10-15	9.7
2	G18	64	DSTR	31-50	-100.0
2	G18	65	SBOU	31-50	-7.7
2	G18	66	CNAT	31-50	-100.0
2	G18	67	SINT	16-30	11.5
2	G18	68	ACER	31-50	NA
2	G18	69	ACER	16-30	NA
2	G18	70	ACER	16-30	NA
2	G18	71	ACER	31-50	NA
2	G18	72	ACER	16-30	NA
2	G18	73	ACER	10-15	NA
2	G18	74	ACER	16-30	NA
2	G18	75	ACER	16-30	NA
2	G18	76	ACER	16-30	NA
3	99	135	SBOU	31-50	-2.8
3	99	136	DSTR	>50	-4.7
3	99	137	CNAT	31-50	-12.5
3	99	138	SBOU	31-50	20.9
3	99	139	DSTR	>50	4.5
3	99	140	DSTR	>50	14.5

Appendix Table 15. Final (24 month vs initial) control colony percent tissue area change based on traced images. Negative values indicate a measurable decrease in tissue area. NA indicates colonies whose images were not traced. Four letter species codes are listed in Appendix Table 1.

Site #	Pin #	Tag	Species	Size Class (cm)	% Change	Site #	Pin #	Tag	Species	Size Class (cm)	% Change
1	G14	115	PAST	10-15	54.0	1	G15	113	DSTO	10-15	-100
1	G14	116	PAST	10-15	-100	1	G15	114	MCAV	31-50	-44.7
1	G14	117	DCLI	16-30	-100	2	19	166	PAST	10-15	-63.1
1	G14	118	MCAV	16-30	-100	2	19	167	ACER	>50	NA
1	G14	119	MCAV	>50	-100	2	19	168	PAST	10-15	0.6
1	G14	120	PAST	16-30	5.1	2	19	169	MCAV	>50	-76.1
1	G14	121	AAGA	16-30	-4.9	2	19	170	PAST	10-15	-100
1	G14	122	SINT	16-30	-39.6	2	19	171	MCAV	16-30	-49.2
1	G14	123	PAST	16-30	-41.3	2	19	172	ACER	16-30	NA
1	G14	124	DLAB	>50	-100	2	19	173	SBOU	16-30	-100
1	G14	125	MCAV	31-50	2.8	2	19	174	SBOU	10-15	11.3
1	G14	126	MCAV	>50	-35.1	2	19	175	PAST	16-30	29.5
1	G14	127	PAST	10-15	12.8	2	19	176	MCAV	>50	-100
1	G14	128	DSTO	10-15	-100	2	19	177	SSID	10-15	-74.9
1	G14	129	MCAV	>50	-64.3	2	19	178	MCAV	31-50	-10.2
1	G14	130	DSTR	>50	-100	2	19	179	SSID	16-30	-6.0
1	G14	131	SSID	16-30	-10.1	2	19	180	PAST	16-30	-13.4
1	G14	132	MCAV	16-30	-24.9	2	19	181	MCAV	31-50	-100
1	G14	133	MCAV	31-50	-29.6	2	G18	100	DCLI	16-30	-56.4
1	G14	134	PAST	16-30	92.2	2	G18	101	SSID	16-30	-48.4
1	G15	100	DSTR	10-15	-100	2	G18	102	SINT	10-15	40.8
1	G15	101	PAST	10-15	-100	2	G18	103	DSTO	10-15	-100
1	G15	102	PAST	10-15	19.5	2	G18	104	MCAV	31-50	-100
1	G15	103	SSID	16-30	12.3	2	G18	105	PAST	10-15	-6.3
1	G15	104	DSTO	10-15	-100	2	G18	106	MANN	16-30	1.8
1	G15	105	DCLI	31-50	-13.7	2	G18	107	PAST	16-30	-43.8
1	G15	106	DSTR	10-15	-100	2	G18	108	SSID	31-50	50.9
1	G15	107	MCAV	31-50	-54.5	2	G18	109	SSID	10-15	-100
1	G15	108	DSTO	16-30	-100	2	G18	110	SBOU	31-50	-8.5
1	G15	109	DCLI	16-30	-100	2	G18	111	SSID	16-30	25.0
1	G15	110	SSID	16-30	-5.2	2	G18	112	SSID	16-30	-100
1	G15	111	PAST	10-15	-18.3	2	G18	113	MCAV	>50	-72.2
1	G15	112	SINT	10-15	-15.2	2	G18	114	MCAV	>50	-99.7



August 26, 2020

F/SER47:KG/pw

(Sent via Electronic Mail)

Colonel Andrew Kelly, Commander
U.S. Army Corps of Engineers, Jacksonville District
701 San Marco Boulevard
Jacksonville, Florida 32207-8175

Attention: Kristen L. Donofrio

Dear Colonel Kelly:

NOAA's National Marine Fisheries Service (NMFS) reviewed the letter from the Jacksonville District dated August 18, 2020, responding to the six essential fish habitat (EFH) conservation recommendations the NMFS provided by letter dated June 18, 2020, for the work described in the *Draft Environmental Assessment for the Broward County Shore Protection Project Segment II Beach Renourishment*, dated May 2020 (Draft EA). The Draft EA describes plans to conduct periodic nourishment along 8.9 miles of Broward County shoreline using sand from upland sources. Nourishment would occur in previously nourished areas and in locations not included in prior consultations with the NMFS under the EFH provisions of the Magnuson-Stevens Act, either as a federal civil works project or as a federal permit authorizing Broward County to nourish the beach. To protect EFH, the NMFS recommended:

1. The Jacksonville District should provide recent survey information (collected within the last two years) characterizing hardbottom communities likely to be affected by the project, including areas not previously surveyed in Reach 1 (R-25 to R-32 and R-42 to R-51) or evaluated in the prior EFH consultation (for Reaches 2 through 4). This recommended survey area also includes areas where the hardbottom edge is within 500 feet of the Equilibrium-Toe-Of-Fill in Reaches 2 through 4 (R-25.5; just north of R-28; R-31.3 to R-37; R-41 to R-44.5; and R-46 to R-49.5). The surveys should identify benthic community composition, benthic community condition, and the coral species present, including corals protected under the Endangered Species Act. The NMFS requested providing the new information in context with results from previous surveys.
2. Once benthic resource surveys for the full extent of the Broward Segment II project area are complete, the Jacksonville District should propose specific, enforceable measures to avoid or minimize impacts to coral, hardbottom, and worm reef from sediment and turbidity resulting from the nourishment project. The Final Environmental Assessment should include a summary of these assessments.
3. The Jacksonville District should provide the status of the coral relocation that was required as an impact minimization measure for the previous iteration of the project. Specifically, the NMFS requested the District provide the number of corals relocated, a summary of the monitoring efforts, and the number of corals meeting the criteria for successful coral relocation. If the success criteria were not met, additional compensatory mitigation should be provided.
4. The Jacksonville District should provide compensatory mitigation for the past and the proposed new impacts to coral, hardbottom, or worm reef likely caused by the filling. The Final Environmental Assessment should assess prior impacts to these habitats and the status of the required mitigation, including additional mitigation to address unforeseen delays in constructing



the mitigation. The Jacksonville District should coordinate with the NMFS to discuss steps for completing the mitigation agreed to during earlier coordination, including updates to performance criteria and changes to the coral species expected to recruit to the reefs due to the Stony Coral Tissue Loss Disease (SCTLD). The District should use a functional assessment to evaluate the mitigation type, location, and amount.

5. The Jacksonville District should provide a biological monitoring plan describing pre-construction and post-construction surveys for mapping the nearshore hardbottom edge and evaluating data from 150-meter shore-perpendicular transects. The NMFS requests an opportunity to review the monitoring plan prior to its finalization.
6. When revising the Draft EA, the Jacksonville District should include an assessment of potential cumulative impacts with the Port Everglades Deepening Project (PEDP).

In response to recommendation 1, the Jacksonville District describes plans for Broward County to conduct a reconnaissance survey during late summer or fall 2020 to characterize hardbottom habitats in Reach 1. The District also agrees to provide NMFS with the most recent survey information available for Reaches 2 through 4. The District commits to reviewing the new survey information with NMFS to determine if additional coral relocation or compensatory mitigation is necessary.

In response to recommendation 2, the District describes measures proposed to avoid or minimize impacts to coral and hardbottom habitats. The District also identified the specific Project Design Criteria (PDCs) it believes apply from the South Atlantic Regional Biological Opinion (SARBO). In addition, the District agrees to depict the locations of hardbottom on contract drawings. The District will require the cessation of work and notification when project activities are expected to impact hardbottom or are observed to be impacting hardbottom. The District also commits to marking the mean high water line (MHWL) to allow visual confirmation sand placement is above the MHWL during construction. In addition, the contractor will be required to develop and submit to the District an Environmental Protection Plan (EPP) describing how the contractor will meet the contract's environmental specifications, including protection of coral and hardbottom habitats. The District has agreed to share the EPP with the NMFS.

In response to recommendation 3, the District's letter summarizes the status of the coral relocation required under the previous authorization and a copy of the draft final monitoring report. The coral relocation did not meet the success criterion of 85 percent of relocated colonies having live tissue after two years. The monitoring report describes the ongoing SCTLD outbreak as the primary cause of death for both relocated corals and reference site corals. The NMFS agrees the failure to meet this success criterion is not the fault of Broward County, but rather a consequence of conducting the work during the peak of the SCTLD outbreak.

The District's response to recommendation 4 indicates the District's Regulatory Division modified the permit issued to Broward County to extend the timeframe for construction of the mitigation for previous coral and hardbottom impacts. Based on coordination with the Jacksonville District's Regulatory Division and Florida Department of Environmental Protection (FDEP), the NMFS learned an administrative appeal hampered the schedule for the construction of 6.64 acres of artificial reef modules. Accordingly, the NMFS is not recommending additional mitigation for the loss of ecological function from the resulting time lag. However, NMFS recommends the Final Environmental Assessment describe the status of the coral relocation and construction of the mitigation. At this time, the District does not anticipate additional impacts to coral or hardbottom habitats will result from the nourishment planned at Segment II. However, if the results from the new surveys (described in recommendation 1) provide information suggesting otherwise, the District agrees to coordinate with the NMFS.

In response to recommendation 5, the District agrees to include monitoring transects within Reach 1 and conduct a baseline monitoring event within the entire project area. The District's letter also states the

NMFS will have the opportunity to review and comment on the biological monitoring plan that FDEP and Broward County are developing before the plan is final.

In response to recommendation 6, the District refers the NMFS to Section 4.18 of the Draft EA where PEDP is mentioned. While mentioning PEDP falls short of a full evaluation of cumulative effects, the District notes the impact assessment being prepared for the supplemental Environmental Impact Statement for PEDP is not yet complete. The letter also states the results from the spillage model conducted for PEDP in March 2020 and the minimization measures for PEDP as described in a Memorandum for the Record dated August 7, 2018, will be added to the cumulative impacts section of the Final Environmental Assessment.

In closing, the NMFS views the EFH consultation for this beach nourishment project as complete, even though additional coordination is expected to occur regarding minimization or mitigation measures that may be needed based on the new information coming for Reaches 1 through 4. In addition, further coordination will occur after the contractor submits the EPP and updates are made to the biological monitoring plan.

Please note these comments do not satisfy consultation responsibilities under section 7 of the Endangered Species Act of 1973, as amended. This letter is not a determination that the work described in the Draft EA is covered under the SARBO, nor does this letter provide a comprehensive list of all the SARBO PDCs germane to this project. Please contact our Protected Resources Division to discuss further the application of SARBO to this project.

The NMFS greatly appreciates the collaboration with the Jacksonville District in completing this EFH consultation. Of note, the NMFS met with the District on August 18, 2020, to discuss the District's response to our recommendations, contributing to an efficient resolution of this consultation. Please direct related correspondence to the attention of Mr. Kurtis Gregg at our West Palm Beach Office, 400 North Congress Ave, Suite 270, West Palm Beach, Florida 33401, at 561-440-3167, or at Kurtis.Gregg@noaa.gov.

Sincerely,

WILBER.THOMAS
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/for

Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc: COE, Kristen.L.Donofrio@usace.army.mil, Jason.J.Spinning@usace.army.mil
Wendy.S.Dauberman-Zerby@usace.army.mil, Angela.E.Dunn@usace.army.mil
FWS, Ashleigh_Blackford@fws.gov
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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

Ms. Roxanna Hinzman
Field Supervisor
South Florida Field Office
U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, Florida 32960

Dear Ms. Hinzman:

Pursuant to the National Environmental Policy Act of 1969, as amended, (NEPA) and the U.S. Army Corps of Engineers Regulation (33 CFR 230.11), this letter constitutes the Corps' Notice of Availability of the Proposed Finding of No Significant Impact (FONSI) and Draft Environmental Assessment (EA) for the continued periodic renourishment of the Broward County Shore Protection Project (BCSPP), Segment II Beach Renourishment in Broward County, Florida. In order to comply with Section 7 of the Endangered Species Act (ESA) of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), the U.S. Army Corps of Engineers, Jacksonville District (Corps), respectfully requests a letter of concurrence from the U.S. Fish and Wildlife Service (USFWS) on the Corps' may affect, not likely to adversely affect (MANLAA) effect determinations for the project.

The purpose for the project is to provide coastal storm risk management through beach nourishment of the Segment II portion of the BCSPP in Broward County, Florida. The need of the project is driven by the loss of sand (erosion) along the shoreline, most recently from Hurricane Irma in September 2017. Erosion has reduced the width of the beach, thus increasing the risk for storm damages that are otherwise mitigated by the beach design. Periodic nourishment of the beach is required to replace sand along the shoreline and thus maintains the beach to its federally-authorized dimensions.

The Preferred Alternative is the continued periodic nourishment of Segment II of the BCSPP and the feeder beach via truck haul from upland sand mines. The upcoming nourishment event will include placement of approximately 413,000 cubic yards (CY) of sand in the following Florida Department of Environmental Protection (FDEP) monuments: Reach 1: Approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder each feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only. Reach 2: Approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.

- Reach 3: Approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.

- Reach 4: Approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immoklaee), Vulcan Witherspoon Mine (Witherspoon), and/or Cemex Davenport Mine (Cemex). The 2020 EA also evaluates the use of the upland sand mine Garcia Family Farm, LLC in Henry County (Garcia Mine).

Listed species and/or designated critical habitat (DCH) which may occur in the vicinity of the proposed work and are under the jurisdiction of the USFWS include:

Common Name	Scientific Name	Listing Status	Corps' Effect Determination
Green sea turtle <i>North Atlantic Distinct Population Segment (DPS)</i>	<i>Chelonia mydas</i>	Threatened	MANLAA*
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	MANLAA*
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	MANLAA*
Loggerhead sea turtle <i>Northwest Atlantic DPS</i>	<i>Caretta caretta</i>	Threatened/Critical Habitat	MANLAA*
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	Endangered	MANLAA*
American crocodile	<i>Crocodylus acutus</i>	Threatened	MANLAA*
Piping plover	<i>Charadrius melodus</i>	Threatened	MANLAA*
Florida manatee	<i>Trichechus manatus latirostris</i>	Threatened	MANLAA*
Beach jacquemontia	<i>Jacquemontia reclinata</i>	Endangered	No Effect

*MANLAA = May affect, not likely to adversely affect

The Corps determined that the project and its effects are consistent with those analyzed in the Statewide Programmatic Biological Opinion (SPBO) and Piping Plover Programmatic Biological Opinion (P3BO). The Corps will abide by all applicable minimization measures, Reasonable and Prudent Measures (RPMs), and Terms and Conditions (T&Cs) in the SPBO and P3BO to ensure the protection of nesting sea turtles and piping plover. The Corps requests concurrence from the USFWS on the Corps' MANLAA determinations for the American crocodile and Florida manatee. Included with this letter is additional information describing the project background, project location and proposed action, potential effects American crocodiles, Florida manatees, and beach jacquemontia, and efforts to eliminate/avoid effects to listed

species. Additional details on the Preferred Alternative can be found in the draft EA, which is available for your review on the Jacksonville District's Environmental planning website, under Broward County:

<http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/>

(On that page, click on the "+" next to "Broward". Scroll down to the project name.)

In addition to notifying USFWS of the draft documents and requesting concurrence with the MANLAA effect determinations, the Corps respectfully requests that the USFWS sign the enclosed memorandum for the record (MFR). The MFR documents an informal understanding between the two agencies to utilize the project's NEPA review process to complete coordination responsibilities under the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq., March 10, 1934, as amended 1946, 1958, 1978, and 1995). This agreement will avoid duplicate analysis and documentation as authorized under 40 CFR section 1500.4 (k), 1502.25, 1506.4.

Due to current circumstances with COVID-19, the Corps is requesting that any questions or comments you may have be submitted in writing via electronic mail to Kristen.L.Donofrio@usace.army.mil within 30 days of the date of this letter. Correspondence may also be sent to the letterhead address above; however, due to limited staff availability at the District office, electronic submittal of comments via email is preferred.

Sincerely,



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Angela E. Dunn
Chief, Environmental Branch

Encl

Broward County Shore Protection Project Segment II Beach Nourishment in Broward County, Florida

In order to comply with Section 7 of the Endangered Species Act of 1973 (ESA) (87 Stat. 884, as amended; 16 U.S.C. 1531 *et seq.*), the U.S. Army Corps of Engineers, Jacksonville District (Corps), respectfully requests a letter of concurrence within 30 days of the date of this letter from the U.S. Fish and Wildlife Service (USFWS) for the continued periodic renourishment of the Broward County Shore Protection Project (BCSPP), Segment II Beach Renourishment in Broward County, Florida.

The Corps has determined that the proposed project may affect, but is not likely to adversely affect (MANLAA) nesting sea turtles (green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), Kemp's ridley sea turtle (*Lepidochelys kempii*)), Florida manatees (*Trichechus manatus latirostris*), American crocodiles (*Crocodylus acutus*), and piping plover (*Charadrius melodus*). The project will have no effect on beach Jacquemontia (*Jacquemontia reclinata*).

Pursuant to our request, the Corps is providing the following information:

- Description of the Project Background;
- Description of the Project Location and Proposed Action;
- Listed Species Under USFWS Jurisdiction;
- Potential Effects to Listed Species and Efforts to Eliminate/Avoid Impacts; and
- Corps' Effect Determination.

Description of the Project Background

The purpose for the project is to provide coastal storm risk management through beach nourishment of the Segment II portion of the BCSPP in Broward County, Florida. The need of the project is driven by the loss of sand (erosion) along the shoreline, most recently from Hurricane Irma in September 2017. Erosion has reduced the width of the beach, thus increasing the risk for storm damages that are otherwise mitigated by the beach design. Periodic nourishment of the beach is required to replace sand along the shoreline and thus maintains the beach to its federally-authorized dimensions.

Pursuant to NEPA and the ESA, the 2004 Final Environmental Impact Statement (EIS) BCSPP Segments II and III, Broward County, Florida and 2015 Broward County, Florida Shore Protection Project – Segment II, Limited Reevaluation Report (LRR) with Environmental Assessment (EA) included consultation with USFWS for potential effects to listed species. Due to the inclusion of the Reach 1 shore protection and feeder beach feature, the Corps reevaluated the project's potential effects to species under USFWS jurisdiction. The Corps determined that implementation of the Preferred Alternative (continued periodic renourishment of Segment II of the BCSPP and construction of the Reach 1 shore protection and feeder beach feature via truck haul from upland sand mines) may affect some federally-listed species under USFWS jurisdiction.

Description of the Project Location and Preferred Alternative

Broward County is located on the southeast coast of Florida between Palm Beach County to the north and Miami-Dade County to the south. The shoreline of Broward County includes 24 miles of coastline and two coastal inlets. It is divided up into three segments: Segment I extends from the northern Broward County line to Hillsboro Inlet (Florida Department of Environmental Protection (FDEP) monuments R-1 to R-24), Segment II continues from Hillsboro Inlet to Port Everglades Inlet (R-25 to R-85), and Segment III reaches from Port Everglades to the southern Broward County line (R-86 to R-128) (see **Figure 1**).

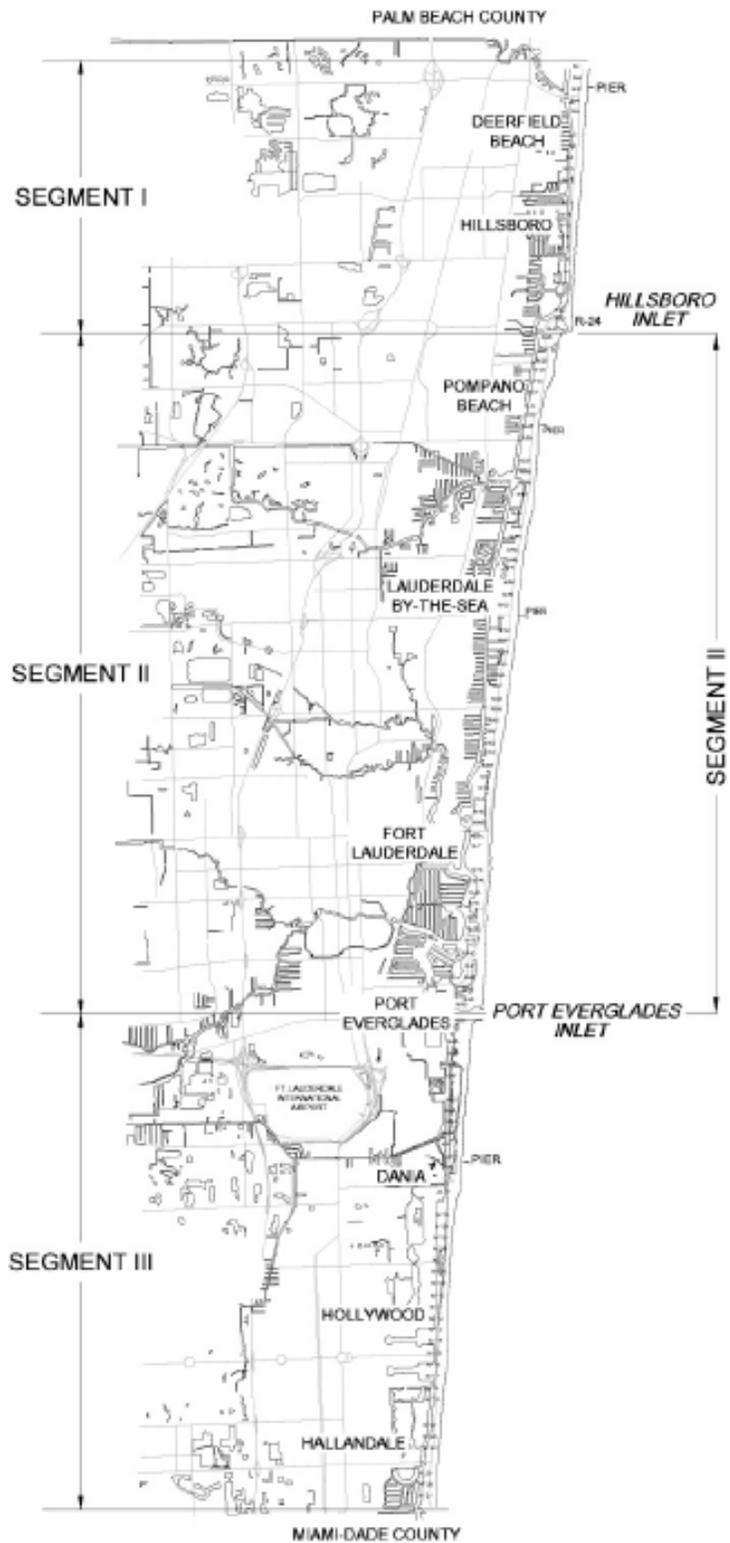


Figure 1. Map of the BCSP segment locations.
SOURCE: CB&I and Olsen 2015

The authorized Federal project for Segment II includes the Atlantic Ocean shoreline in central Broward County between Hillsboro Inlet (R-25) and Port Everglades Inlet (R-85); however, only between R-25 and R-72 have been constructed to date. The Segment II shoreline is approximately 11.3 miles long and includes the municipalities of Pompano Beach, Lauderdale-By-The-Sea, Sea Ranch Lakes, and Fort Lauderdale. Sand will be placed along the 8.9 miles shoreline previously constructed between R-25 and R-72, which includes all four municipalities, but just the northern portion of Fort Lauderdale. The project is split into four reaches: Reach 1 (R-25 to R-36), Reach 2 (R-36 to R-41.3), Reach 3 (R-41.3 to R-51) and Reach 4 (R-51 to R-72).

The upcoming renourishment event will include placement of approximately 413,000 cubic yards (CY) of sand¹ along the following FDEP monuments:

- Reach 1: Approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: Approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.
- Reach 3: Approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.
- Reach 4: Approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immokalee), Vulcan Witherspoon Mine (Witherspoon), and/or Cemex Davenport Mine (Cemex).

Listed Species under USFWS Jurisdiction

Listed species which may occur in the vicinity of the proposed work and are under the jurisdiction of the USFWS include the following species:

Common Name	Scientific Name	Listing Status	Corps' Effect Determination
Green sea turtle <i>North Atlantic Distinct Population Segment (DPS)</i>	<i>Chelonia mydas</i>	Threatened	MANLAA*
Hawksbill sea turtle	<i>Eretmochelys imbricata</i>	Endangered	MANLAA*
Leatherback sea turtle	<i>Dermochelys coriacea</i>	Endangered	MANLAA*

¹ The actual quantity of volume placed may vary based on changes in the existing conditions; the volumes provided are based on existing conditions and need identified through the November 2019 beach profile survey.

Common Name	Scientific Name	Listing Status	Corps' Effect Determination
Loggerhead sea turtle <i>Northwest Atlantic DPS</i>	<i>Caretta caretta</i>	Threatened/Critical Habitat	MANLAA*
Kemp's ridley sea turtle	<i>Lepidochelys kempii</i>	Endangered	MANLAA*
Piping plover	<i>Charadrius melodus</i>	Threatened	MANLAA*
Florida manatee	<i>Trichechus manatus latirostris</i>	Threatened	MANLAA*
American crocodile	<i>Crocodylus acutus</i>	Threatened	MANLAA*
Beach jacquemontia	<i>Jacquemontia reclinata</i>	Endangered	No Effect

*MANLAA = May affect, not likely to adversely affect

Corps' Analysis and Effect Determinations on Listed Species under USFWS Jurisdiction:

Nesting Sea Turtles (Green sea turtle, hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle, Kemp's ridley sea turtles)

Broward County is within the nesting range of four species of sea turtles; the loggerhead (*Caretta caretta*), the North Atlantic Distinct Population Segment (DPS) of green sea turtle (*Chelonia mydas*) (80 FR 15272), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*). The leatherback sea turtle and hawksbill sea turtle are listed as endangered under the Endangered Species Act (ESA). The loggerhead sea turtle and the North Atlantic DPS of the green sea turtle are listed as threatened. Additionally, the waters offshore of Broward County are used for foraging and shelter for the four species listed above as well as the endangered Kemp's ridley sea turtle (*Lepidochelys kempii*). The USFWS designated critical habitat for the loggerhead sea turtle in 2014 (79 FR 39855-39912), including areas within the boundaries of Broward County; however, it is north of the project area (see **Figure 3**).

Three species of sea turtles, the loggerheads, greens, and leatherbacks, are known to regularly nest on Broward County beaches. Peak sea turtle nesting and hatching period is from May 1 to November 1 in Broward County, with nesting typically ending around mid-November. Broward County has maintained a conservation program for threatened and endangered sea turtle species since 1978. Conservation activities include the permitted relocation of nests from hazardous locations, accurate surveys of nesting patterns and nesting success, response to strandings/turtle emergencies, and public outreach. To reduce potential impacts to nesting and hatchling sea turtles, placement of sand on the beach is not allowed during the peak sea turtle nesting and hatching period, which is between May 1 to November 1 in Broward County.

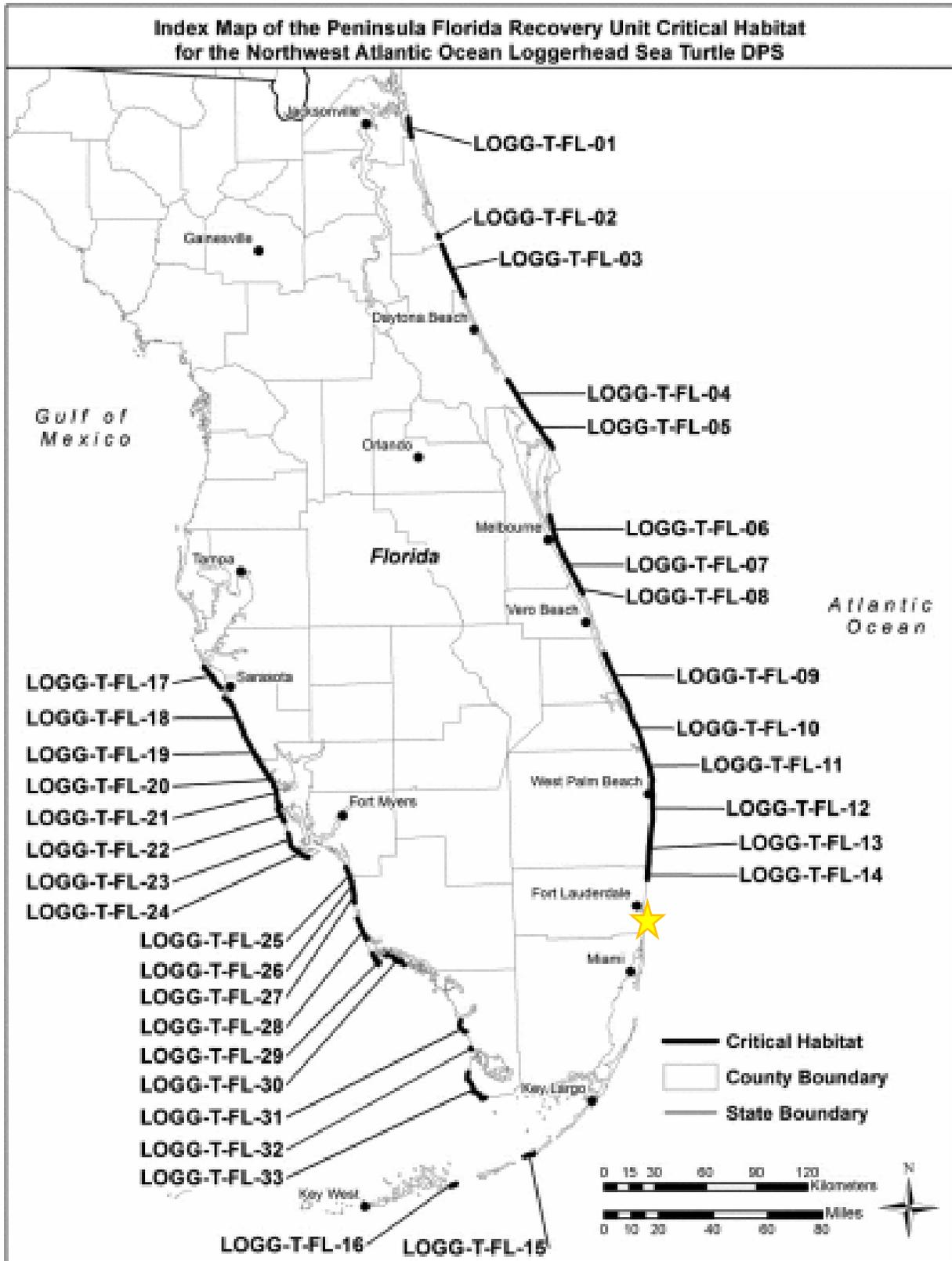


Figure 2. Map of USFWS Designated Critical Habitat for loggerhead sea turtles.
(SOURCE: USFWS 2014)

Corps' Effect Determination: MANLAA.

The Corps determined that beach renourishment is consistent with the SPBO. By implementing the applicable terms and conditions (T&Cs) of the SPBO, the Corps determined that the project's beach placement activities may affect but are not likely to adversely affect nesting sea turtles. The SPBO acknowledges that placement of sand on a critically eroded beach can enhance sea turtle nesting habitat if the sand placed is highly compatible (*i.e.*, grain size, shape, color, etc.) with naturally occurring beach sediments at the recipient site, and compaction and escarpment remediation measures are properly adopted (USFWS 2015). Because a truck haul project would not require use of dredges or other vessels, it is unlikely that offshore sea turtle habitat would be impacted. A truck haul approach also minimizes the use of in-water vessels and the potential for entanglement, entrainment, or strikes. Effects to sea turtles from truck haul activity include risk of injury from interaction with heavy equipment during construction as well as avoidance of construction activities, related noise, and physical exclusion from areas blocked by turbidity curtains (if implemented). These effects are determined to be insignificant as direct, physical injury is not anticipated since sea turtles are highly mobile and able to easily avoid the area.

Piping Plover

The piping plover (*Charadrius melodus*) Atlantic Coast and Northern Great Plains populations were listed as threatened in 1985 (50 FR 50726). Piping plovers are generally found on sandy beaches on the Atlantic Coast and Great Lakes as well as sandbars along major rivers on the northern Great Plains. While most shorebirds have a wide distribution, the piping plover barely extends into Mexico during the winter (Audubon 2018). Piping plovers are foragers and feed on prey such as insects, marine worms, and crustaceans. The populations have declined primarily due to human disturbance on nesting areas, especially in competition for beach use. Nests are shallow scrapes in open ground with no direct shelter or shade. Although critical habitat was designated for the species in 2001 (66 FR 36038), there is no DCH in the project area.

Corps' Effect Determination: MANLAA.

The Corps determined that the project's beach placement activities may affect but are not likely to adversely affect piping plovers. Implementation of the Preferred Alternative would increase habitat that could be used by the piping plover; however, it is not considered optimal habitat. Direct effects to the birds from project construction are expected to be minimal as birds are motile and can avoid construction activities. Placement of sand on the beach may temporarily displace foraging and resting birds. This interruption is limited to the immediate area and duration of construction. Habitat exists outside of the beach placement areas with similar characteristics that may be used by displaced species while renourishment activities are underway. The prey base, which includes the benthic organisms, may be temporarily reduced in the proposed beach placement areas. This effect would be short-term as recovery of beach infauna is expected to occur quickly.

The project's beach placement activities and its effects on piping plover are consistent with those analyzed in the Piping Plover Programmatic Biological Opinion (P3BO). The

Corps will abide by all applicable minimization measures, RPMs, and T&Cs in the P3BO to ensure the protection of piping plovers that may be in the project area. If the species are found in the project footprint, the protective conditions developed for migratory birds will be utilized as well as conditions of the P3BO. Compliance with the reasonable and prudent measures and T&Cs listed in the P3BO will provide sufficient protection for piping plover.

West Indian (Florida) Manatee

The Florida manatee is a subspecies of the West Indian manatee (*Trichechus manatus*) and can be found throughout the southeastern United States. The manatee is a large, plant-eating aquatic mammal that move between freshwater and saltwater environments. They can be found in shallow coastal waters, rivers, and springs. Adult manatees are approximately 10 feet long, weighing between 800 – 1200 pounds, and consume approximately 4-9% of their body weight each day. Although manatees feed underwater, they frequently rest just below the water surface with only the snout above water. Manatees were listed as endangered throughout its range for both the Florida and Antillean subspecies (*Trichechus manatus latirostris* and *Trichechus manatus manatus*) in 1967 (32 FR 4001). In May 2017, the USFWS reclassified the manatee from endangered to threatened.

Federal law, specifically the Marine Mammal Protection Act of 1972 and the Endangered Species Act of 1973 protects manatees. Critical habitat is defined under the Endangered Species Act as specific areas within and/or outside a geographical area that are occupied by a species at the time of listing, that contain physical or biological features essential to the conservation of the species and therefore require special management considerations or protection for the benefit of the species. Critical habitat for the Florida manatee was described in 1976 in 50 CFR 17.95 for Florida. The project is not located within USFWS designated critical habitat (DCH) (see **Figures 3 and 4**); however, the project is located in the Florida Fish and Wildlife Conservation Commission Manatee Protection Zone (see **Figure 5**).



Figure 3. USFWS Florida manatee DCH.

(Source: https://www.fws.gov/northflorida/manatee/2009_CH_Petition/20100112_frn_Federal%20Register_manatee_12-mo_325.pdf)

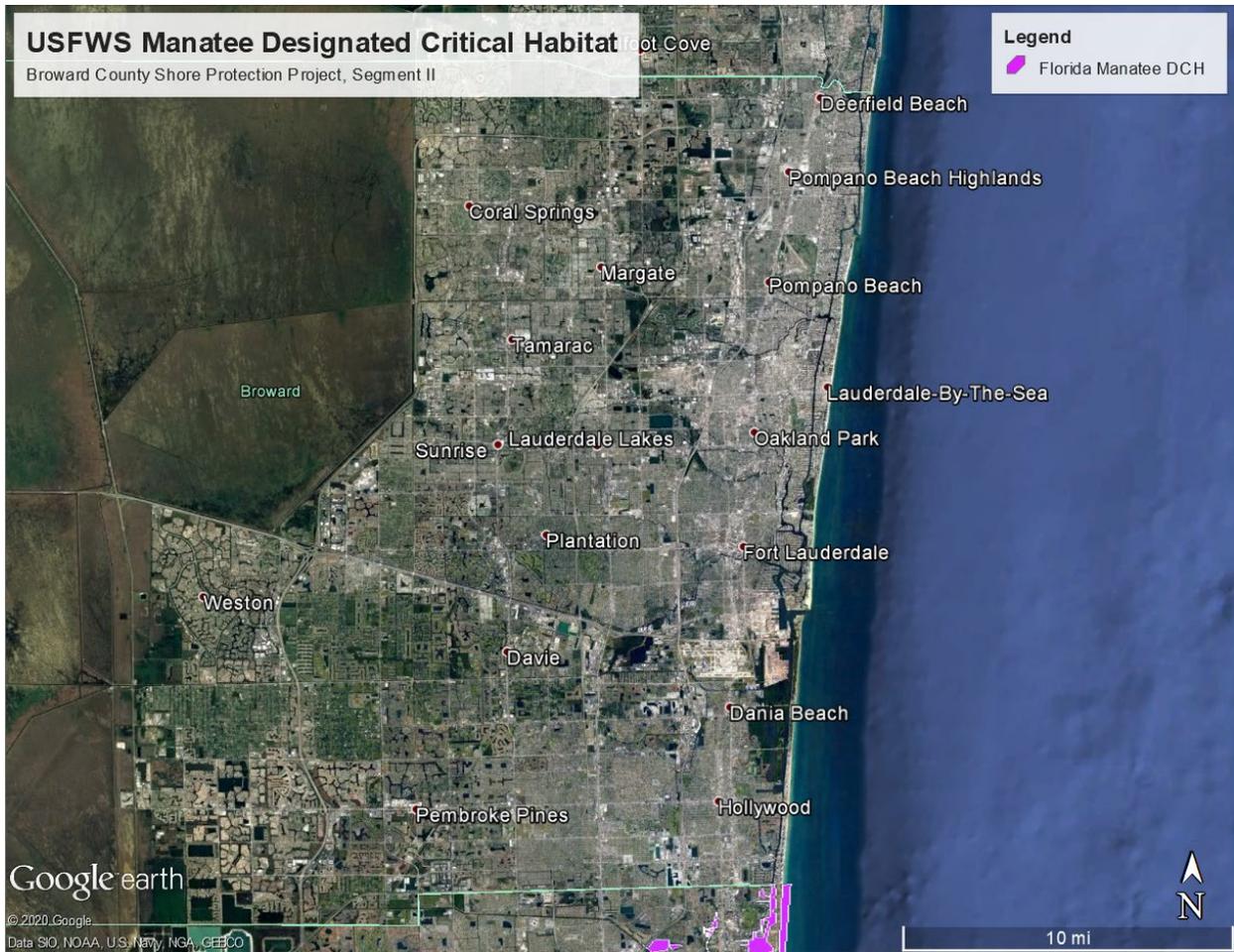


Figure 4. USFWS Florida manatee DCH, zoomed to project vicinity.

(Source: Resources at Risk layer, Corps' Regulatory Division)

Florida Counties with FWC Manatee Protection Zones

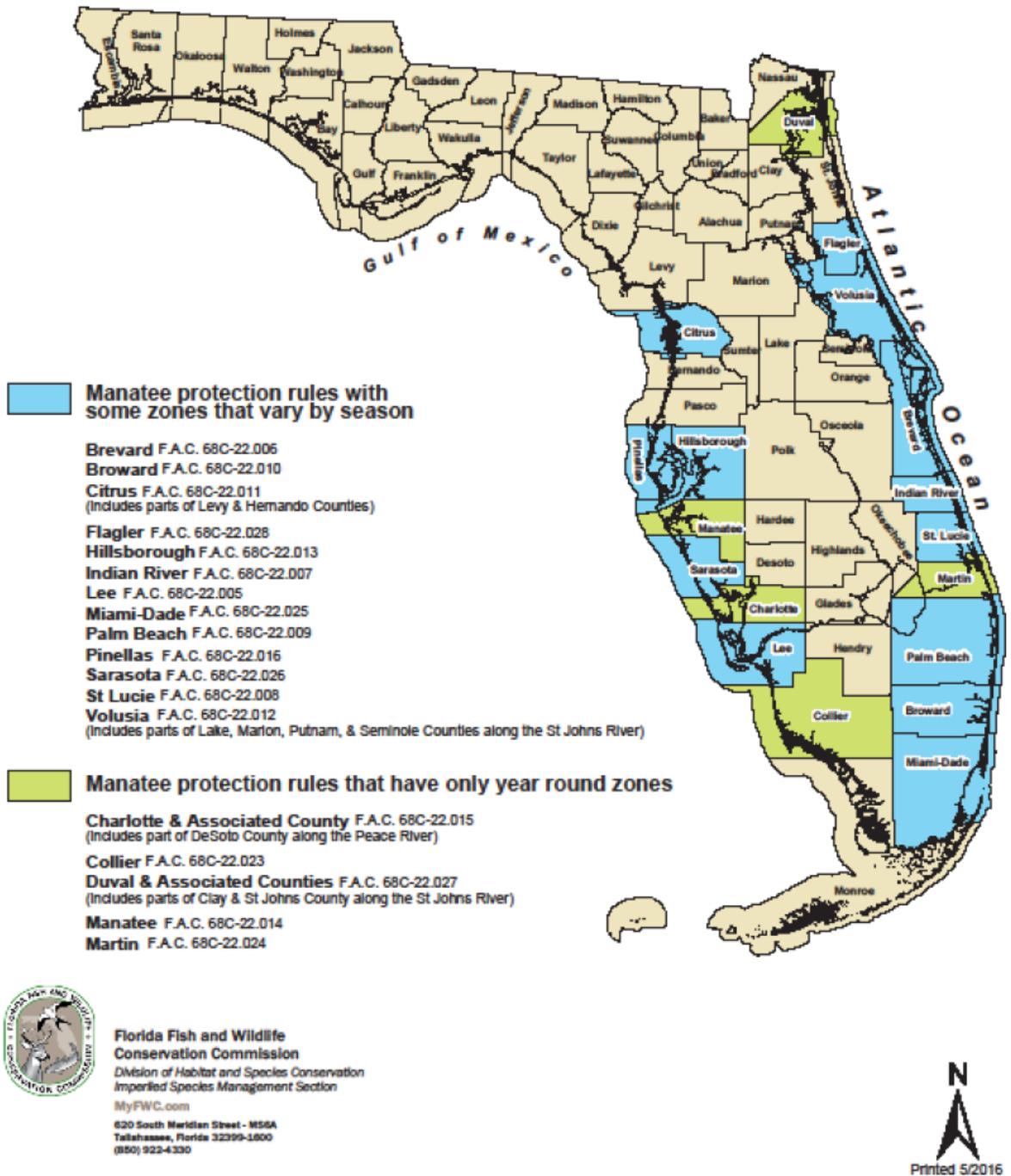


Figure 5. Florida Fish and Wildlife Conservation Commission (FWC) manatee protection zones.

(Source: <http://myfwc.com/media/2944209/MPZStatewideMap.pdf>)

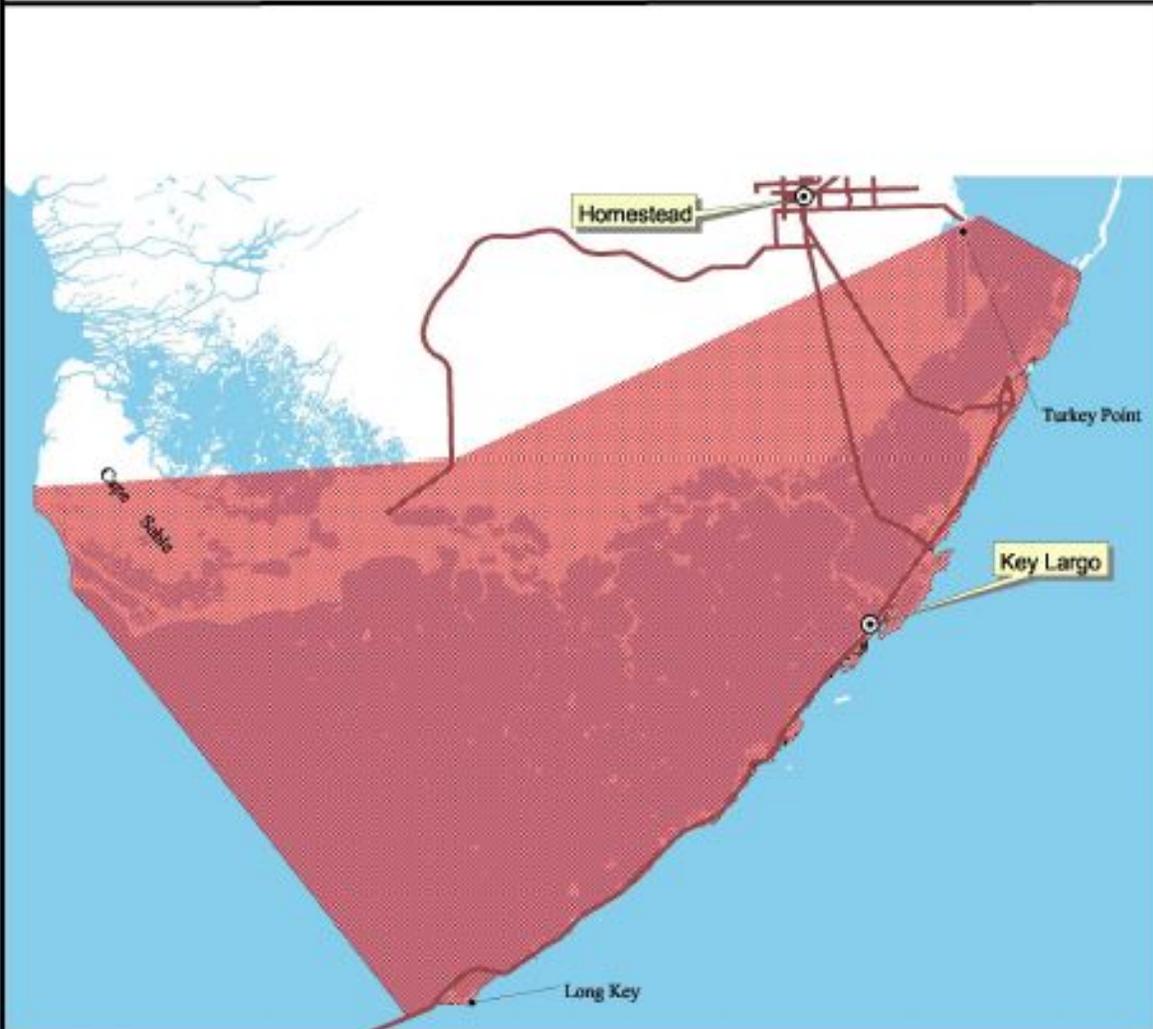
Corps' Effect Determination: MANLAA.

The Corps determined that the proposed project may affect, but is not likely to adversely affect Florida manatees. Although Florida manatees are unlikely to enter the project area, the species is located in the project vicinity. The use of a truck haul approach instead of a dredge-and-fill approach minimizes the use of in-water vessels and the potential for entanglement, entrainment, or strikes in the water. Direct, physical injury effects to this species are not anticipated from construction operations, machinery, or materials as the species are highly mobile and able to easily avoid the area; however, the Corps will include the 2011 USFWS' Standard Manatee Conditions for In-Water Work (see Attachment 1) in the project plans and specifications to ensure protection of the species. The Corps determined implementation of the Preferred Alternative may affect, but is not likely to adversely affect, Florida manatees.

American Crocodile

The American crocodile (*Crocodylus acustus*) is endemic to the United States and inhabits mostly low-energy bays, creeks, and inland swamps in extreme South Florida, the Caribbean, Mexico, Central America and northern South America. The species was listed as endangered by the USFWS in 1975 (40 FR 44151) due to habitat loss and fragmentation, changes in the distribution, timing, and quantity of water flows, and hunting for hide and meat. Hurricanes, cold weather, and traffic also threaten the mortality of American crocodiles. In March 2007, the USFWS reclassified the American crocodile from endangered to threatened. Feeding typically occurs shortly before sunset to just after sunrise and consists of opportunistic foraging for any animals they can catch and easily overpower. Nesting habitat includes sandy shorelines, creek banks adjacent to deep water, or manmade structures, such as canal berms. Males establish and defend breeding territory from late February through March. Females select a nest site and typically clutch size ranges from as few as eight to as many as 56 eggs. Hatchlings are about 10 inches and yellowish-tan in color with cross markings that fade as they grow. Adults are typically greenish-gray with black mottling and can be over 14 feet long. Although DCH was identified in 1979 in the extreme southern portion of Florida (44 CFR 75076), no DCH is present in the project area (see **Figure 6**).

General locations of the designated critical habitat for the American crocodile.



General Area



Distance: Miles

0 5 10 15 Miles



Legend

-  City/Town
-  Major Road/Highway
-  Critical Habitat

Use Constraints: This map is intended to be used as a guide to identify the general areas where critical habitat has been designated. Refer to the narrative description published in the Code of Federal Regulations (CFR) 50 Parts 1 to 199 (a copy of this text is printed on the reverse of this map).

Figure 6. USFWS American crocodile DCH.

(Source: <https://ecos.fws.gov/ecp0/profile/speciesProfile?sPCODE=C02J#crithab>)

Corps' Effect Determination: MANLAA.

The Corps has determined that the proposed project may affect, but is not likely to adversely affect American crocodiles. Although American crocodiles are unlikely to be found in an area with high levels of disturbance (i.e. vessel traffic, human attention, etc.), this species has been sighted in the surf zone in beaches south of the project area. Although a truck haul approach minimizes the use of in-water vessels and the potential for entanglement, entrainment, or strikes in the water, American crocodiles could also be found on the beach or in the surf zone. Due to the species being highly mobile and able to easily avoid the area, direct, physical injury effects to this species are not anticipated from construction operations, machinery, or materials.

Beach Jacquemontia

Jacquemontia reclinata is commonly known as beach jacquemontia or beach clustervine. This species is a perennial vine with a woody base and non-woody, twining stems up to six feet long. Leaves are fleshy, rounded or egg-shaped and approximately 1-inch long with blunted or indented tips. Flowers are white or pinkish, 1-inch across, and deeply five-lobed with a short tube. *Jacquemontia reclinata* is endemic to the coastal barrier islands in southeast Florida from Palm Beach to Miami-Dade Counties (Johnson et al. 1992).

Jacquemontia reclinata was listed as federally endangered in 1993 (58 FR 62046). The majority of habitat, coastal beach strand, has been destroyed or lost due to residential and commercial construction, development of recreational areas, and beach erosion. This species is further threatened by invasion of exotic plant species including Australian pine, carrotwood, Brazilian pepper, and turf grass. The 2013 EA (Corps 2013) describes that all but one of the wild populations in Florida exist on public lands in parks or conservation areas and surveys indicate that studied populations were declining in total number of individuals. Protection and management of this species involves removal of exotics, protecting coastal habitats from development by conservation purchases or easements, and establishing new populations of this species in protected areas. Major threats to survival of this species include highly fragmented habitat due to coastal development, and associated reproductive isolation that hinders genetic variability and reproduction.

Corps' Effect Determination: No effect.

Given the low documented abundance for beach jacquemontia in the project area, the Corps determined the proposed project would have no effect on this species. However, if beach jacquemontia is in the area, placement of sand on the beach may benefit the species by increasing available habitat.

References:

- Audubon. 2018. Guide to North American Birds: Piping Plover *Charadrius melodus*. <https://www.audubon.org/field-guide/bird/piping-plover>. Website accessed August 6, 2019.
- Johnson, A.F., J.W. Muller and K.A. Bettinger. 1992. An Assessment of Florida's Remaining Coastal Upland Natural Communities: Southeast Florida. Florida Natural Areas Inventory. Tallahassee, Florida.
- CB&I Coastal Planning & Engineering, Inc. (CB&I), Olsen Associates, Inc. (Olsen). 2015. Broward County, Florida Shore Protection Project – Segment II, Limited Reevaluation Report (LRR) with Environmental Assessment (EA).
- U.S. Army Corps of Engineers (Corps). 2015. Broward County, Florida Shore Protection Project – Segment II, Limited Reevaluation Report with Environmental Assessment.
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- U.S. Fish and Wildlife Service (USFWS). 2020. American crocodile (*Crocodylus acutus*). Retrieved from <https://ecos.fws.gov/ecp0/profile/speciesProfile?spcode=C02J>. Website accessed May 1, 2020.
- U.S. Fish and Wildlife Service (USFWS). 2020a. West Indian Manatee (*Trichechus manatus*). Retrieved from <https://www.fws.gov/southeast/wildlife/mammal/manatee/>. Website accessed May 1, 2020.
- U.S. Fish and Wildlife Service (USFWS). 2015. Shore Protection Activities along the Coast of Florida. Statewide Programmatic Biological Opinion (Revised). Service Log Number: 41910-2011-F-0170. March 13, 2015.
- U.S. Fish and Wildlife Service (USFWS). 2013. Programmatic Piping Plover Biological Opinion for Shore Protection Activities in the Geographical Regional of the North and South Florida Ecological Services Field Offices. Service Log Number: 04EF1000-2013-F-0124. May 22, 2013.
- U.S. Fish and Wildlife Service (USFWS). 2011. Standard manatee conditions for in-

water work. Retrieved from https://www.fws.gov/northflorida/manatee/Manate_Key_Programmatic/20130425_gd_Appendix%20B_2011_Standard%20Manatee%20Construction%20Conditions.pdf. Website accessed May 1, 2020.

U.S. Fish and Wildlife Service (USFWS). 1999. Multi-Species Recovery Plan for South Florida. Retrieved from https://ecos.fws.gov/docs/recovery_plan/140903.pdf. Website accessed May 1, 2020.

ATTACHMENT 1:
USFWS 2011 STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

2011

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

- a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.
- b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.
- c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.
- d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.
- e. Any collision with or injury to a manatee shall be reported immediately to the Florida Fish and Wildlife Conservation Commission (FWC) Hotline at 1-888-404-3922. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or in Vero Beach (1-772-562-3909) for south Florida, and emailed to FWC at ImperiledSpecies@myFWC.com.
- f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Temporary signs that have already been approved for this use by the FWC must be used. One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 8½" by 11" explaining the requirements for "Idle Speed/No Wake" and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities. These signs can be viewed at http://www.myfwc.com/WILDLIFEHABITATS/manatee_sign_vendors.htm. Questions concerning these signs can be forwarded to the email address listed above.

CAUTION: MANATEE HABITAT

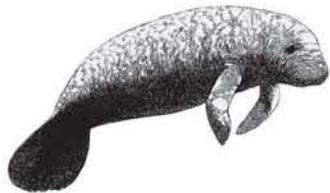
All project vessels

IDLE SPEED / NO WAKE

When a manatee is within 50 feet of work
all in-water activities must

SHUT DOWN

Report any collision with or injury to a manatee:



Wildlife Alert:

1-888-404-FWCC(3922)

cell *FWC or #FWC



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

CESAJ-PD-E (ER 200-2-2)

MEMORANDUM FOR THE RECORD

SUBJECT: Compliance with the Fish and Wildlife Coordination Act for the continued periodic renourishment of the Broward County Shore Protection Project (BCSPP), Segment II Beach Renourishment in Broward County, Florida.

PURPOSE: To document an informal understanding between the U.S. Army Corps of Engineers, Jacksonville District (Corps), and the U.S. Fish and Wildlife Service (USFWS), South Florida Ecological Services Office.

BACKGROUND. The purpose for the project is to provide coastal storm risk management through beach nourishment of the Segment II portion of the BCSPP in Broward County, Florida. The need of the project is driven by the loss of sand (erosion) along the shoreline, most recently from Hurricane Irma in September 2017. Erosion has reduced the width of the beach, thus increasing the risk for storm damages that are otherwise mitigated by the beach design. Periodic nourishment of the beach is required to replace sand along the shoreline and thus maintains the beach to its federally-authorized dimensions.

PREFERRED ALTERNATIVE. The Preferred Alternative is the continued periodic nourishment of Segment II of the BCSPP and the feeder beach via truck haul from upland sand mines. The upcoming nourishment event will include placement of approximately 413,000 cubic yards (CY) of sand in the following Florida Department of Environmental Protection (FDEP) monuments:

- Reach 1: Approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: Approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.
- Reach 3: Approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.
- Reach 4: Approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immokalee), Vulcan Witherspoon Mine (Witherspoon), and/or Cemex Davenport Mine (Cemex). The draft EA also evaluates

CESAJ-PD-E (ER 200-2-2)

SUBJECT: Compliance with the Fish and Wildlife Coordination Act for the continued periodic renourishment of the Broward County Shore Protection Project (BCSPP), Segment II Beach Renourishment in Broward County, Florida.

the use of the upland sand mine Garcia Family Farm, LLC in Henry County (Garcia Mine).

The Corps has determined that the proposed project is likely to adversely affect (LAA) nesting sea turtles (green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), loggerhead sea turtle (*Caretta caretta*), leatherback sea turtle (*Dermochelys coriacea*), and Kemps' ridley sea turtle (*Lepidochelys kempii*)) and may affect, but is not likely to adversely affect (MANLAA), Florida manatees (*Trichechus manatus latirostris*), American crocodiles (*Crocodylus acutus*), and piping plover (*Charadrius melodus*). The project will have no effect on beach jacquemontia (*Jacquemontia reclinata*). (Details on the Preferred Alternative can be found in the project's draft EA.)

COORDINATION. The Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq., March 10, 1934, as amended 1946, 1958, 1978, and 1995) (FWCA) requires Federal agencies to consult with USFWS regarding the impacts to fish and wildlife resources and the proposed measures to mitigate these impacts. Additional coordination authorities exist through the review process of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321-4347, January 1, 1970, as amended 1975 and 1982) and the Endangered Species Act of 1973 (ESA; 7 U.S.C. 136, 16 U.S.C. 1531 et seq. December 28, 1973). USFWS continues to coordinate and consult with the Corps through NEPA and the ESA in which impacts to fish and wildlife resources are adequately addressed via these two authorities. USFWS will include comments relevant to FWCA in the USFWS review and response to this project's draft EA.

AGREEMENT. The undersigned, the Corps and USFWS, agree to utilize the project's NEPA review process to complete coordination responsibilities under the FWCA. This agreement will avoid duplicate analysis and documentation as authorized under 40 CFR section 1500.4 (k), 1502.25, 1506.4, and is consistent with Presidential Executive Order for Improving Regulation and Regulatory Review, released January 18, 2011.

ROXANNA HINZMAN Digitally signed by
ROXANNA HINZMAN
Date: 2020.08.24
10:18:07 -04'00'

Roxanna Hinzman
Field Supervisor
South Florida Ecological Services Field Office

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Angela E. Dunn
Chief, Environmental Branch



United States Department of the Interior



FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

August 17, 2020

Andrew D. Kelly, Colonel
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Service Consultation Code: 04EF2000-2020-F-0855
Corps Application Number: CESAJ-PD-E (ER 200-2-2)
Date Received: May 18, 2020
Consultation Initiation Date: August 6, 2020
Project: Segment II Shoreline
Stabilization
Applicant: Broward County Board of
County Commissioners
County: Broward

Dear Colonel Kelly:

This document transmits the U.S. Fish and Wildlife Service's (Service) decision document to the U.S. Army Corps of Engineers (Corps) for the Broward County Board of County Commissioners' Segment II shoreline stabilization along approximately 8.9 miles (mi) of shoreline in Broward County, Florida (Project). The Corps determined that the Project may affect, and is likely to adversely affect the threatened North Atlantic Distinct Population Segment (DPS) of the green sea turtle (*Chelonia mydas*), the endangered hawksbill sea turtle (*Eretmochelys imbricata*), the endangered Kemp's ridley sea turtle (*Lepidochelys kempii*), the endangered leatherback sea turtle (*Dermochelys coriacea*), the threatened Northwest Atlantic DPS of the loggerhead sea turtle (*Caretta caretta*); and may affect, but is not likely to adversely affect the threatened American crocodile (*Crocodylus acutus*; crocodile), piping plover (*Charadrius melodus*), red knot (*Calidris canutus rufa*), and West Indian manatee (*Trichechus manatus*; manatee). For the purposes of this document, the five identified sea turtles will be referred to collectively as sea turtles. This document is provided in accordance with section 7 of the Endangered Species Act of 1973, as amended (Act) (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

The Service and the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) share Federal jurisdiction for sea turtles under the Act. The Service has responsibility for sea turtles on the nesting beach and the NOAA Fisheries has jurisdiction for sea turtles in the marine environment. Our analysis in this document will only address activities that may impact nesting sea turtles, their nests and eggs, and hatchlings as they emerge from the nest and crawl to the sea. Please note the provisions of this consultation do not apply to sea turtles in the marine environment, such as swimming juvenile and adult sea turtles or loggerhead critical habitat in the marine environment. If applicable, you are required to consult with the NOAA Fisheries on this Project. For further information on Act compliance

with the NOAA Fisheries, please contact Karla Reece, Acting Chief of the Interagency Cooperation Branch, by e-mail at karla.reece@noaa.gov or by phone at 727-824-5348.

This analysis is based on information provided in the Corps' consultation letter, public notice, and emails from the Applicant. A complete record of this consultation is on file at the South Florida Ecological Services Office, Vero Beach, Florida.

Consultation History

On May 18, 2020, the Service received a concurrently dated letter from the Corps, and a copy of the public notice dated May 3, 2019, requesting initiation of informal consultation concerning the Project. The letter included copies of a draft Environmental Assessment and Finding of No Significant Impact, containing additional Project information.

On August 6, 2020, the Service informed the Corps that the Project is not located in loggerhead sea turtle critical habitat, and suggested the Corps revise their determination for sea turtles to "may affect, likely to adversely affect" for these species since the Applicant will be utilizing the sand placement programmatic biological opinion.

On August 6, 2020, the Corps revised the determination for loggerhead critical habitat to "no effect," and revised the determination for sea turtles to "may affect, likely to adversely affect". The Service initiated formal consultation with the Corps concerning the potential effects of the Project on nesting sea turtles and informal consultation on piping plovers, crocodiles, and manatees.

DESCRIPTION OF THE PROPOSED ACTION

The Broward County Board of County Commissioners (Applicant) is requesting to reauthorize an existing shore protection project (Broward County Segment III) that will replace approximately 413,000 cubic yards (cy) of compatible beach quality sand along the shoreline of southern Broward County, Florida (Figure 1). The applicant seeks authorization for the continued periodic placement of sand to maintain federally authorized beach dimensions. The Project would affect waters of the United States associated with the discharge of fill material along the shoreline of Southern Broward County and adjacent to the Atlantic Ocean. The Project is located within four reaches, along approximately 8.9 mi of shoreline from Hilsboro Inlet to Port Everglades, spanning Florida Department of Environmental Protection monuments R-25 to R-72.

The material will be truck hauled to the Project area from five approved commercial upland sand sources (Witherspoon, Ortona, Immokalee, Garcia Farms, and Cemex mines). Sand will be transported to the project site by truck and offloaded directly onto the beach's berm, above the mean high-water line, within the Project area. Thereafter, sand will be moved alongshore by truck to the fill placement site and deposited within the permitted fill template. The sand will then be graded with bulldozers to the required construction elevations, lines, grades, and slopes. All sand placement activities will be completed using upland equipment, and no water-dependent equipment (e.g., dredges, pipelines, barges, etc.) will be utilized. All work will be conducted during daylight hours between November 1 and April 30, which is outside the nesting season for sea turtles.

The project lies within the design template of a previously authorized nourishment project and no additional impacts to submerged aquatic resources beyond what was already mitigated for are proposed or anticipated. Turbidity impacts would be temporary, and monitoring will be required. All construction vehicles and equipment will transverse or be stored within the designated staging area or the beach corridor. Existing vegetated habitat at the staging area and beach access corridor shall be protected to the maximum extent possible to minimize disturbance; therefore, impacts associated with the beach access corridor, staging area, and beach fill template are not anticipated. If impacts occur, all impacted areas and vegetation will be restored to preconstruction condition and elevation. All loose debris will be removed and properly disposed of prior to sand placement.

Minimization measures and exceptions

The Applicant will follow and implement the minimization measures, Reasonable and Prudent Measures (RPMs), and the Terms and Conditions identified in the revised *Statewide Programmatic Biological Opinion* (2015-SPBO; Service 2015) that apply to the proposed Project concerning nesting sea turtles. In addition, the Applicant will follow and implement the Conservation Measures identified in the *Programmatic Piping Plover Biological Opinion* (P³BO; Service 2013) that apply to the proposed Project concerning piping plovers. The P³BO Conservation Measures will also minimize effects to red knots.

Action Area

The action area is defined as all areas to be affected directly or indirectly by the action and not merely the immediate area involved in the action. The Service identifies the action area to include the sand placement areas, upland sand stockpiles, dune restoration areas, staging areas, and beach access. The Project is located along the Atlantic Ocean, Broward County, Florida, between latitude 26.258043 and longitude -80.081940 (north end), and latitude 26.095103 and longitude -80.104917 (south end).

THREATENED AND ENDANGERED SPECIES

Piping plover

Piping plovers may use the proposed Project area during winter and migration periods. According to our Geographic Information System (GIS) database and eBird (2020), several piping plovers have been documented in the action area. The Service has determined the Project's impact to non-optimal piping plover habitat is consistent with the analysis in the P³BO. As previously stated, the Applicant has agreed to follow and implement the Conservation Measures outlined in the P³BO that apply to the Project.

Because the Project, as proposed, is consistent with the analysis for non-optimal piping plover habitat in the P³BO, the Service concurs that the Project, as proposed, may affect, but is not likely to adversely affect this species.

Red knot

Red knots may use the proposed Project area during winter and migration periods. In Florida, red knots are commonly found along sandy, gravel, or cobble beaches, tidal mudflats, salt marshes, shallow coastal impoundments, mangrove and brackish lagoons. Red knots forage along sandy beaches during spring and fall migration throughout Florida. To date, critical habitat has not been proposed or designated for the red knot. According to our GIS database and eBird (2020), red knots have been documented twice in the action area. Because suitable habitat for the red knot and piping plover is similar, minimization measures for potential effects to red knots in non-optimal habitat will be incorporated into the Project through the Applicant's implementation of the Conservation Measures to reduce impacts on piping plovers for projects located in non-optimal piping plover habitat as outlined in the P³BO.

Based on the implementation of P³BO's Conservation Measures and the fact that the proposed Project area is located in non-optimal red knot habitat, the Service concurs that the Project, as proposed, may affect, but is not likely to adversely affect this species.

Sea turtles

The proposed Project is located adjacent to sea turtle nesting habitat, and therefore could adversely affect nesting sea turtles, their nests, and hatchlings. The purpose of the proposed Project is to place beach compatible material on approximately 8.9 mi of shoreline along Broward County. Without the restorative activities, erosion is expected to continue, potentially impacting sea turtle nesting. Consequently, the proposed Project could have beneficial effects to nesting sea turtles. The Service has determined the Project's effects concerning sand placement activities are consistent with those analyzed in the 2015-SPBO. Therefore, it is appropriate to apply the 2015-SPBO to the Project. Based on the Applicant's commitment to implement the minimization measures, RPMs, and the Terms and Conditions identified in the 2015-SPBO, the Project's take coverage for listed sea turtles is henceforth covered under the 2015-SPBO.

West Indian manatee

The Project is located within the geographic range of the manatee and in the manatee consultation area, but not in an important manatee area or designated critical habitat. No in-water work is proposed, but the Applicant has agreed to follow and implement the *Standard Manatee Conditions for In-Water Work* (Florida Fish and Wildlife Conservation Commission 2011) if in-water work becomes necessary. Based on the proposed protection measures, the Service concurs with the Corps' determination that the Project may affect, but is not likely to adversely affect the species.

REINITIATION NOTICE

This concludes consultation on the action outlined in the request. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if:

1. The amount or extent of incidental take outlined in the 2015-SPBO is exceeded. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending reinitiation;
2. New information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this analysis;
3. The agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat not considered in this analysis; or,
4. A new species is listed, or critical habitat designated that may be affected by the action.

Thank you for your cooperation in the effort to conserve fish and wildlife resources. Should you have additional questions or require clarification regarding this letter, please contact Adam Knutson at 772-469-4252.

Sincerely,

**ROXANNA
HINZMAN**

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ROXANNA HINZMAN
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Roxanna Hinzman
Field Supervisor
South Florida Ecological Services Office

cc: electronic only

Corps, Jacksonville, Florida (Kristen Donofrio)
DEP, Tallahassee, Florida (Lainie Edwards)
EPA, Atlanta, Georgia (Jennifer Derby)
FWC, Tallahassee, Florida (FWC-CPS, Kristen Nelson-Sella)
FWC, West Palm Beach, Florida (Ricardo Zambrano)
NOAA Fisheries, St. Petersburg, Florida (Anne Marie Lauritsen)

LITERATURE CITED

- eBird. 2020. An online database of bird distribution and abundance [Internet]. Cornell Lab of Ornithology; Ithaca, New York. Available from: <http://www.ebird.org>. Accessed August 6, 2020.
- Florida Fish and Wildlife Conservation Commission. 2011. Standard Manatee Conditions for In-Water Work. Tallahassee, Florida. Available from: https://myfwc.com/media/7246/manatee_stdcondin_waterwork.pdf. Accessed July 9, 2020
- U.S. Fish and Wildlife Service (Service). 2013. Programmatic piping plover biological opinion to the U.S. Army Corps of Engineers (Service Log No. 04EF1000-2013-F-0124) for shore protection activities in the geographical region of the north and south Florida Ecological Services Field Offices (May 22, 2013). Jacksonville and Vero Beach Field Offices, Florida.
- U.S. Fish and Wildlife Service (Service). 2015. Statewide programmatic biological opinion to the U.S. Army Corps of Engineers (Service Log No. 41910-2011-F-0170) for shore protection activities along the coast of Florida (March 13, 2015). Jacksonville, Panama City, and Vero Beach Field Offices, Florida.



Figure 1. Location of the Segment II beach restoration and maintenance project along Broward County, Florida.

From: [Stahl, Chris](#)
To: [Donofrio, Kristen L CIV USARMY CESAJ \(USA\)](#)
Cc: [State Clearinghouse](#)
Subject: [Non-DoD Source] State Clearance Letter for FL202005218956C- Draft Environmental Assessment Broward County Shore Protection Project Segment II Beach Renourishment In Broward County, Florida
Date: Friday, July 17, 2020 4:38:40 PM
Attachments: [20200619_FWC Comments_Broward Segment II Nourishment_ltr.pdf](#)

July 17, 2020

Kristen Donofrio

U.S. Army Corps of Engineers

Jacksonville District

P. O. BOX 4970

Jacksonville, Florida 32232-0019

RE: Department of Defense, Office of the Chief of Engineers, Department of the Army, Navigation Projects, Draft Environmental Assessment Broward County Shore Protection Project Segment II Beach Renourishment in Broward County, Florida

SAI# FL202005218956C

Dear Kristen:

Florida State Clearinghouse staff has reviewed the proposal under the following authorities: Presidential Executive Order 12372; § 403.061(42), Florida Statutes; the Coastal Zone Management Act, 16 U.S.C. §§ 1451-1464, as amended; and the National Environmental Policy Act, 42 U.S.C. §§ 4321-4347, as amended.

The Florida Departments of Environmental Protection and State, as well as the Florida Fish and Wildlife Conservation Commission has reviewed the proposed action and submitted comments. As a courtesy, these have been attached to this letter and are incorporated hereto.

Based on the information submitted and minimal project impacts, the state has no objections to the subject project and, therefore, it is consistent with the Florida Coastal Management Program (FCMP). Thank you for the

opportunity to review the proposed project. If you have any questions or need further assistance, please don't hesitate to contact me at (850) 717-9076.

Sincerely,

Chris Stahl

Chris Stahl, Coordinator

Florida State Clearinghouse

Florida Department of Environmental Protection

3800 Commonwealth Blvd., M.S. 47

Tallahassee, FL 32399-2400

ph. (850) 717-9076

State.Clearinghouse@floridadep.gov <<mailto:State.Clearinghouse@floridadep.gov>>

<Blocked<http://survey.dep.state.fl.us/?refemail=Chris.Stahl@dep.state.fl.us>>



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MyFWC.com

June 19, 2020

Chris Stahl, Coordinator
Florida State Clearinghouse
Florida Department of Environmental Protection
2600 Blair Stone Road, M.S. 47
Tallahassee, FL 32399-2400
Chris.Stahl@dep.state.fl.us
State.Clearinghouse@dep.state.fl.us

Subject: File No. FL202005218956C; Environmental Assessment for Broward County Shore Protection Project Segment II Beach Renourishment in Broward County

Dear Mr. Stahl:

The Florida Fish and Wildlife Conservation Commission (FWC) staff has reviewed the above referenced proposed application and provides the following comments for your consideration in accordance with Chapter 379, Florida Statutes, and the Coastal Zone Management Act, Florida's Coastal Management Program.

Project Description and Location

The proposed modification request includes extending the project limit 2.1 miles northward from R-36 to the Hillsboro Inlet jetty at R-25 to nourish critically eroded shoreline of Broward County Segment II. To provide a smooth transition to the currently permitted project area, the area between R36 and R-36.5 will have a full design template, rather than the taper that is currently permitted. The project beach includes a turtle-friendly design with a flat upper berm elevation of +7.9 ft NAVD88, sloping down at 1V:20H to a flat lower berm elevation of +5.9 ft NAVD88. The upper berm crest extends landward to tie-in with the existing grade or structure. The lower berm has a crest width ranging from 12 to 50 feet. The seaward limit of the lower berm slopes down at 1V:10H to the existing grade. The beach template described above includes a +0.5-foot vertical tolerance allowance. The volume required to fill this section of beach of this project will require approximately 290,000 cubic yards of in-place fill sand on current conditions (November 2020). The sand source for this project will be from an upland mine(s) and truck hauled to beach fill area. This modification also includes adding the Garcia Sand Mine as a potential upland sand source.

Comments and Recommendations

The beaches in Broward County provide important nesting habitat for threatened loggerhead (*Caretta caretta*), threatened green (*Chelonia mydas*), and endangered leatherback (*Dermodochelys coriacea*) marine turtles. On-beach construction activities can disturb nesting females if the project occurs during the nesting season, and the placement of sand may physically alter nesting habitat. In addition, increases in artificial lighting due to dredging and construction activities and the creation of an elevated beach berm can expose hatchlings and nesting females to lights that were not visible prior to the project, thereby increasing the occurrence of disorientations which are often fatal. Incidental take of marine turtles including the relocation of nests due to the proposed project must be authorized via U.S. Fish and Wildlife Service (USFWS) and National

Marine Fisheries Service (NMFS) Biological Opinions (BO) and Incidental Take Authorization as appropriate.

Conclusion

We concur with the U.S. Army Corp of Engineer's intentions to follow the terms of all federal biological opinions that apply to the proposed modifications. The FWC will coordinate with NMFS and the USFWS as those BOs are implemented and developed. The FWC will also provide recommended conditions for listed species and habitat protection to the State permitting agency during the State permitting process related to the proposed dredging

If you have specific technical questions regarding the content of this letter, please contact me or Luke Davis of my staff at (850) 922-4330 or by email at Luke.Davis@MyFWC.com.

Sincerely,

A handwritten signature in black ink, appearing to read "M. Pasawicz", with a large, stylized flourish at the end.

Michelle R. Pasawicz
Biological Administrator
Imperiled Species Management Section
Division of Habitat and Species Conservation



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

18 May 2020

Chris Stahl
Coordinator
Florida State Clearinghouse
Florida Department of Environmental Protection
2600 Blair Stone Road, M.S. 47
Tallahassee, FL 32399

Dear Mr. Stahl:

Pursuant to the National Environmental Policy Act and the U.S. Army Corps of Engineers Regulation (33 CFR 230.11), this letter constitutes the Notice of Availability of the proposed Finding of No Significant Impact (FONSI), draft Environmental Assessment (EA), and the Federal Consistency Determination (FCD) for the continued periodic renourishment of the Broward County Shore Protection Project, Segment II Beach Nourishment project in Broward County, Florida.

The Preferred Alternative is the continued periodic nourishment of Segment II of the BCSP and the feeder beach via truck haul from upland sand mines. The upcoming nourishment event will include placement of approximately 413,000 cubic yards (CY) of sand in the following Florida Department of Environmental Protection (FDEP) monuments:

- Reach 1: Approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: Approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.
- Reach 3: Approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.
- Reach 4: Approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immoklaee), Vulcan Witherspoon Mine

(Witherspoon), and/or Cemex Davenport Mine (Cemex). This EA also evaluates the use of the upland sand mine Garcia Family Farm, LLC in Henry County (Garcia Mine).

The Corps is requesting a consistency determination pursuant to the Coastal Zone Management Act and the Florida Coastal Management Program based on the information contained in the draft EA. We understand the final concurrence from your agency will be determined during the review performed as part of the state's environmental permitting process that includes water quality certification under Section 401 of the Clean Water Act. The proposed FONSI, draft EA, and associated appendices are available for your review on the Jacksonville District's Environmental planning website, under Broward County:

<http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/>

(On that page, click on the "+" next to "Broward". Scroll down to the project name.)

The Corps determined that the proposed project is consistent with Florida's approved Coastal Zone Management Program. Due to current circumstances with COVID-19, the Corps is requesting that any questions or comments you may have be submitted in writing via electronic mail to Kristen.L.Donofrio@usace.army.mil within 60 days of the date of this letter. Correspondence may also be sent to the letterhead address above; however, due to limited staff availability at the District office, electronic submittal of comments via email is preferred.

Sincerely,



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Angela E. Dunn
Chief, Environmental Branch

Encl

**Florida Coastal Zone Management Program Evaluation Procedures
Federal Consistency Determination (FCD)**

**Broward County Shore Protection Project (BCSPP),
Segment II Beach Renourishment in
Broward County, Florida**

May 2020

Enforceable Policy. Florida Statutes considers “enforceable policy” under the Coastal Zone Management Act (www.dep.state.fl.us/cmp/federal/24_statutes.htm).

Applicability of the Coastal Zone Management Act. The following table summarizes the process and procedures under the Coastal Zone Management Act for federal actions and for non-federal applicants*.

Item	Non-federal Applicant (15 CFR 930, subpart D)	Federal Action (15 CFR 930, subpart C)
Enforceable Policies	Reviewed and approved by NOAA (in FL www.dep.state.fl.us/cmp/federal/24_statutes.htm)	Same
Effects Test	Direct, Indirect (cumulative, secondary), adverse or beneficial	Same
Review Time	6 months from state receipt of Consistency Certification (30-days for completeness notice) Can be altered by written agreement between state and applicant	60 Days, extendable (or contractible) by mutual agreement
Consistency	Must be Fully Consistent	To Maximum Extent Practicable**
Procedure Initiation	Applicant provides Consistency Certification to state	Federal Agency provides “Consistency Statement” to state
Appealable	Yes, applicant can appeal to Secretary (NOAA)	No (NOAA can “mediate”)
Activities	Listed activities with their geographic location (State can request additional listing within 30 days)	Listed or Unlisted Activities in State Program
Activities in Another State	Must have approval for interstate reviews from NOAA	Interstate review approval NOT required
Activities in Federal Waters	Yes, if activity affects state waters	Same

* There are separate requirements for activities on the Outer Continental Shelf (subpart E) and for “assistance to an applicant agency” (subpart F).

** Must be fully consistent except for items prohibited by applicable law (generally does not count lack of funding as prohibited by law, 15 CFR 930.32).

Coastal Zone Consistency Statement by Statute/Enforceable Policy

1. CHAPTER 161, F.S., BEACH AND SHORE PRESERVATION.

Coastal areas are among the state's most valuable natural, aesthetic, and economic resources. The state is required to protect coastal areas from imprudent activities that could jeopardize the stability of the beach-dune system, accelerate erosion, provide inadequate protection to upland structures, endanger adjacent properties, or interfere with public beach access. Coastal areas used, or likely to be used, by sea turtles are designated for nesting, and the removal of vegetative cover that binds sand is prohibited. This statute provides policy for the regulation of construction, reconstruction, and other physical activities related to the beaches and shores of the state. Additionally, this statute requires the restoration and maintenance of critically eroding beaches.

RESPONSE: The purpose for the project is to provide coastal storm risk management through beach renourishment of the Segment II portion of the Broward County Shore Protection Project (BCSPP) in Broward County, Florida. The need of the project is driven by the loss of sand (erosion) along the shoreline, most recently from Hurricane Irma in September 2017. Erosion has reduced the width of the beach, thus increasing the risk for storm damages that are otherwise mitigated by the beach design. Periodic renourishment of the beach is required to replace sand along the shoreline and thus maintains the beach to its federally-authorized dimensions.

The Preferred Alternative consists of the truck haul and placement of sand on Segment II of the BCSPP. The upcoming renourishment event will include placement of approximately 413,000 cubic yard (CY) of sand¹ along the following Florida Department of Environmental Protection (FDEP) monuments:

- Reach 1: Approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: Approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.
- Reach 3: Approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.
- Reach 4: Approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand placement generally located between R-25 and R-27 establishes a fill template and the ability to protect the vulnerable upland infrastructure in this area when needed, rather than being subject to the Hillsboro Inlet bypassing project's inconsistent, and recently reduced, fill schedule. The feeder beach, generally located between R-28 and R-31,

¹ The actual quantity of volume placed may vary based on changes in the existing conditions; the volumes provided are based on existing conditions and need identified through the November 2019 beach profile survey.

introduces sand into the coastal system to provide a slow sustained transport to the south that may extend the time required until the next renourishment. The remaining fill, generally located between R-31 and R-36 and between R-41.3 and R-51, will be placed above MHW only and provides sand to portions of the beach where the berm is deflated to provide adequate upland protection and reduce ponding along the landward side of the berm. All proposed fill templates are located within the historical envelope of beach changes.

Renourishment of Segment II of the BCSP would occur on a periodic cycle or as-needed basis using any combination of existing sand sources (Ortona Mine, Immokalee Mine, Witherspoon Mine, and/or Cemex Mine) and/or Garcia upland sand mine. The proposed project is consistent with the goals of this chapter.

2. CHAPTER 163, PART II, F.S., INTERGOVERNMENTAL PROGRAMS: GROWTH POLICY; COUNTY AND MUNICIPAL PLANNING: LAND DEVELOPMENT REGULATION

The purpose of this statute is to provide for the implementation of comprehensive planning programs to guide and control future development in the state. The comprehensive planning process encourages units of local government to preserve, promote, protect, and improve the public health, safety, comfort, good order, appearance, convenience, law enforcement and fire prevention, and general welfare; prevent the overcrowding of land and avoid undue concentration of population; facilitate the adequate and efficient provision of public facilities and services; and conserve, develop, utilize, and protect natural resources within their jurisdictions.

RESPONSE: Pursuant to the National Environmental Protection Act (NEPA), the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. The proposed project meets the goals of the State Comprehensive Plan by mitigating coastal storm damages to infrastructure along or near Segment II of the BCSP through beach renourishment. The proposed project is consistent with the goals of this chapter.

3. CHAPTER 186, F.S., STATE AND REGIONAL PLANNING

The state comprehensive plan provides basic policy direction to all levels of government regarding the orderly social, economic, and physical growth of the state. The goals, objectives, and policies of the state comprehensive plan are statewide in scope and are consistent and compatible with each other. The statute provides direction for the delivery of governmental services, a means for defining and achieving the specific goals of the state, and a method for evaluating the accomplishment of those goals.

RESPONSE: Pursuant to NEPA, the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. The proposed project meets the goals of the State Comprehensive Plan by mitigating coastal storm damages to infrastructure along or near Segment II of the BCSP through beach renourishment. The proposed project is consistent with the goals of this chapter.

4. CHAPTER 252, F.S., EMERGENCY MANAGEMENT

The state of Florida is vulnerable to a wide range of emergencies, including natural, technological, and manmade disasters. This vulnerability is exacerbated by the tremendous growth in the state's population. This statute directs the state to reduce the vulnerability of its people and property to natural and manmade disasters; prepare for, respond to and reduce the impacts of disasters; and decrease the time and resources needed to recover from disasters.

Disaster mitigation is necessary to ensure the common defense of Floridians' lives and to protect the public peace, health, and safety. The policies provide the means to assist in the prevention or mitigation of emergencies that may be caused or aggravated by the inadequate planning or regulation. State agencies are directed to keep land uses and facility construction under continuing study and identify areas that are particularly susceptible to natural or manmade catastrophic occurrences.

RESPONSE: The purpose for the project is to provide coastal storm risk management through beach renourishment of the Segment II portion of the BCSPP in Broward County, Florida. The need of the project is driven by the loss of sand (erosion) along the shoreline, most recently from Hurricane Irma in September 2017. Erosion has reduced the width of the beach, thus increasing the risk for storm damages that are otherwise mitigated by the beach design. Periodic renourishment of the beach is required to replace sand along the shoreline and thus maintains the beach to its federally-authorized dimensions. The proposed project is consistent with the goals of this chapter.

5. CHAPTER 253, F.S., STATE LANDS

The Board of Trustees of the Internal Improvement Trust Fund (Trustees) is vested and charged with the acquisition, administration, management, control, supervision, conservation, protection, and disposition of all lands owned by the state. Lands acquired for preservation, conservation and recreation serve the public interest by contributing to the public health, welfare and economy. In carrying out the requirements of this statute, the Trustees are directed to take necessary action to fully: conserve and protect state lands; maintain natural conditions; protect and enhance natural areas and ecosystems; prevent damage and depredation; and preserve archaeological and historical resources.

All submerged lands are considered single-use lands to be maintained in natural condition for the propagation of fish and wildlife and public recreation. Where multiple-uses are permitted, ecosystem integrity, recreational benefits and wildlife values are conserved and protected.

RESPONSE: The Preferred Alternative consists of the continued periodic renourishment of Segment II of the BCSPP and construction of the Reach 1 shore protection and feeder beach feature via truck haul of sand from upland mines. Portions of the project will occur on submerged lands of the State of Florida. The Corps will coordinate the project with the State of Florida through the issuance of a water quality certification (WQC), Federal Consistency Determination (FCD) review, and the review process of the 2020 draft Environmental Assessment (EA).

Environmental protection measures, as described in detail in Section 6 of the 2020 EA, will be implemented to minimize adverse effects to the maximum extent practicable to fish and other wildlife resources, threatened and endangered (T&E) species, water quality, air quality, or other environmental resources. Consultation on the Preferred Alternative has been initiated with the Florida State Historic Preservation Office (SHPO) and appropriate federally-recognized tribes for compliance with Section 106 of the National Historic Preservation Act. Consultation is ongoing and will be completed prior to the start of construction.

Pursuant to NEPA, the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. The proposed project is consistent with the goals of this chapter.

6. CHAPTER 258, F.S., STATE PARKS AND PRESERVES

The statute addresses the state's administration of state parks, aquatic preserves, and recreation areas, which are acquired to emblemize the state's natural values and to ensure that these values are conserved for all time. Parks and preserves are managed for the non-depleting use, enjoyment, and benefit of Floridians and visitors and to contribute to the state's tourist appeal.

Aquatic Preserves are recognized as having exceptional biological, aesthetic, and scientific value and are set aside for the benefit of future generations. Disruptive physical activities and polluting discharges are highly restricted in aquatic preserves. State managed wild and scenic rivers possess exceptionally remarkable and unique ecological, fish and wildlife, and recreational values. These rivers are also designated for permanent preservation and enhancement for both the present and future.

RESPONSE: Renourishment of Segment II of the BCSP will maintain opportunities for recreational use of the beach and habitat for nesting sea turtles and other wildlife. The proposed project complies with the goals of this chapter.

7. CHAPTER 259, F.S., LAND ACQUISITION FOR CONSERVATION OR RECREATION

The statute addresses public ownership of natural areas for purposes of maintaining the state's unique natural resources; protecting air, land, and water quality; promoting water resource development to meet the needs of natural systems and citizens of this state; promoting restoration activities on public lands; and providing lands for natural resource based recreation. Lands are managed to protect or restore their natural resource values, and provide the greatest benefit, including public access, to the citizens of this state.

RESPONSE: Pursuant to NEPA, the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. Environmental protection measures, as described in detail in Section 6 of the 2020 EA, will be implemented to minimize adverse effects to the maximum extent

practicable to fish and other wildlife resources, T&E species, water quality, air quality, or other environmental resources. Renourishment of Segment II of the BCSP will maintain opportunities for recreational use of the beach and habitat for nesting sea turtles and other wildlife. Portions of the project will occur on submerged lands of the State of Florida. The Corps will coordinate the project with the State of Florida through the issuance of a WQC, FCD review, and the review process of 2020 draft EA. The proposed project complies with the goals of this chapter.

8. CHAPTER 260, F.S., FLORIDA GREENWAYS AND TRAILS ACT

A statewide system of greenways and trails is established in order to conserve, develop, and use the natural resources of Florida for healthful and recreational purposes. These greenways and trails provide open space benefiting environmentally sensitive lands and wildlife and provide people with access to healthful outdoor activities. The greenways and trails serve to implement the concepts of ecosystem management while providing recreational opportunities such as horseback riding, hiking, bicycling, canoeing, jogging, and historical and archaeological interpretation. As of August 29th, 2016, Chapter 260, F.S., does not contain any enforceable policies for federal consistency purposes.

RESPONSE: No Florida greenways or trails exist in the project area or will be affected by the project.

9. CHAPTER 267, F.S., HISTORICAL RESOURCES

The management and preservation of the state's archaeological and historical resources are addressed by this statute. This statute recognizes the state's rich and unique heritage of historic resources and directs the state to locate, acquire, protect, preserve, operate and interpret historic and archeological resources for the benefit of current and future generations of Floridians.

Objects or artifacts with intrinsic historic or archeological value located on, or abandoned on, state-owned lands or state-owned submerged lands belong to the citizens of the state. The state historic preservation program operates in conjunction with the National Historic Preservation Act of 1966 to require state and federal agencies to consider the effect of their direct or indirect actions on historic and archeological resources. These resources cannot be destroyed or altered unless no prudent alternative exists. Unavoidable impacts must be mitigated.

RESPONSE: Consultation on the Preferred Alternative has been initiated with the SHPO and appropriate federally-recognized tribes for compliance with Section 106 of the National Historic Preservation Act. Consultation will be completed prior to the start of construction. The proposed project is consistent with the goals of this chapter.

10. CHAPTER 288, F.S., COMMERCIAL DEVELOPMENT AND CAPITAL IMPROVEMENTS

The framework to promote and develop general business, trade, and tourism components of the state economy are established in this statute. The statute includes requirements to protect and promote the natural, coastal, historical, and cultural tourism

assets of the state; foster the development of nature-based tourism and recreation; and upgrade the image of Florida as a quality destination. Natural resource-based tourism and recreational activities are critical sectors of Florida's economy. The needs of the environment must be balanced with the need for growth and economic development.

RESPONSE: Renourishment of Segment II of the BCSP will ensure the continuation of benefits to socioeconomic resources (e.g. recreation, tourism, etc.). Environmental protection measures, as described in detail in Section 6 of the 2020 EA, will be implemented to minimize adverse effects to the maximum extent practicable to fish and other wildlife resources, T&E species, water quality, air quality, or other environmental resources. The proposed project is consistent with the goals of this chapter.

11. CHAPTER 334, F.S., TRANSPORTATION ADMINISTRATION

The statute addresses the state's policy concerning transportation administration. It establishes the responsibilities of the state, the counties, and the municipalities in the planning and development of the transportation systems; and the development of an integrated, balanced statewide transportation system. This is necessary for the protection of public safety and general welfare and for the preservation of all transportation facilities in the state. As of October 9th, 2017, Chapter 334, F.S., does not contain any enforceable policies for federal consistency purposes.

RESPONSE: Public transportation systems will not be affected by the proposed project.

12. CHAPTER 339, F.S., TRANSPORTATION FINANCE AND PLANNING

The statute addresses the finance and planning needs of the state's transportation system.

RESPONSE: Public transportation systems will not be affected by the proposed project.

13. CHAPTER 373, F.S., WATER RESOURCES

The waters in the state of Florida are managed and protected to conserve and preserve water resources, water quality, and environmental quality. This statute addresses sustainable water management; the conservation of surface and ground waters for full beneficial use; the preservation of natural resources, fish, and wildlife; protecting public land; and promoting the health and general welfare of Floridians. The state manages and conserves water and related natural resources by determining whether activities will unreasonably consume water; degrade water quality; or adversely affect environmental values such as protected species habitat, recreational pursuits, and marine productivity.

Specifically, under Part IV of Chapter 373, the Department of Environmental Protection, water management districts, and delegated local governments review and take agency action on wetland resource, environmental resource, and stormwater permit applications. These permits address the construction, alteration, operation, maintenance, abandonment, and removal of any stormwater management system, dam, impoundment,

reservoir, or appurtenant work or works (including dredging, filling and construction activities in, on, and over wetlands and other surface waters).

RESPONSE: Pursuant to NEPA, the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. Environmental protection measures, as described in detail in Section 6 of the 2020 EA, will be implemented to minimize adverse effects to the maximum extent practicable to water resources. The Corps will coordinate the project with the State of Florida through the issuance of a WQC, FCD review, and the review process of 2020 draft EA. The proposed project complies with the goals of this chapter.

14. CHAPTER 375, F.S., OUTDOOR RECREATION AND CONSERVATION LANDS

The statute addresses the development of a comprehensive outdoor recreation plan. The purpose of the plan is to document recreational supply and demand, describe current recreational opportunities, estimate the need for additional recreational opportunities, and propose the means to meet the identified needs.

RESPONSE: Beach renourishment would maintain opportunities for recreational use of the beach. The proposed project complies with the goals of this chapter.

15. CHAPTER 376, F.S., POLLUTANT DISCHARGE PREVENTION AND REMOVAL

regulating the transfer, storage, and transportation of pollutants, and the cleanup of pollutant discharges is essential for maintaining coastal resources (specifically the coastal waters, estuaries, tidal flats, beaches, and public lands adjoining the seacoast) in as close to a pristine condition as possible. The preservation of the seacoast as a source of public and private recreation, along with the preservation of water and certain lands are matters of the highest urgency and priority.

This statute provides a framework for the protection of the state's coastline from spills, discharges, and releases of pollutants. The discharge of pollutants into or upon any coastal waters, estuaries, tidal flats, beaches, and lands adjoining the seacoast of the state is prohibited. The statute provides for hazards and threats of danger and damages resulting from any pollutant discharge to be evaluated; requires the prompt containment and removal of pollution; provides penalties for violations; and ensures the prompt payment of reasonable damages from a discharge.

Portions of Chapter 376, F.S., serve as a complement to the national contingency plan portions of the federal Water Pollution Control Act.

RESPONSE: The proposed project does not involve the transportation or discharge of pollutants. The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will include conditions on how to handle inadvertent spills of pollutants, such as vehicle fuels. A spill prevention plan will be required of the contractor. The proposed project is consistent with the goals of this chapter.

16. CHAPTER 377, F.S., ENERGY RESOURCES

The statute addresses the regulation, planning, and development of the energy resources of the state. The statute provides policy to conserve and control the oil and gas resources in the state, including products made therefrom and to safeguard the health, property and welfare of Floridians. The Department of Environmental Protection (DEP) is authorized to regulate all phases of exploration, drilling, and production of oil, gas, and other petroleum products in the state.

The statute describes the permitting requirements and criteria necessary to drill and develop for oil and gas. DEP rules ensure that all precautions are taken to prevent the spillage of oil or any other pollutant in all phases of extraction and transportation. The state explicitly prohibits pollution resulting from drilling and production activities. No person drilling for or producing oil, gas, or other petroleum products may pollute land or water; damage aquatic or marine life, wildlife, birds, or public or private property; or allow any extraneous matter to enter or damage any mineral or freshwater-bearing formation.

Penalties for violations of any provisions of this chapter are detailed.

RESPONSE: The proposed project does not involve the development of energy resources.

17. CHAPTER 379, F.S., FISH AND WILDLIFE CONSERVATION

The framework for the management and protection of the state of Florida's wide diversity of fish and wildlife resources are established in this statute. It is the policy of the state to conserve and wisely manage these resources. Particular attention is given to those species defined as being endangered or threatened. This includes the acquisition or management of lands important to the conservation of fish and wildlife.

This statute contains specific provisions for the conservation and management of marine fisheries resources. These conservation and management measures permit reasonable means and quantities of annual harvest (consistent with maximum practicable sustainable stock abundance) as well as ensure the proper quality control of marine resources that enter commerce.

Additionally, this statute supports and promotes hunting, fishing and the taking of game opportunities in the State. Hunting, fishing, and the taking of game are considered an important part in the state's economy and in the conservation, preservation, and management of the state's natural areas and resources.

RESPONSE: Pursuant to Section 7 of the Endangered Species Act, the Corps coordinated with the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) for beach renourishment activities. Detailed analysis of the Corps' effect determinations are in Section 4 of the 2020 EA, and details of the consultations with USFWS and NMFS are included in Section 6. A summary of the effect determinations are as follows:

Effect determinations for species under NMFS jurisdiction:

May Affect, Not Likely to Adversely Affect (MANLAA):

Swimming sea turtles (green sea turtle, hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle, Kemp's ridley sea turtle), smalltooth sawfish, Nassau grouper, giant manta ray, and corals (pillar coral, rough cactus coral, lobed star coral, mountainous star coral, boulder star coral, elkhorn coral, staghorn coral)

Effect determinations for species under USFWS jurisdiction:

MANLAA:

Nesting sea turtles (green sea turtle, hawksbill sea turtle, leatherback sea turtle, loggerhead sea turtle, Kemp's ridley sea turtle), American crocodile, Florida manatee, piping plover

No Effect:

Beach jacquemontia

To address potential effects from beach renourishment activities to federally-listed T&E species under the NMFS jurisdiction, the project adheres to the PDCs as described in the NMFS' SARBO dated March 27, 2020. The Preferred Alternative's potential effects to listed species and their Designated Critical Habitat (DCH) under NMFS jurisdiction are covered by the 2020 South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States (SARBO). The project adheres to the SARBO's project design criteria (PDCs). The project will comply with all terms and conditions of the SARBO. Additionally, NMFS' sea turtle and smalltooth sawfish construction conditions would be implemented.

For potential effects to federally-listed T&E species under the USFWS jurisdiction, the Corps requested concurrence from the USFWS on the Corps' may affect, but not likely to adversely affect (MANLAA) determinations. The Preferred Alternative's beach placement activities and potential effects to nesting sea turtles and piping plover are covered by the Statewide Programmatic Biological Opinion (SPBO) and the Piping Plover Programmatic Biological Opinion (P3BO), respectively. The project will comply with all applicable minimization measures, Reasonable and Prudent Measures, and T&Cs of the SPBO and P3BO. Additionally, the USFWS' 2011 Standard Manatee Conditions for In-Water Work would be implemented. Consultation with USFWS for potential effects to American crocodiles and Florida manatees is ongoing through review of the draft EA. The USFWS' final determination will be noted in the final NEPA document.

Pursuant to NEPA, the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. Environmental protection measures, as described in detail in Section 6 of the 2020 EA, will be implemented to minimize adverse effects to the maximum extent practicable to T&E species as well as fish and other wildlife resources. The project is consistent with the goals of this chapter.

18. CHAPTER 380, F.S., LAND AND WATER MANAGEMENT

Land and water management policies are established to protect natural resources and the environment; and to guide and coordinate local decisions relating to growth and development. The statute provides that state land and water management policies be implemented by local governments through existing processes for the guidance of growth and development. The statute also provides that all the existing rights of private property be preserved in accord with constitutions of this state and of the United States.

The chapter establishes the Areas of Critical State Concern designation, the Florida Communities Trust as well as the Florida Coastal Management Act. The Florida Coastal Management Act provides the basis for the Florida Coastal Management Program which seeks to protect the natural, commercial, recreational, ecological, industrial, and aesthetic resources of Florida's coast.

RESPONSE: The purpose for the project is to provide coastal storm risk management to Segment II of the BCSP through beach renourishment. Renourishment of Segment II of BCSP will ensure the continuation of benefits to socioeconomic resources (e.g. recreation, tourism, etc.). Pursuant to NEPA, the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. The project is consistent with the goals of this chapter.

19. CHAPTER 381, F.S., PUBLIC HEALTH: GENERAL PROVISIONS

The statute establishes public policy concerning the state's public health system, which is designated to promote, protect, and improve the health of all people in the state.

RESPONSE: The state's public health system will not be affected by the proposed project.

20. CHAPTER 388, F.S., MOSQUITO CONTROL

Mosquito control efforts of the state are to achieve and maintain such levels of arthropod control as will protect human health and safety; promote the economic development of the state; and facilitate the enjoyment of its natural attractions by reducing the number of pestiferous and disease-carrying arthropods.

It is the policy of the state to conduct arthropod control in a manner consistent with protection of the environmental and ecological integrity of all lands and waters throughout the state.

RESPONSE: The proposed project will not further the propagation of mosquitoes or other pest arthropods. The proposed project is consistent with the goals of this chapter.

21. CHAPTER 403, F.S., ENVIRONMENTAL CONTROL

Environmental control policies conserve state waters; protect and improve water quality; and maintain air quality. This statute provides wide-ranging authority to address various environmental control concerns, including air and water pollution; electrical power plant and transmission line siting; the Interstate Environmental Control Compact;

resource recovery and management; solid and hazardous waste management; drinking water protection; pollution prevention; ecosystem management; and natural gas transmission pipeline siting.

RESPONSE: Pursuant to NEPA, the proposed project will be coordinated with federal, state, federally-recognized Native American tribes, local agencies, and other interested parties. Environmental protection measures, as described in detail in Section 6 of the 2020 EA, will be implemented to minimize adverse effects to the maximum extent practicable to fish and other wildlife resources, T&E species, water quality, air quality, or other environmental resources. The proposed project complies with the goals of this chapter.

22. CHAPTER 553, F.S., BUILDING AND CONSTRUCTION STANDARDS

The statute addresses building construction standards and provides for a unified Florida Building Code.

RESPONSE: The proposed project does not include building construction.

23. CHAPTER 582, F.S., SOIL AND WATER CONSERVATION

It is the state's policy to preserve natural resources; control and prevent soil erosion, prevent floodwater and sediment damages; and to further the conservation, development and use of soil and water resources.

Farm, forest, and grazing lands are among the basic assets of the state; and the preservation of these lands is necessary to protect and promote the health, safety, and general welfare of its people.

These measures help to preserve state and private lands, control floods, maintain water quality, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, preserve wildlife and protect wildlife habitat, protect the tax base, protect public lands, and protect and promote the health, safety, and general welfare of the people of this state.

RESPONSE: The project is not located on or near agricultural lands. The proposed project will include appropriate erosion control plans and measures where applicable. The proposed project is consistent with the goals of this chapter.

24. CHAPTER 597, F.S., AQUACULTURE

The statute establishes public policy concerning the cultivation of aquatic organisms in the state. The intent is to enhance the growth of aquaculture, while protecting Florida's environment. This includes a requirement for a state aquaculture plan which provides for: the coordination and prioritization of state aquaculture efforts; the conservation and enhancement of aquatic resources; and mechanisms for increasing aquaculture production.

RESPONSE: The proposed project does not include aquaculture.



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

Mr. Kevin Donaldson
NAGPRA Representative
Miccosukee Tribe of Indians of Florida
PO Box 440021
Tamiami Station
Miami, FL 33144

Re: the Broward County Shore Protection Project, Segment II Beach Nourishment, Broward County, Florida.

Dear Mr. Donaldson:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is preparing an Environmental Assessment (EA) for the Broward County Shore Protection Project (BCSPP), Segment II Beach Nourishment, Broward County, Florida. The authorized Federal project (Figure 1) includes the Atlantic Ocean shoreline in central Broward County between Hillsboro Inlet (Florida Department of Environmental Protection [FDEP] coastal range monument R-25) and Port Everglades Inlet (R-85). The Segment II shoreline is approximately 11.3 miles long and includes the municipalities of Pompano Beach, Lauderdale-By-The-Sea, Sea Ranch Lakes, and Fort Lauderdale. The Preferred Alternative is the continued periodic nourishment of Segment II of the BCSPP (Figure 2) via truck haul from upland sand mines. The current BCSPP construction event will include placement of approximately 413,000 cubic yards (CY) of sand in the following FDEP coastal range monuments:

- Reach 1: approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.
- Reach 3: approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.
- Reach 4: approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immoklaee), Vulcan Witherspoon Mine (Witherspoon), and/or Cemex Davenport Mine (Cemex). The BCSP may also use the sand mine of the Garcia Family Farm, LLC in Hendry County (Garcia Mine).

Based on archival research of the Florida Master Site File (FMSF) no prehistoric archaeological sites are recorded within the beach placement area; however, several prehistoric midden sites (8BD00006, 8BD00007, 8BD00008, and 8BD00057) are located within 0.5 mile westward of the BCSP, and will not be adversely impacted. In addition several historic structures (8BD05071 through 8BD05077, 8BD05079 through 8BD05082, 8BD05087 through 8BD05090, 8BD05977, 8BD02190, 8BD02192, and 8BD02194) and the Birch Historic Estates District (BD04462) are located within 200 to 1,000 feet of the placement activities. One significant historic structure (8BD01099), known as the Bonnet House is located within 200 feet of the BCSP and is listed on the National Register of Historic Places (NRHP). These properties are located outside of the area of potential effects (APE) and beach placement of sand will have a beneficial effect of preventing future erosion. The most recent determination of no adverse effects and consultation by the Corps regarding the BCSP was in 2013 (DHR Project File No.: 2013-02923). The 2015 EA documented shoreline erosion all the way to the seawalls. Erosion in that reach was so severe in the past, it impacted SR A1A, a major hurricane evacuation route. Moreover, northeasters, tropical storms, and hurricanes overwash the beach, resulting in severe coastal erosion and flooding.

The commercial upland sand sources identified for the BCSP Segment II Project include the Ortona Sand Mine and the Witherspoon Sand Mine. Over the years, a number of cultural resource surveys have been conducted for the Ortona Sand Mine (Department of Historical Resources [DHR] Survey Nos. 6689, 4847, 3021, 17005, and 16862). Several prehistoric archaeological sites associated with the Ortona Mound complex have been identified and recorded within the mine property including Ortona Canal East (8GL4a), Quarry Mound (8GL81), Lance's Mound (8GL419), Sawpalmetto Haven Mound (8GL420), and Tallant Mound (8GL00083). FMSF records indicate that the Ortona Canal East (8GL4a) and Quarry Mound (8GL81) have been mitigated. Cultural resources investigations for the adjacent Witherspoon sand mine have been completed (DHR Survey No. 4602). Two archaeological sites (8GL378 T.C. Cabbage Palm Mound and 8GL379 Fox Hammock Midden) were identified as eligible for inclusion in the National Register of Historic Places (NRHP). These sites will not be impacted by the sand mining activities.

Any upland sand mines (including Imokalee, CEMEX, and Garcia Land Mines) employed for this project are subject to the requirement of proving compliance with the State of Florida's statutory requirements in Chapter 267 for protection of historical resources in the sand source footprints before the Corps will approve utilizing the source.

Portions of the proposed BCSPP have been renourished beginning in 1970 until as recent as 2016 such that the entire fill template of the Project has been subjected to past modification and disturbances (Figure 3). Previous Corps consultations did not include the beach renourishment of the feeder beach from FDEP Monuments R28 to R31; however, this area has been previously constructed. No cultural resources are located within this specific placement area, and the placement of sand at this location would be considered a protective measure preventing erosion and potential disturbance to unknown resources that may exist further inland beyond the current project's area of potential effect.

Based on this information, truck haul of sand from upland commercial sand mines and placement of materials on the beach between R-25 to R-72 poses no adverse effect to historic properties. Pursuant to Section 106 of the National Historic Preservation Act (16 USC 470) and its implementing regulations (36 CFR 800), the Corps kindly requests your comments on the determination of no adverse effect within 30 days from receipt of this letter. If there are any questions, please contact Mr. Marc Tiemann at 904-232-1557 or email at Marc.A.Tiemann@usace.army.mil.

Sincerely,



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Angela E. Dunn
Chief, Environmental Branch

Encl

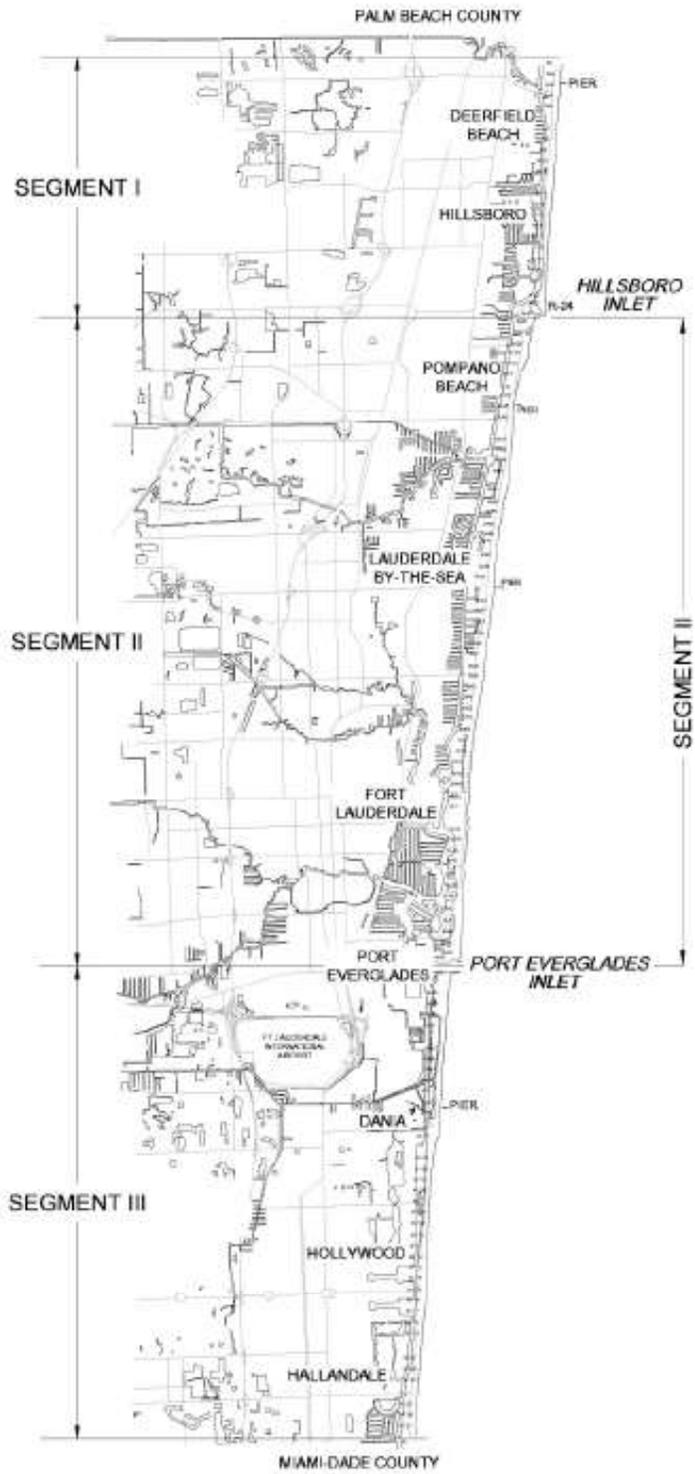


Figure 1. Broward County SPP Project Location

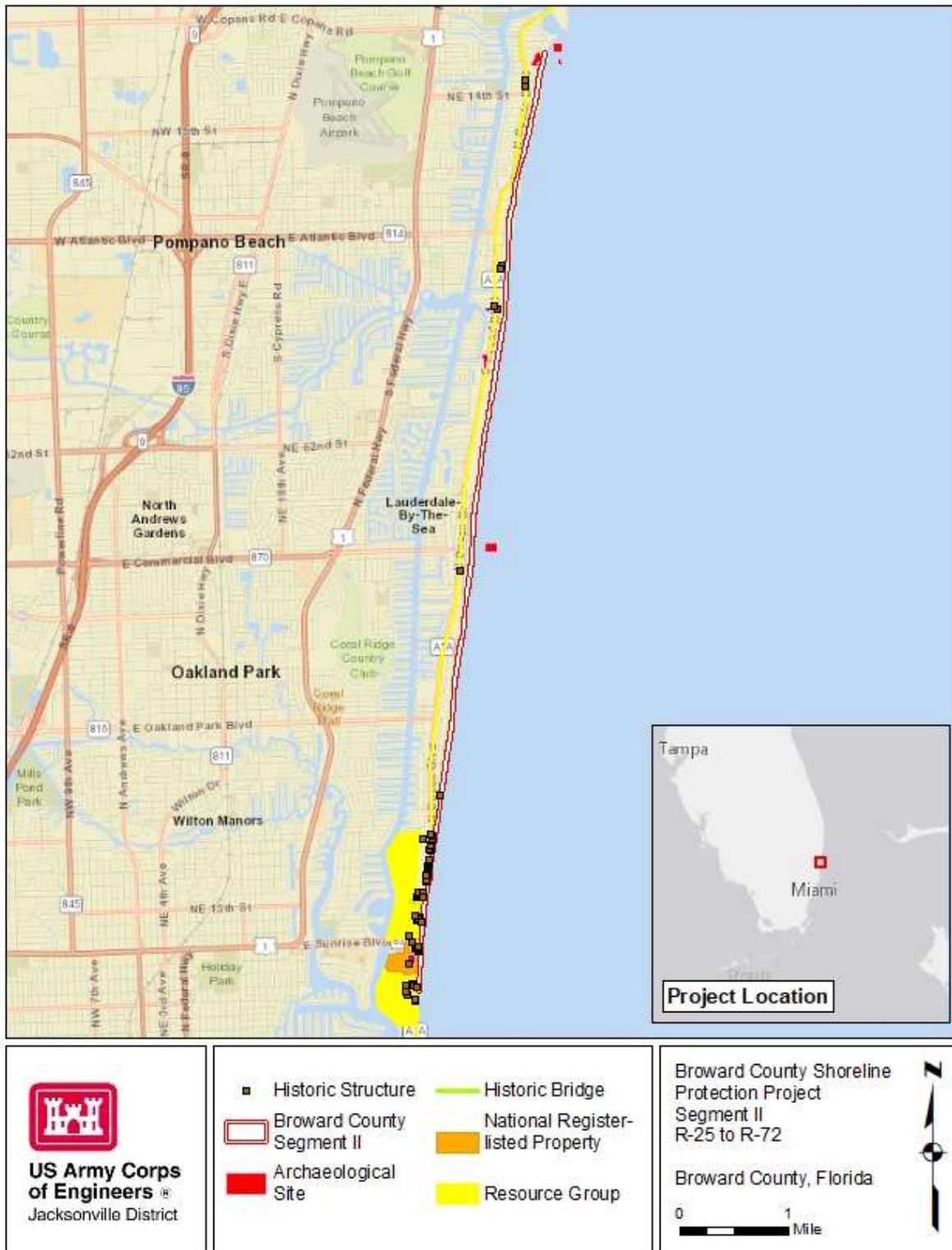


Figure 2. Broward County SPP Segment II Construction Template and Cultural Resources

BROWARD COUNTY – SEGMENT II Sand Placement Areas

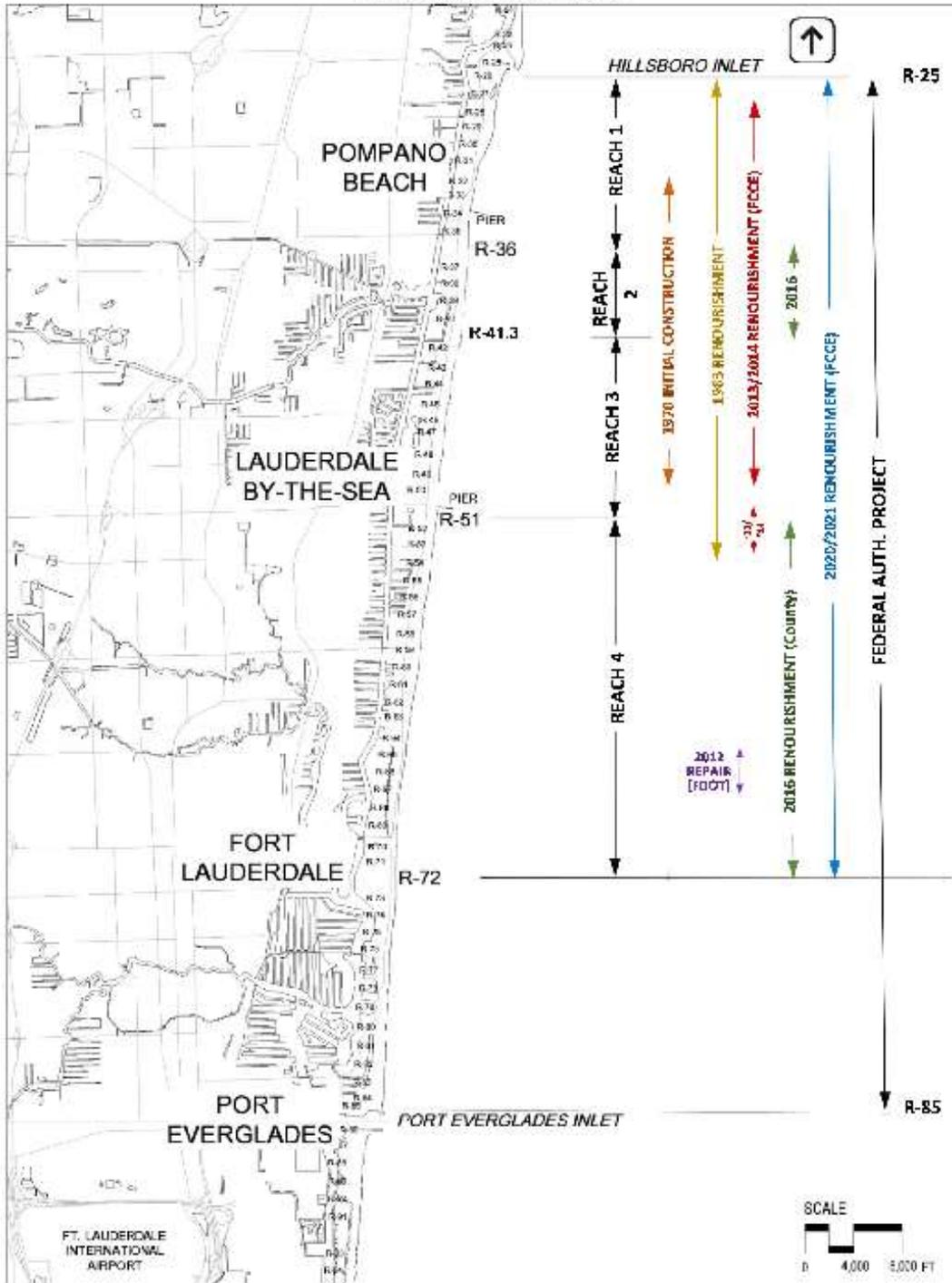


Figure 3. Previous Beach Renourishments of the Broward County Shore Protection Project.



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

Tim Parsons, Ph.D., SHPO
Division of Historical Resources
State Historic Preservation Officer
500 South Bronough Street
Tallahassee, Florida 32399-0250

Re: The Broward County Shore Protection Project, Segment II Beach Nourishment, Broward County, Florida.

Dear Dr. Parsons:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is preparing an Environmental Assessment (EA) for the Broward County Shore Protection Project (BCSPP), Segment II Beach Nourishment, Broward County, Florida. The authorized Federal project (Figure 1) includes the Atlantic Ocean shoreline in central Broward County between Hillsboro Inlet (Florida Department of Environmental Protection [FDEP] coastal range monument R-25) and Port Everglades Inlet (R-85). The Segment II shoreline is approximately 11.3 miles long and includes the municipalities of Pompano Beach, Lauderdale-By-The-Sea, Sea Ranch Lakes, and Fort Lauderdale. The Preferred Alternative is the continued periodic nourishment of Segment II of the BCSPP (Figure 2) via truck haul from upland sand mines. The current BCSPP construction event will include placement of approximately 413,000 cubic yards (CY) of sand in the following FDEP coastal range monuments:

- Reach 1: approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.
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- Reach 3: approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.
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- Reach 4: approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immoklaee), Vulcan Witherspoon Mine (Witherspoon), and/or Cemex Davenport Mine (Cemex). The BCSP may also use the sand mine of the Garcia Family Farm, LLC in Hendry County (Garcia Mine).

Based on archival research of the Florida Master Site File (FMSF) no prehistoric archaeological sites are recorded within the beach placement area; however, several prehistoric midden sites (8BD00006, 8BD00007, 8BD00008, and 8BD00057) are located within 0.5 mile westward of the BCSP, and will not be adversely impacted. In addition several historic structures (8BD05071 through 8BD05077, 8BD05079 through 8BD05082, 8BD05087 through 8BD05090, 8BD05977, 8BD02190, 8BD02192, and 8BD02194) and the Birch Historic Estates District (BD04462) are located within 200 to 1,000 feet of the placement activities. One significant historic structure (8BD01099), known as the Bonnet House is located within 200 feet of the BCSP and is listed on the National Register of Historic Places (NRHP). These properties are located outside of the area of potential effects (APE) and beach placement of sand will have a beneficial effect of preventing future erosion. The most recent determination of no adverse effects and consultation by the Corps regarding the BCSP was in 2013 (DHR Project File No.: 2013-02923). The 2015 EA documented shoreline erosion all the way to the seawalls. Erosion in that reach was so severe in the past, it impacted SR A1A, a major hurricane evacuation route. Moreover, northeasters, tropical storms, and hurricanes overwash the beach, resulting in severe coastal erosion and flooding.

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Sincerely,



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Angela E. Dunn
Chief, Environmental Branch

Encl

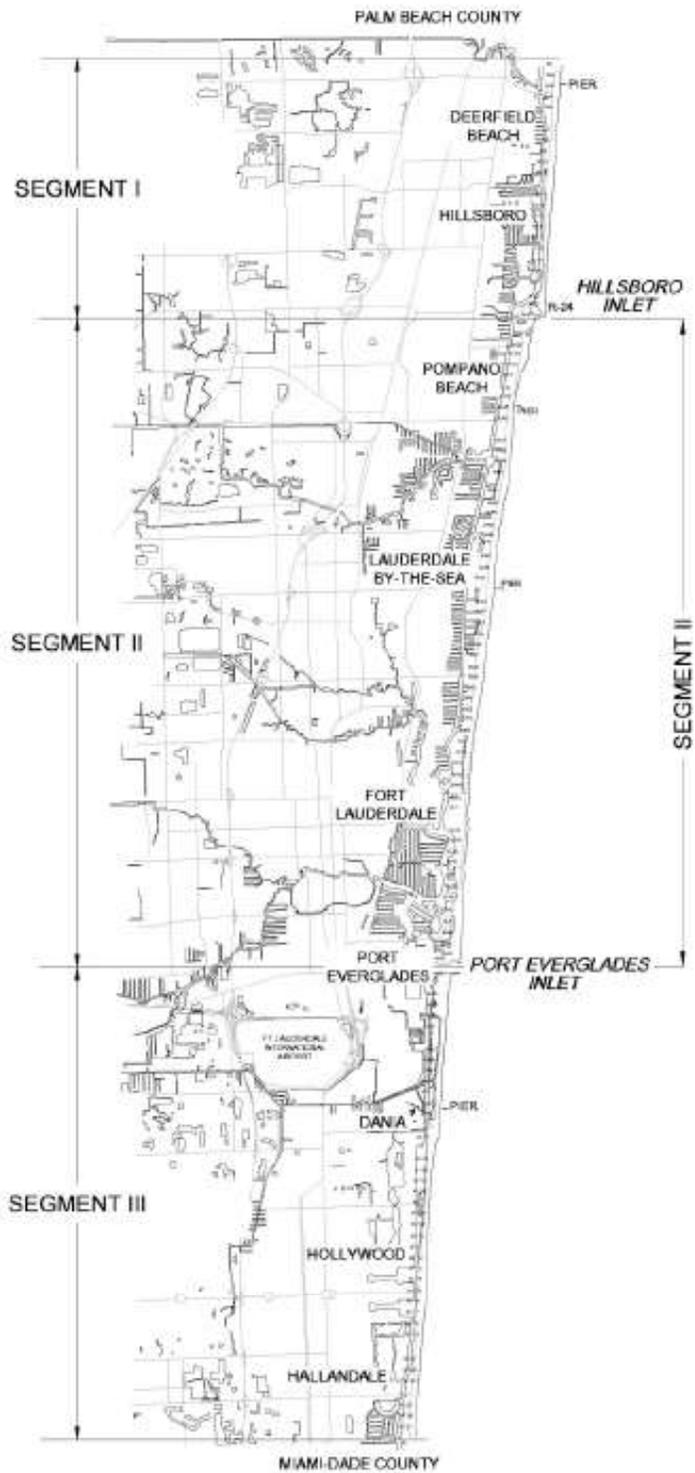


Figure 1. Broward County SPP Project Location

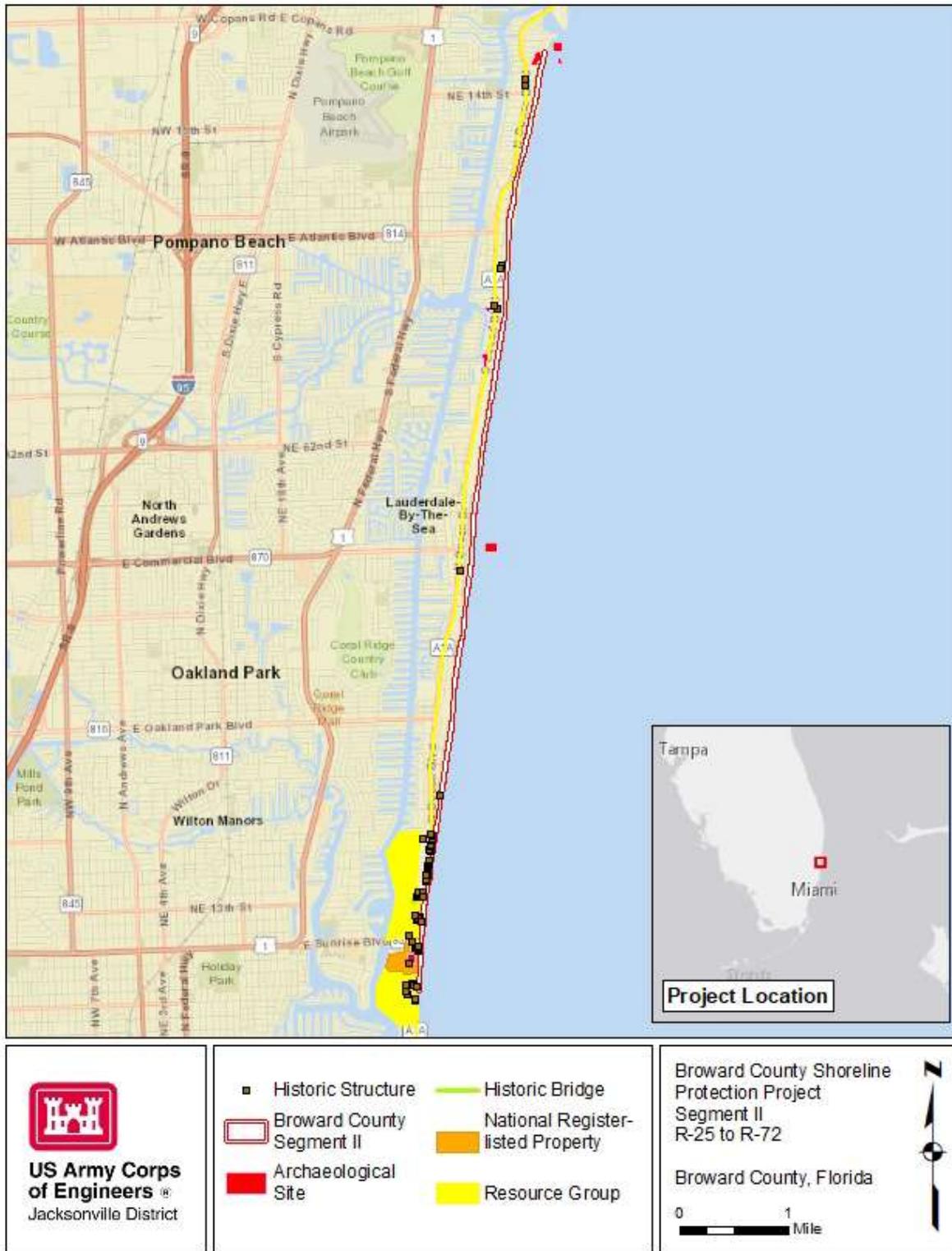


Figure 2. Broward County SPP Segment II Construction Template and Cultural Resources

**BROWARD COUNTY – SEGMENT II
Sand Placement Areas**

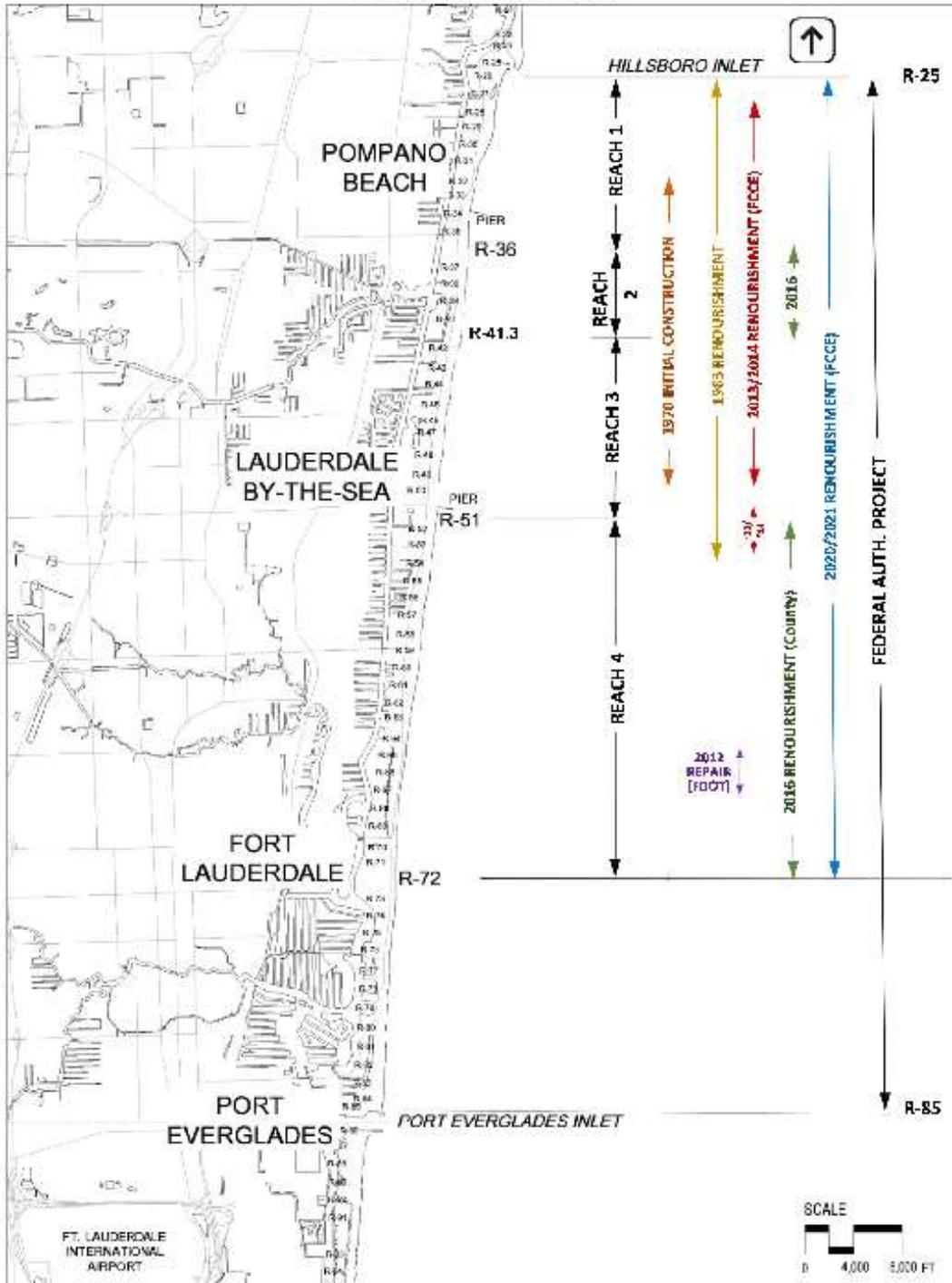


Figure 3. Previous Beach Renourishments of the Broward County Shore Protection Project.



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

Mr. David Frank
Historic Preservation Officer
Seminole Nation of Oklahoma
PO Box 1498
Wewoka, Ok 74884

Re: the Broward County Shore Protection Project, Segment II Beach Nourishment, Broward County, Florida.

Dear Mr. Frank:

The U.S. Army Corps of Engineers, Jacksonville District (Corps) is preparing an Environmental Assessment (EA) for the Broward County Shore Protection Project (BCSPP), Segment II Beach Nourishment, Broward County, Florida. The authorized Federal project (Figure 1) includes the Atlantic Ocean shoreline in central Broward County between Hillsboro Inlet (Florida Department of Environmental Protection [FDEP] coastal range monument R-25) and Port Everglades Inlet (R-85). The Segment II shoreline is approximately 11.3 miles long and includes the municipalities of Pompano Beach, Lauderdale-By-The-Sea, Sea Ranch Lakes, and Fort Lauderdale. The Preferred Alternative is the continued periodic nourishment of Segment II of the BCSPP (Figure 2) via truck haul from upland sand mines. The current BCSPP construction event will include placement of approximately 413,000 cubic yards (CY) of sand in the following FDEP coastal range monuments:

- Reach 1: approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
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Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immoklaee), Vulcan Witherspoon Mine (Witherspoon), and/or Cemex Davenport Mine (Cemex). The BCSP may also use the sand mine of the Garcia Family Farm, LLC in Hendry County (Garcia Mine).

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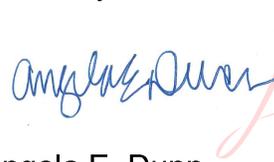
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Sincerely,



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Angela E. Dunn
Chief, Environmental Branch

Encl

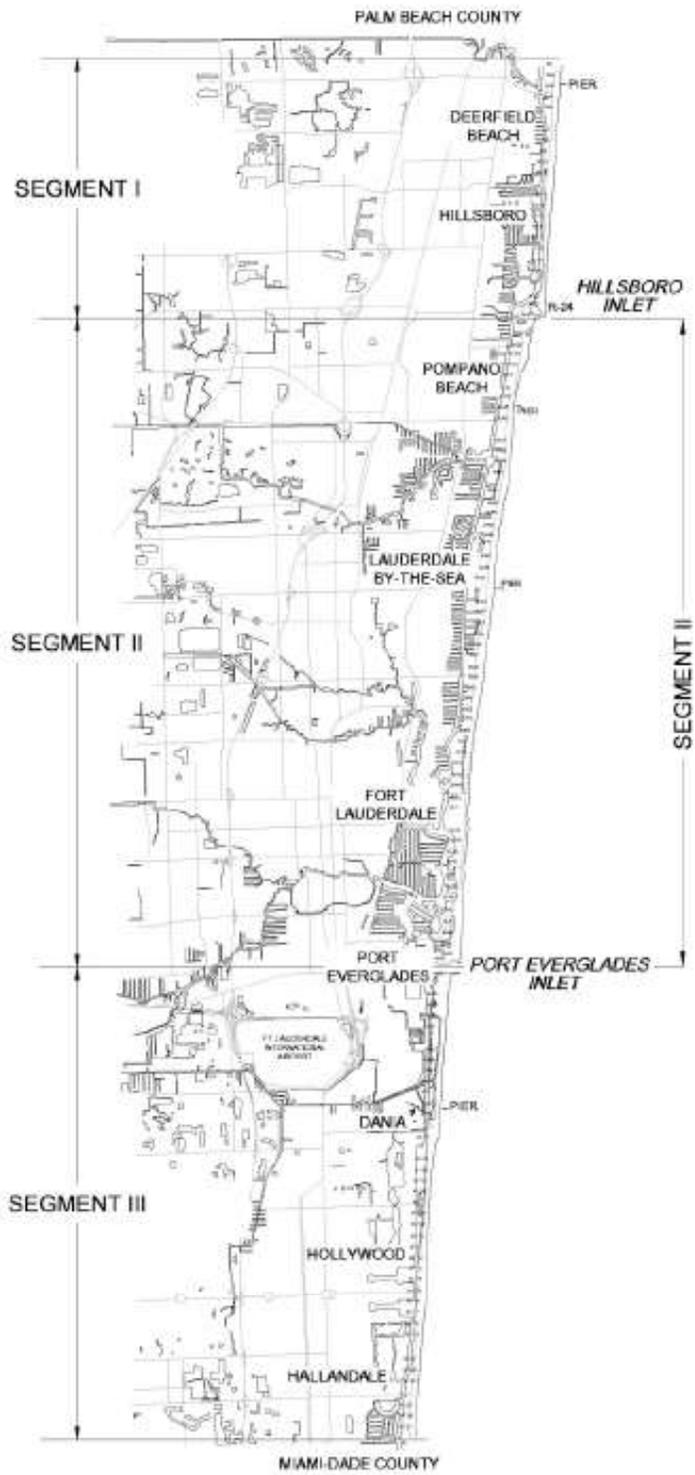


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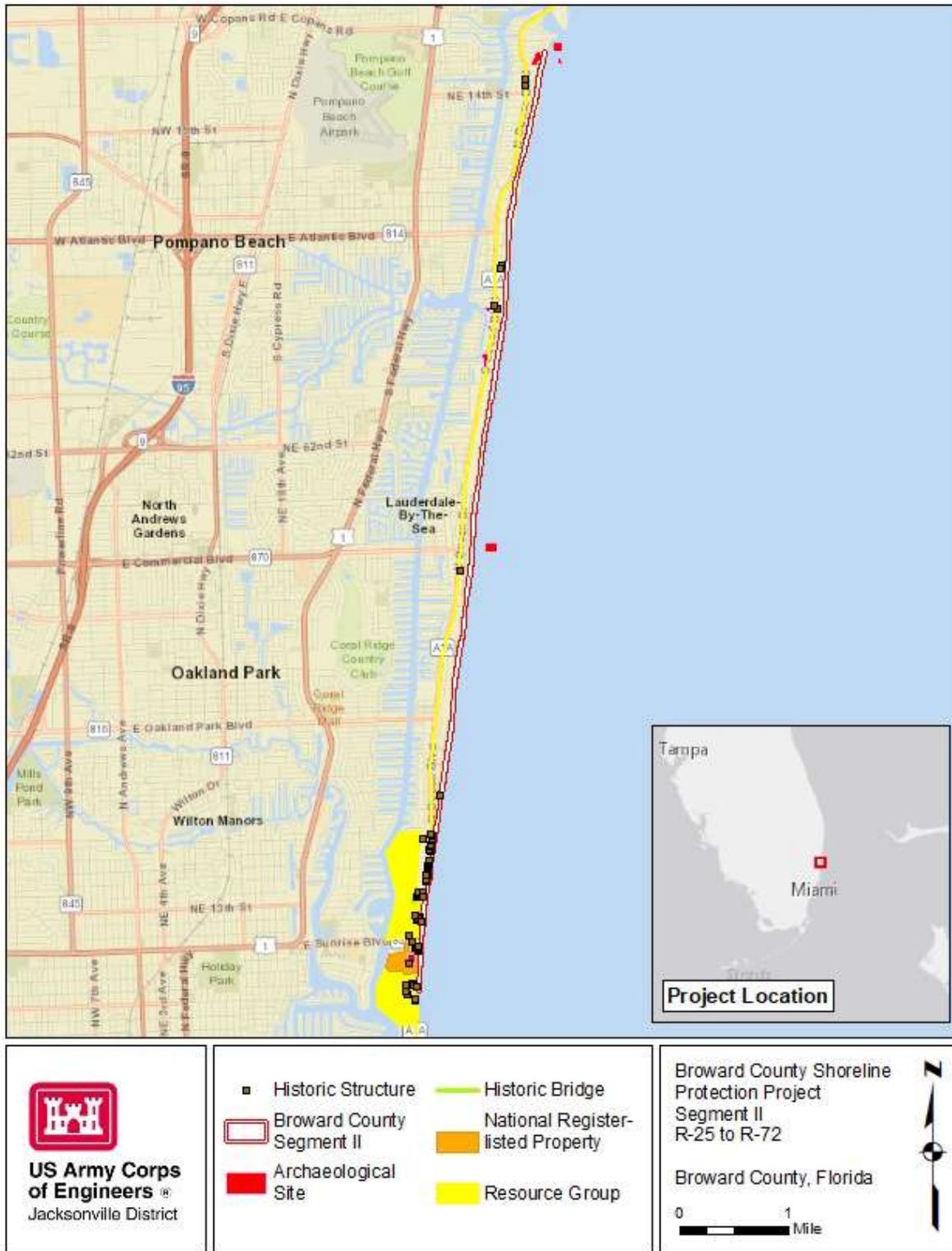


Figure 2. Broward County SPP Segment II Construction Template and Cultural Resources

**BROWARD COUNTY – SEGMENT II
Sand Placement Areas**

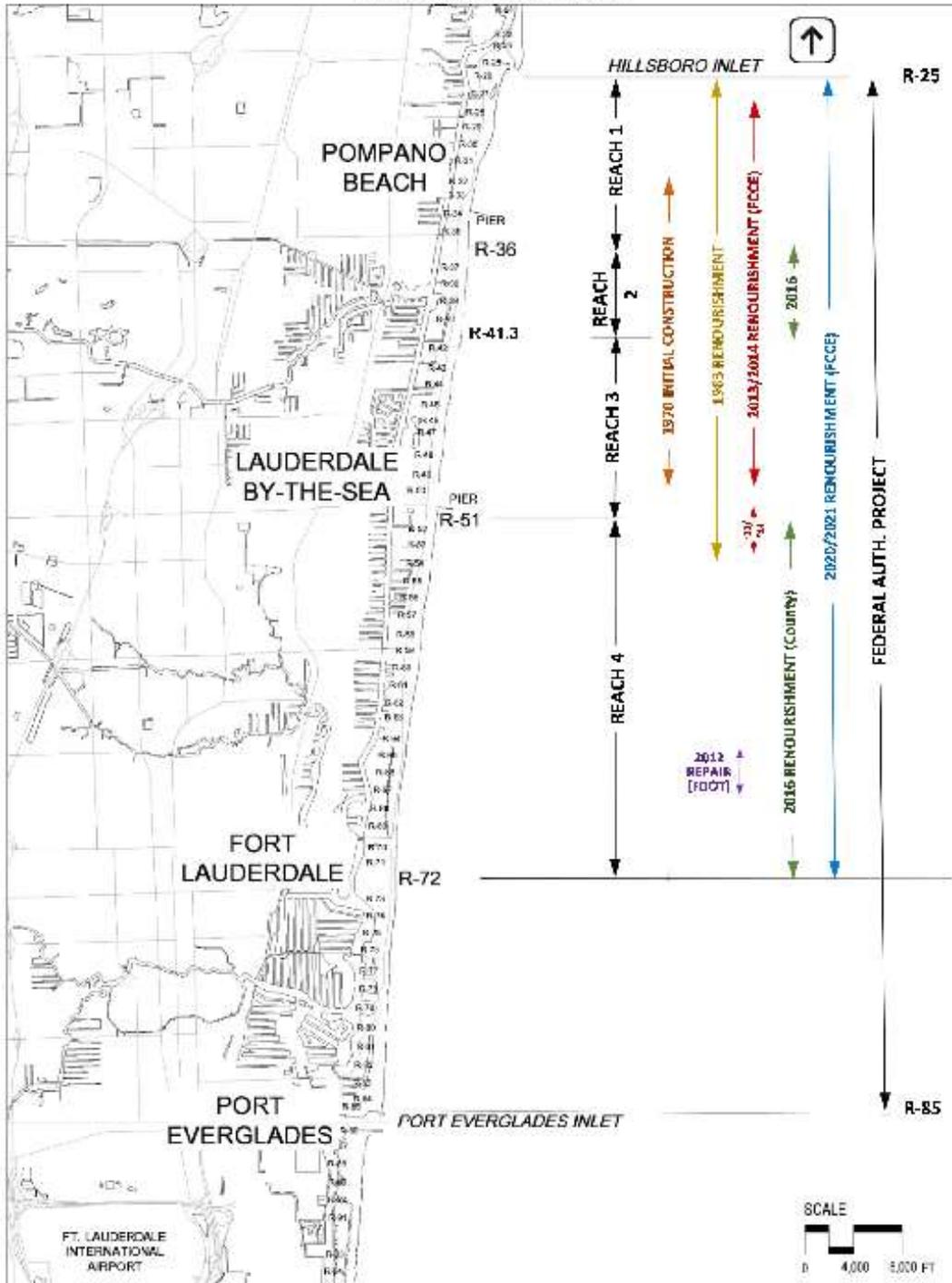


Figure 3. Previous Beach Renourishments of the Broward County Shore Protection Project.

From: [Victoria Menchaca](#)
To: [Tiemann, Marc Auguste CIV USARMY CESAJ \(USA\)](#)
Cc: [Bradley Mueller](#)
Subject: [Non-DoD Source] RE: Broward County Shore Protection Project, Segment II, Broward County, Florida
Date: Wednesday, June 24, 2020 10:11:40 AM
Attachments: [image005.png](#)
[image006.jpg](#)

June 24, 2020

Marc A. Tiemann, M.A., RPA

Archaeologist

Planning Division, Environmental Branch

USACE, Jacksonville District

Phone: 904-232-1557

Email: marc.a.tiemann@usace.army.mil <<mailto:marc.a.tiemann@usace.army.mil>>

Subject: USACE P&P Broward County Shore Protection Project Segment II Beach Nourishment, Broward County FL

THPO #: 0032468

Dear Mr. Tiemann,

Thank you for contacting the Seminole Tribe of Florida – Tribal Historic Preservation Office (STOF-THPO) regarding the USACE P&P Broward County Shore Protection Project Segment II Beach Nourishment, Broward County FL. The proposed undertaking does fall within the STOF Area of Interest. We have reviewed the documents provided and completed our assessment pursuant to Section 106 of the National Historic Preservation Act and its implementing authority, 36 CFR 800. We have no objections to the project at this time. However, please notify us if any archaeological, historical, or burial resources are inadvertently discovered.

Sincerely,

Victoria L. Menchaca MA, RPA

Compliance Review Specialist

STOF-THPO, Compliance Review Section

30290 Josie Billie Hwy, PMB 1004

Clewiston, FL 33440

Office: 863-983-6549 ext 12216

Email: victoriamenchaca@semtribe.com <<mailto:victoriamenchaca@semtribe.com>>

Web: Blockedwww.stofthpo.com <Blockedhttp://www.stofthpo.com>

-----Original Message-----

From: Victoria Menchaca

Sent: Tuesday, June 23, 2020 1:41 PM

To: 'Tiemann, Marc A SAJ (Marc.A.Tiemann@usace.army.mil)' <Marc.A.Tiemann@usace.army.mil>

Subject: FW: Broward County Shore Protection Project, Segment II, Broward County, Florida

Hi Marc,

Hope you are doing well. Could you send a kmz file for those sand placement locations please?

Thanks,

Victoria Menchaca, M.A., RPA

Compliance Review Specialist

Seminole Tribe of Florida

Tribal Historic Preservation Office

30290 Josie Billie Hwy, PMB 1004

Clewiston, FL 33440

Tel: 863-983-6549 Ext: 12216

Email: victoriamenchaca@semtribe.com <<mailto:victoriamenchaca@semtribe.com>>

-----Original Message-----

From: Tiemann, Marc Auguste CIV USARMY CESAJ (USA) <Marc.A.Tiemann@usace.army.mil
<<mailto:Marc.A.Tiemann@usace.army.mil>>>

Sent: Monday, May 18, 2020 3:24 PM

To: Bradley Mueller <bradleymueller@semtribe.com <<mailto:bradleymueller@semtribe.com>>>

Cc: THPO Compliance <THPOCompliance@semtribe.com <<mailto:THPOCompliance@semtribe.com>>>

Subject: Broward County Shore Protection Project, Segment II, Broward County, Florida

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

To all concerned,

Please find attached the USACE determination of effects letter for the Broward County Shore Protection Project, Segment II, Broward County, Florida for your review and comment.

Very respectfully,

Marc

Marc A. Tiemann, M.A., RPA

Archaeologist

Planning Division, Environmental Branch

USACE, Jacksonville District

701 San Marco Blvd.

Jacksonville, FL 32207

Phone: 904-232-1557

Email: marc.a.tiemann@usace.army.mil <<mailto:marc.a.tiemann@usace.army.mil>>



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

Dr. Paul Backhouse, THPO
Seminole Tribe of Florida
Tribe Historic Preservation Office
30290 Josie Billie Highway
PMP 1004
Clewiston, FL 33440

Re: the Broward County Shore Protection Project, Segment II Beach Nourishment, Broward County, Florida.

Dear Dr. Backhouse:

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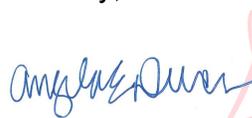
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Sincerely,



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Angela E. Dunn
Chief, Environmental Branch

Encl

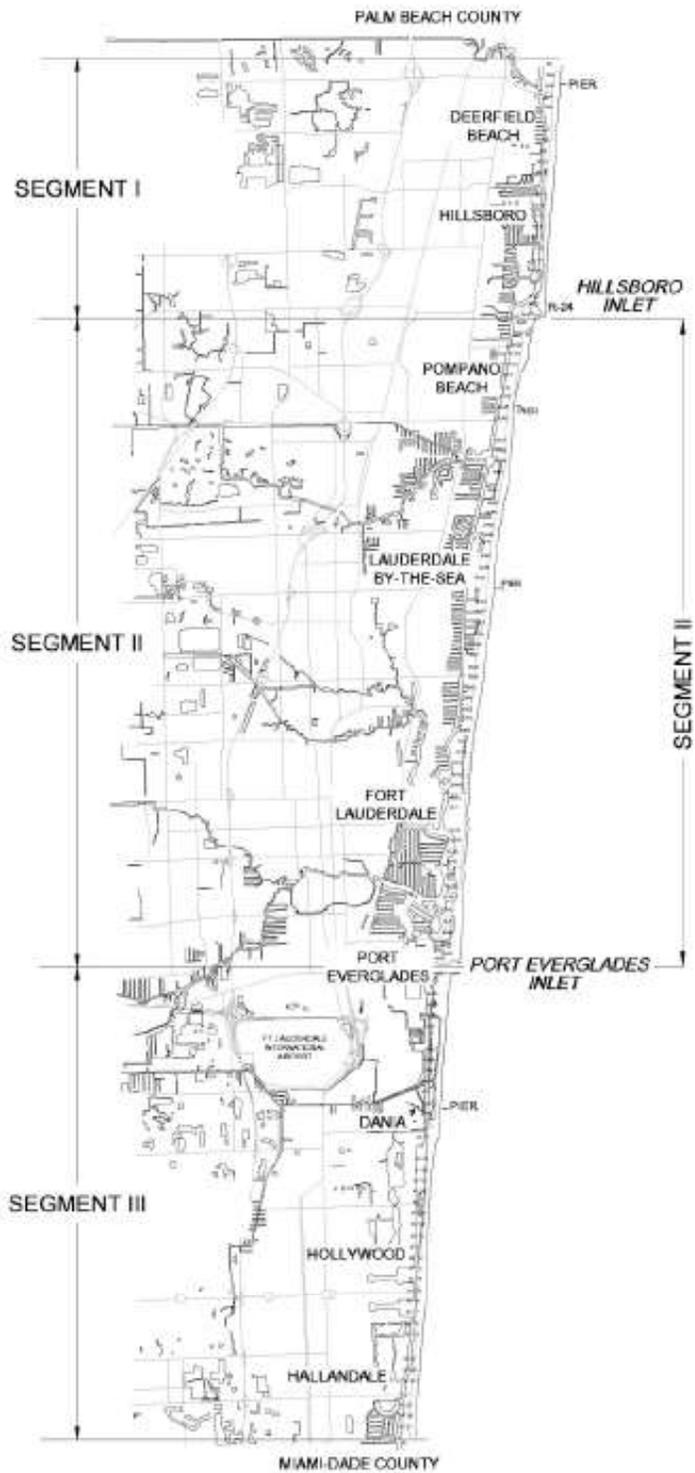


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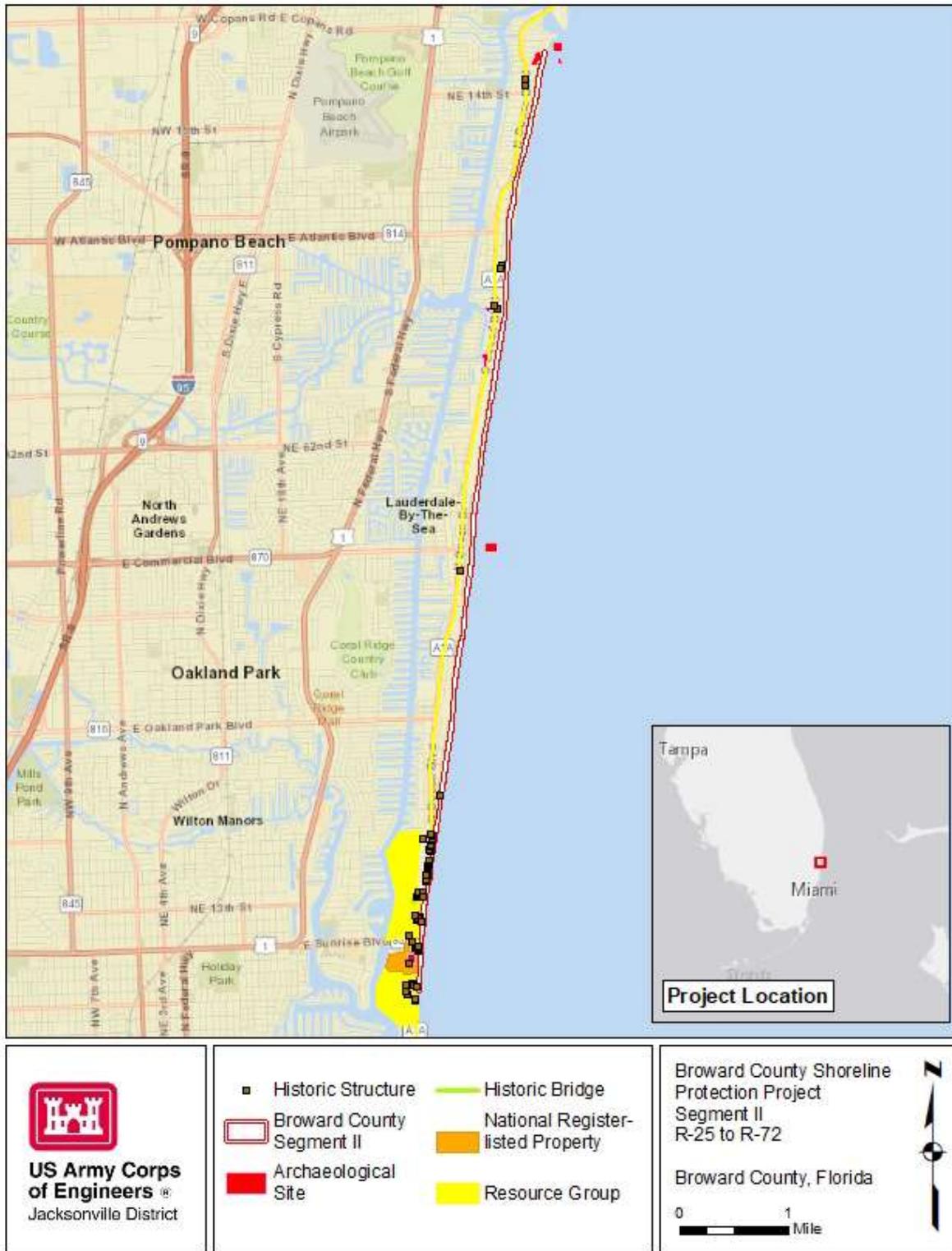


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**BROWARD COUNTY – SEGMENT II
Sand Placement Areas**

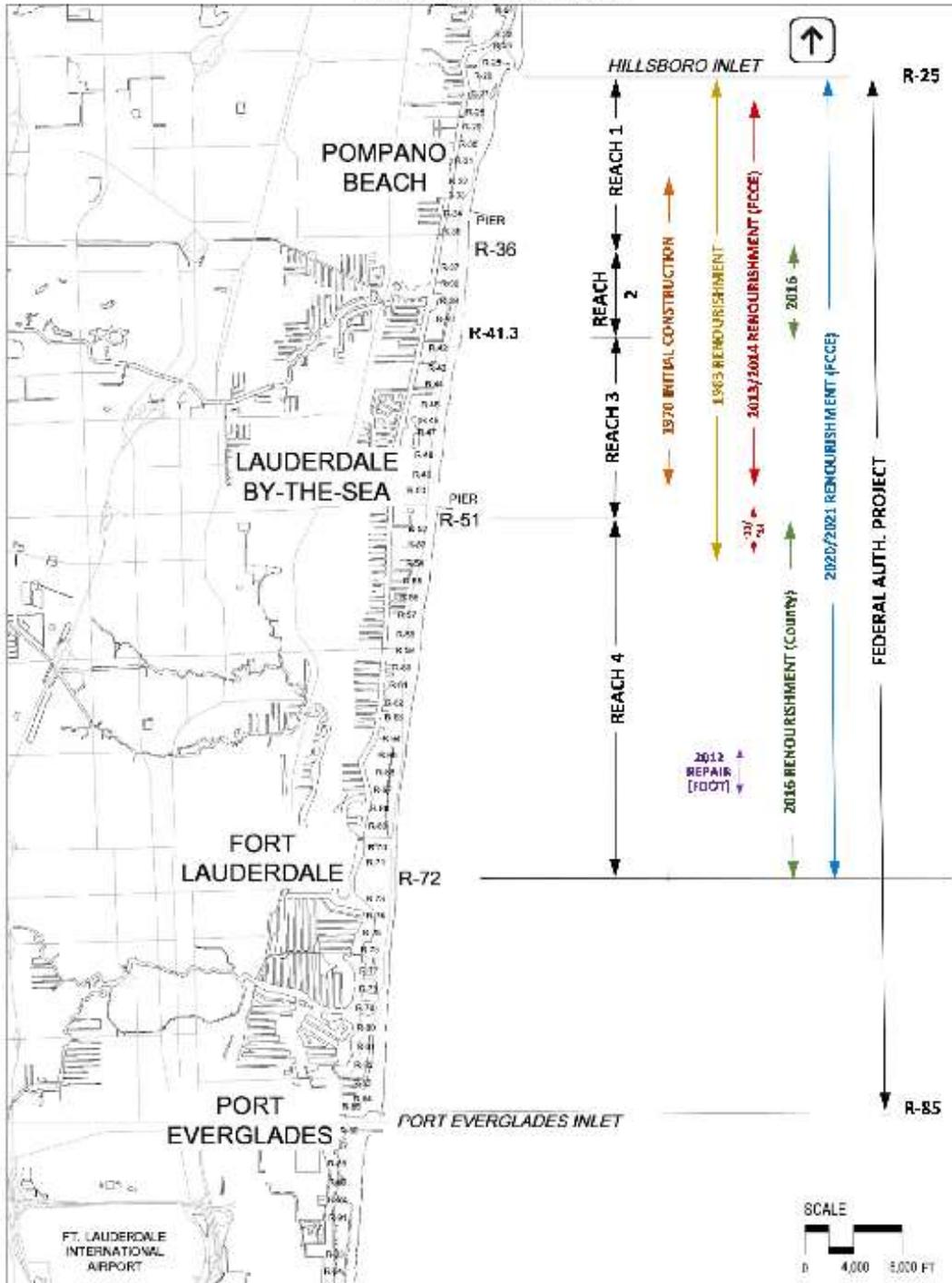


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DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

Ms. Janet Maylen, THPO
Thlopthlocco Tribal Town
P.O. Box 188
Okemah, OK 74859

Re: the Broward County Shore Protection Project, Segment II Beach Nourishment, Broward County, Florida.

Dear Ms. Maylen:

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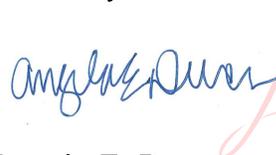
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Any upland sand mines (including Imokalee, CEMEX, and Garcia Land Mines) employed for this project are subject to the requirement of proving compliance with the State of Florida's statutory requirements in Chapter 267 for protection of historical resources in the sand source footprints before the Corps will approve utilizing the source.

Portions of the proposed BCSP have been renourished beginning in 1970 until as recent as 2016 such that the entire fill template of the Project has been subjected to past modification and disturbances (Figure 3). Previous Corps consultations did not include the beach renourishment of the feeder beach from FDEP Monuments R28 to R31; however, this area has been previously constructed. No cultural resources are located within this specific placement area, and the placement of sand at this location would be considered a protective measure preventing erosion and potential disturbance to unknown resources that may exist further inland beyond the current project's area of potential effect.

Based on this information, truck haul of sand from upland commercial sand mines and placement of materials on the beach between R-25 to R-72 poses no adverse effect to historic properties. Pursuant to Section 106 of the National Historic Preservation Act (16 USC 470) and its implementing regulations (36 CFR 800), the Corps kindly requests your comments on the determination of no adverse effect within 30 days from receipt of this letter. If there are any questions, please contact Mr. Marc Tiemann at 904-232-1557 or email at Marc.A.Tiemann@usace.army.mil.

Sincerely,

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Angela E. Dunn
Chief, Environmental Branch

Encl

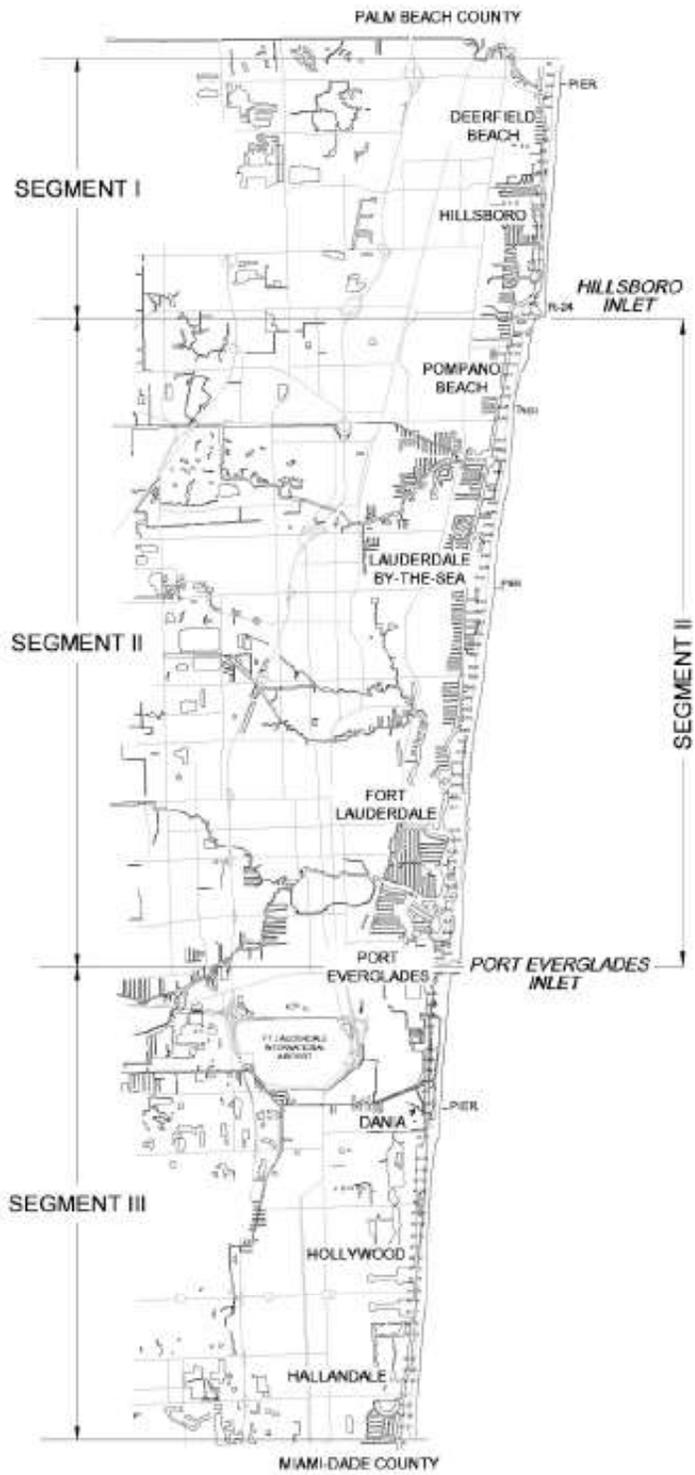


Figure 1. Broward County SPP Project Location

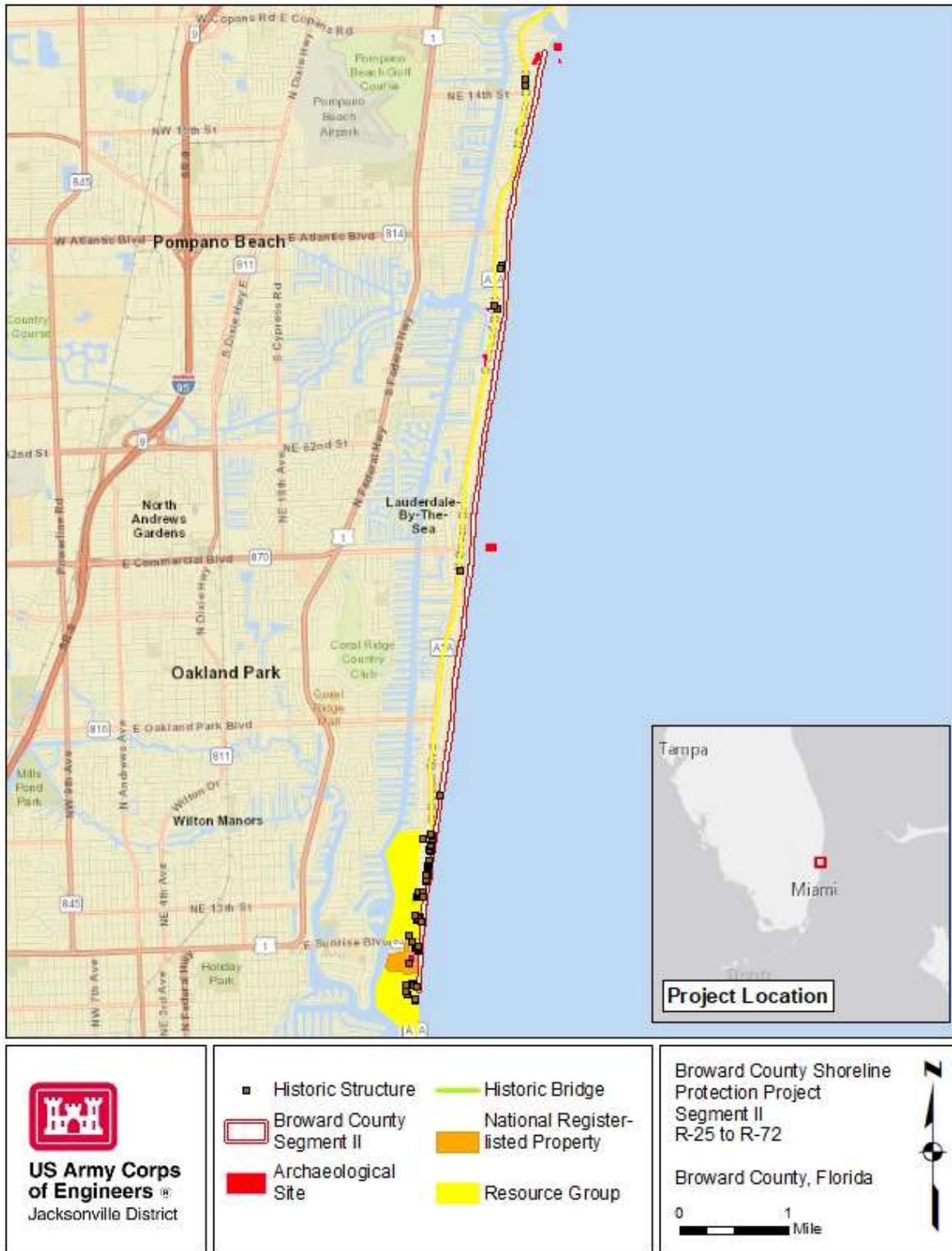


Figure 2. Broward County SPP Segment II Construction Template and Cultural Resources

**BROWARD COUNTY – SEGMENT II
Sand Placement Areas**

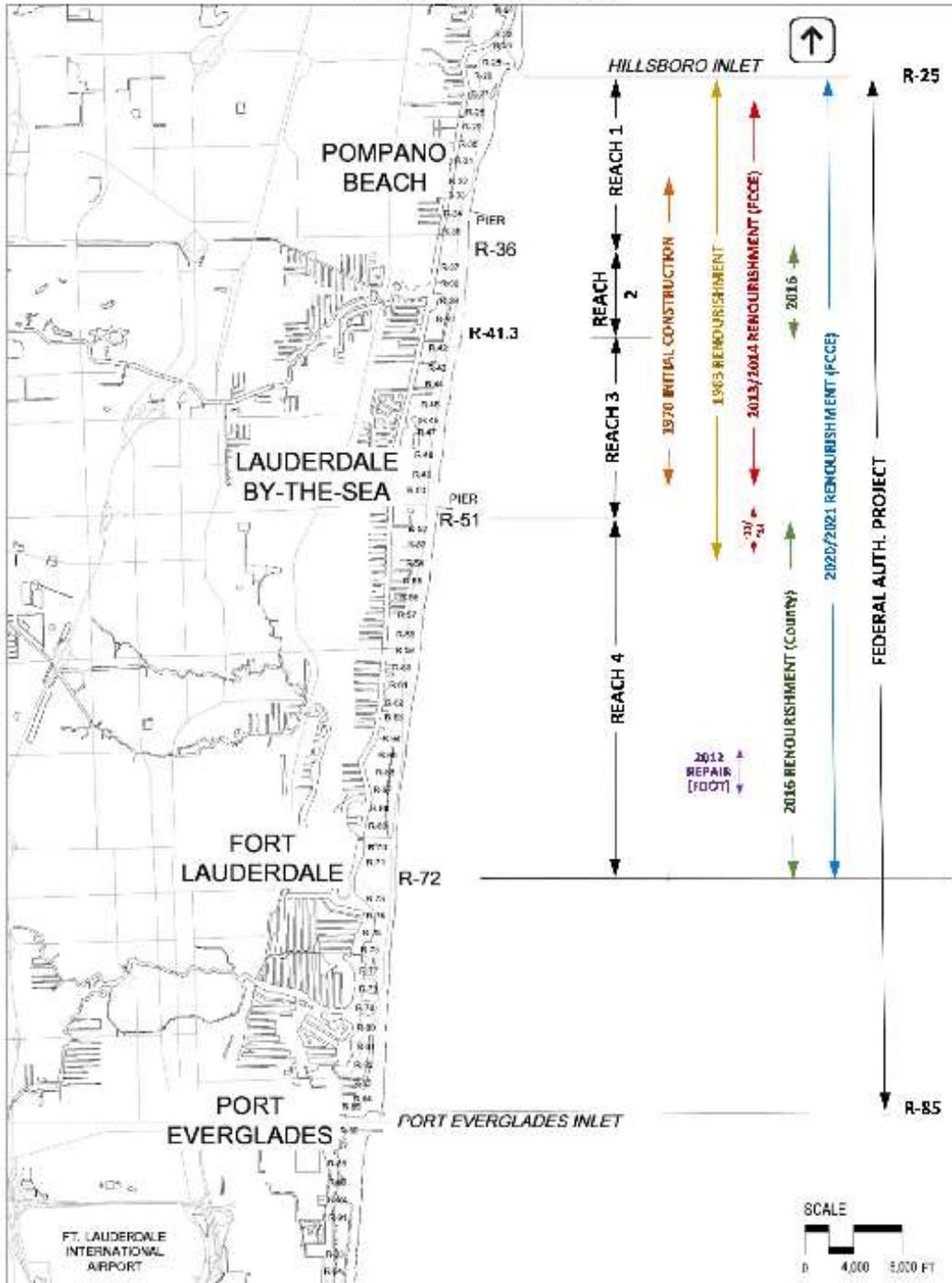


Figure 3. Previous Beach Renourishments of the Broward County Shore Protection Project.



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
JACKSONVILLE, FLORIDA 32207-8175

Planning and Policy Division
Environmental Branch

May 18, 2020

David Bernhart
Asst. Regional Administrator
NMFS-SERO-PRD
263 13th Ave South
St. Petersburg, FL 33701

Dear Mr. Bernhart:

Pursuant to the National Environmental Policy Act and the U.S. Army Corps of Engineers Regulation (33 CFR 230.11), this letter constitutes the Notice of Availability of the proposed Finding of No Significant Impact (FONSI) and draft Environmental Assessment (EA) for the continued periodic renourishment of the Broward County Shore Protection Project, Segment II Beach Nourishment project in Broward County, Florida.

The purpose for the project is to provide coastal storm risk management through beach nourishment of the Segment II portion of the BCSP in Broward County, Florida. The need of the project is driven by the loss of sand (erosion) along the shoreline, most recently from Hurricane Irma in September 2017. Erosion has reduced the width of the beach, thus increasing the risk for storm damages that are otherwise mitigated by the beach design. Periodic nourishment of the beach is required to replace sand along the shoreline and thus maintains the beach to its federally-authorized dimensions.

The Preferred Alternative is the continued periodic nourishment of Segment II of the BCSP and the feeder beach via truck haul from upland sand mines. The upcoming nourishment event will include placement of approximately 413,000 cubic yards (CY) of sand in the following Florida Department of Environmental Protection (FDEP) monuments:

- Reach 1: Approximately 166,000 CY of sand to be placed between R-25 and R-31 above and below mean high water (MHW), with the inclusion of a feeder beach feature between R-28 and R-31. Approximately 22,000 CY of sand to be placed between R-31 and R-36 above MHW only.
- Reach 2: Approximately 42,000 CY of sand to be placed between R-36 and R-41.3 above and below MHW.
- Reach 3: Approximately 32,000 CY of sand to be placed between R-41.3 and R-51 above MHW only.
- Reach 4: Approximately 151,000 CY of sand to be placed between R-51 and R-72 above and below MHW.

Sand sources for the project will be from upland sand mine(s) and truck hauled to the beach fill area. Potential existing sand sources include E.R. Jahna Ortona Mine (Ortona), Stewart Immokalee Mine (Immoklaee), Vulcan Witherspoon Mine (Witherspoon), and/or Cemex Davenport Mine (Cemex). This EA also evaluates the use of the upland sand mine Garcia Family Farm, LLC in Henry County (Garcia Mine).

To address potential effects from beach renourishment activities to federally-listed threatened and endangered species under the NMFS jurisdiction, the project adheres to the project design criteria (PDCs) as described in the NMFS' 2020 South Atlantic Regional Biological Opinion for Dredging and Material Placement Activities in the Southeast United States (SARBO). Therefore, the Corps has determined that the Preferred Alternative's potential effects to listed species and designated critical habitat under NMFS jurisdiction are covered by the SARBO. Section 4 of the draft EA includes the Corps' effect determinations and the Preferred Alternative's effects analysis.

The proposed FONSI, draft EA, and associated appendices are available for your review on the Jacksonville District's Environmental planning website, under Broward County:

<http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/>

(On that page, click on the "+" next to "Broward". Scroll down to the project name.)

Due to current circumstances with COVID-19, the Corps is requesting that any questions or comments you may have be submitted in writing via electronic mail to Kristen.L.Donofrio@usace.army.mil within 30 days of the date of this letter. Correspondence may also be sent to the letterhead address above; however, due to limited staff availability at the District office, electronic submittal of comments via email is preferred.

Sincerely,



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Angela E. Dunn
Chief, Environmental Branch



DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, JACKSONVILLE DISTRICT
701 SAN MARCO BOULEVARD
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Planning and Policy Division
Environmental Branch

May 18, 2020

To Whom It May Concern:

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Angela E. Dunn
Chief, Environmental Branch