

2020 ANNUAL PHYSICAL MONITORING REPORT – BOCA RATON INLET SAND BYPASSING



Prepared by Applied Technology and Management



Prepared for the City of Boca Raton

September 2020

*FDEP Permit No.: 0208818-003-JN
USACE Permit No.: SAJ-2002-08890 (IP-LCK)*

1. Introduction

This physical monitoring report is provided to the Florida Department of Environmental Protection (FDEP) in fulfillment of Specific Condition 4 of Permit No. 0208818-003-JN and Physical Monitoring Plan (Approved 11/2/2009) and to U.S. Army Corps of Engineers (USACE) in fulfillment of Special Conditions 1 and 12 of Permit No.: SAJ-2002-08890. This monitoring report provides the following information.

- Overview: A brief overview of the project and bypassing requirements is provided.
- Dredge Volumes: Dredge records are maintained, and bypassed volumes are summarized. The dredged material is placed on the downdrift beach using a fixed-discharge pipe.
- Hydrographic Survey: The annual hydrographic survey was conducted in June 2020. The survey area is the inlet channel (seaward of the A1A bridge) and a portion of the ebb shoal. This report provides the hydrographic conditions and changes since the July 2019 hydrographic survey of the inlet.
- Aerial Photography: The most recent aerial photography available for the monitoring area is dated January 2019. The City of Boca Raton (City) uses the aerial photography acquired by Palm Beach County.

- Sea Turtle Nesting: A summary of the required sea turtle nesting data is included. Specific Condition 5 of the USACE permit requires that the City submit sea turtle nesting data to the U.S. Fish and Wildlife Service (FWS) and the Florida Fish and Wildlife Conservation Commission (FWC).

2. Overview

The Boca Raton Inlet Sand Bypassing project consists of the ongoing maintenance dredging of the Boca Raton Inlet Channel. The City owns and operates a 10-inch cutter suction-head dredge to bypass sand from the inlet channel to the downdrift beaches and has been performing this bypassing since 1972. The dredge removes material within the permitted area where dredging is necessary. The dredge captain takes depth soundings within the inlet channel and assesses which areas are experiencing deposition of sand and potential shoaling. The dredge discharges sand through a pipe on the dry beach landward of the mean high water (MHW) line, and the material is placed on the downdrift beach within the first 500 feet south of the south jetty. The placed sand has been consistently observed (qualitatively) to be beach compatible.

Based on the 1992 Inlet Management Plan (adopted in 1997), the City's annualized bypassing objective was 71,300 cubic yards per year (cy/yr). In 2004, the bypassing objective was increased to 83,000 cy/yr in the adopted 2008 Strategic Beach Management Plan update, based on an updated sediment budget for the inlet. This project allows the City to meet a portion of the annualized bypassing goal of 83,000 cy/yr. This bypassing objective is achieved through a combination of maintenance dredging using the City-owned dredge (this project) and periodic nourishment of the downdrift beaches (South Boca Raton Beach Maintenance Project, FDEP Permit No. 0182699-001-JC / USACE Permit No. SAJ-1994-01196), using the inlet ebb shoal.

3. Dredge Volumes

The City maintains daily records of the dredge activity. Volumes are based on Hobbs meter readings recording the hours dredged. The City uses these records to estimate the overall bypassed volume based on a production rate of 150 cubic yards per hour (cy/hr). Table 1 provides a monthly summary of bypassed volumes between July 2019 and June 2020. From July 2019 through June 2020, the City has bypassed 75,900 cy of sand from the inlet channel to the downdrift beaches. The estimated monthly inlet maintenance dredging quantities provided in Table 1 show periods of lesser dredging activity in August 2019, and March and April 2020, as compared to quantities observed throughout the monitoring period. In August 2019, dredging activity ceased due to maintenance and repair of the cutter dredge as well as storm-readiness preparations for Hurricane Dorian. As a response to COVID-19, the City shut down in mid-March 2020, halting dredging operations through mid-April 2020. Dredging activity restarted upon the City's assessment and implementation of safe work procedures surrounding COVID-19.

The City maintains daily records of the dredge location with respect to the City's dredge map/grid (Figure 1). Figure 1 also shows the estimated volumes dredged from each grid cell from July 2019 through June 2020. The estimates are based on the daily records of the dredge quantity

and number of grid cells dredged and are calculated by equally dividing the daily dredge volume among the cells dredged for that day. Since July 2019, material has been dredged from Grid Rows 13 through 24, with approximately 48 percent of the material dredged from Grid Rows 16 through 20, which are adjacent to the inland side of the apex of the turn in the channel.

Table 1. Monthly Inlet Maintenance Dredge Bypassing Volumes

Date	Estimated Dredged Volume (cy)
July 2019	4,050
August 2019	0
September 2019	6,150
October 2019	5,250
November 2019	5,100
December 2019	9,300
January 2020	10,350
February 2020	10,200
March 2020	3,000
April 2020	1,800
May 2020	12,750
June 2020	7,950
Total	75,900

Table 2 provides a summary of bypassed volumes since July 2004, when the bypassing goal was increased. The table also provides the relevant periodic dredging events of the ebb shoal. The calculations regarding the annualization of the periodic ebb shoal dredging events are detailed in the footnotes of Table 2. The planned renourishment interval for the South Boca Raton Beach Maintenance Project is 6 years. The City uses this renourishment interval to plan for future ebb shoal dredging events. The next ebb shoal dredging event is scheduled to occur during the 2022/23 dredging window (City of Boca Raton, 2020); thus, the anticipated annualized beach placement for the March 2017 project, which placed 134,100 cy, is 22,350 cy/yr (134,100 cy divided by 6 years).

The total amount of sand bypassed to the downdrift beaches is determined by adding the estimated inlet bypassing to the annualized periodic ebb shoal dredging events (Table 2). The City bypassed an annualized 98,250 cy for the time period July 2019 through June 2020, taking into account the 2017 ebb shoal dredging event. Since July 2004, the City has attained an average annualized total bypassing rate of 96,790 cy/yr and has placed a cumulative total of 1,548,550 cy of sand since July 2004. The City continues to meet the annualized bypassing objective of 83,000 cy/yr.

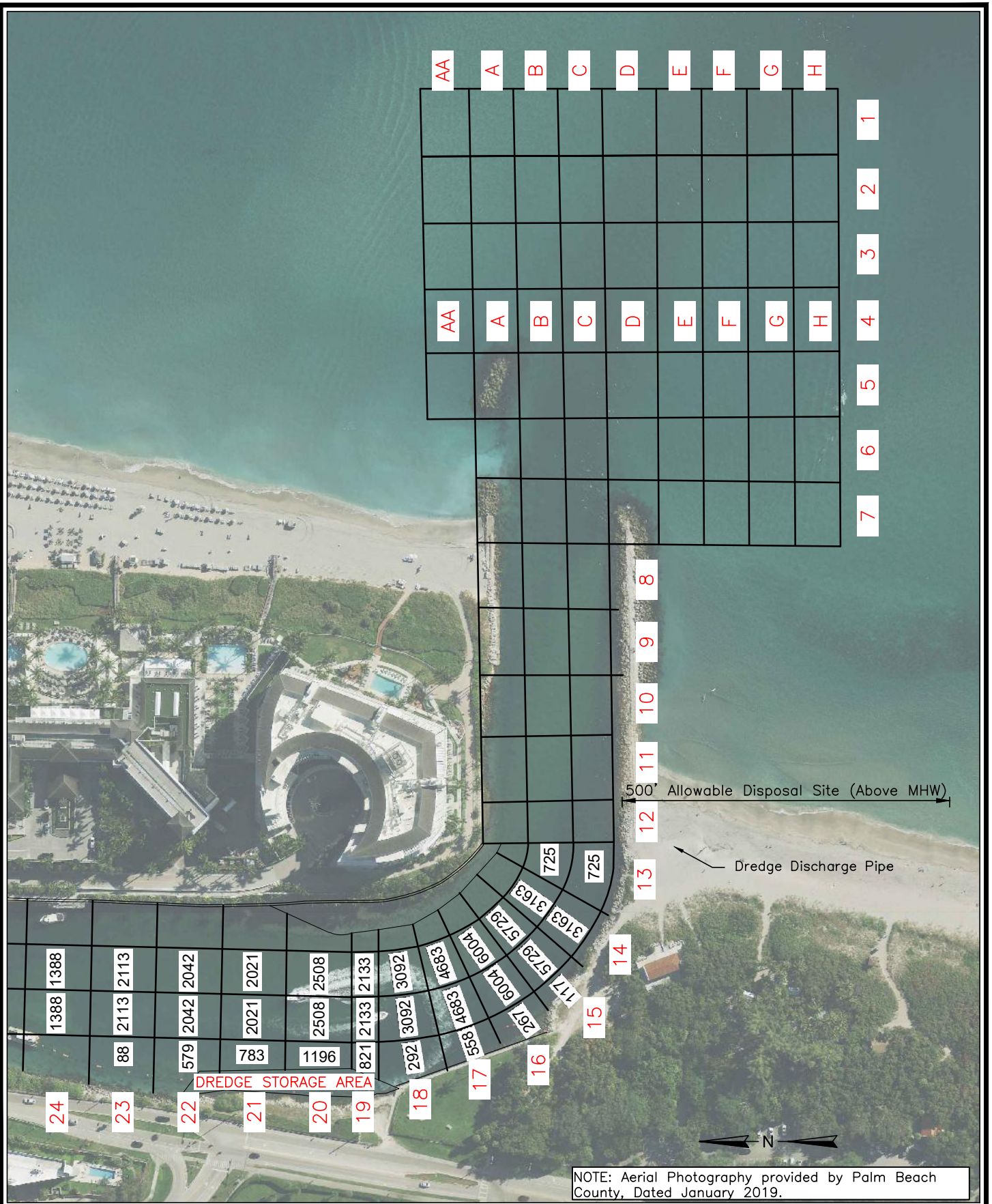


Table 2. Annualized Total Bypassed Volumes.

Time Period	Estimated Inlet Maintenance Bypassed Quantity (cy/yr)	Periodic Dredging of Ebb Shoal (cy)	Annualized Periodic Dredging of Ebb Shoal (cy/yr)¹	Total Bypassed to Downdrift Beaches (cy/yr)
July 2004 to June 2005	65,090		43,810	108,900
July 2005 to June 2006	45,970		43,810	89,780
July 2006 to June 2007	59,170		43,810	102,980
July 2007 to June 2008	68,720		43,810	112,530
July 2008 to June 2009	67,740		43,810	111,550
July 2009 to June 2010	60,560	183,800	45,360	105,920
July 2010 to June 2011	52,400		49,140	101,540
July 2011 to June 2012	46,730		49,140	95,870
July 2012 to June 2013	39,150		49,140	88,290
July 2013 to June 2014	47,760	168,900	50,280	98,040
July 2014 to June 2015	30,250		51,180	81,430
July 2015 to June 2016	58,280		51,180	109,460
July 2016 to June 2017	62,250	134,100	43,830	106,080
July 2017 to June 2018	40,650		22,350	63,000
July 2018 to June 2019	52,580		22,350	74,930
July 2019 to June 2020 ²	75,900		22,350	98,250
Subtotals (cy)	873,200		675,350	1,548,550
Annualized Sub-Averages (cy/yr)	54,580		42,210	
Average Annualized Bypassed ³ (cy/yr)	96,790			

Notes:

- 1) Refer to the 2017 Annual Physical Monitoring Report (ATM 2017) for details regarding calculations of the annualization of periodic dredging of ebb shoal events.
- 2) The anticipated renourishment interval for the March 2017 project is 6 years; thus, the anticipated Annualized Periodic Dredging of the Ebb Shoal for July 2019 to June 2020 is 22,350 cy/yr (134,100 cy / 6 years).
- 3) July 2004 is the basis for the average annualized bypassed rate.

The Central Boca Raton Beach Maintenance Project adjacent to the inlet and the passing of major storms and hurricanes affect the inlet and ebb shoal system. The Central Boca Raton Beach Maintenance Project places sand on the beaches adjacent to the northern jetty. The placement of sand within the Central Boca Raton Beach Maintenance Project occurred in 2004, 2006 and 2017. The 2006 project was a hurricane repair project back-passing sand from the ebb shoal onto the updrift beaches due to the impacts of Hurricanes Frances and Jeanne (2004). This project nourishment event placed on the order of 500,000 cy of sand along 7,900 feet of beach immediately adjacent to the north side of the inlet. As a result of alongshore spreading and littoral

drift, the constructed beach provides an influx of sand into the inlet channel and ebb shoal. The rate of littoral transport is variable on physical factors (beach width, jetty weir, etc.) and natural wave conditions (seasonal wave fluctuations, storms, etc.). Overall, there is anecdotal correlation to the Central Boca Raton Beach placement events to the amount of material the City dredges from the inlet channel and bypasses to the downdrift shoreline as part of this project. That is, this project continually feeds sand to the inlet channel and ebb shoal throughout the lifespan of the project, albeit at a decreasing rate. Thus, it is anticipated that, for a short time span following Central Boca Raton Beach placement events, the City's dredge is able to dredge larger volumes from the inlet channel. As the sand supply decreases from the Central Boca Raton Beach placement event, there is a reduction in material available in the inlet channel to bypass to the downdrift beaches.

In the time period since 2004, major storms and hurricanes, including but not limited to, Hurricanes Frances and Jeanne (2004), Hurricane Sandy (2012), Hurricane Matthew (2016), Hurricane Irma (2017) and Hurricane Dorian (2019), impacted the City of Boca Raton's shoreline. The variability of these storms results in impacts to the inlet and ebb shoal from elevated tides and increased wave energy. Like the Central Boca Raton Beach Project, the passing of storms and their impacts are anecdotally correlated to the City's dredge bypassing quantities.

The morphological dynamics of the inlet channel and ebb shoal system result in variability of the amount of material available for bypassing. In addition, the bypassing operations are primarily dependent on the deposition rate of material within the inlet channel. Although the City exceeded the bypassing goal during this monitoring period, this variability may impair the City's ability to meet the bypassing goal for future monitoring periods in absolute terms.

4. Hydrographic Survey

Applied Technology and Management, Inc. (ATM) conducted a survey of the inlet channel and dredge grid on June 18, 2020. The survey was conducted in accordance with the FDEP-approved Physical Monitoring Plan for this project (ATM, 2009) and FDEP's *Monitoring Standards for Beach Erosion Control Projects* (FDEP, 2014), as appropriate. Based on the bathymetric contours for the project area (Figure 2), the water depths are generally 10 to 14 feet referenced to the North American Vertical Datum of 1988 (NAVD88) in the inlet channel. Some areas in the channel inside the inlet (Figure 2a) are as deep as 22 feet NAVD88 in discrete areas; however, the controlling depth of the inlet channel inside the jetties is 10 feet NAVD88 along the northeast-eastern side of the inlet channel and in the area adjacent to the southern jetty, and 12 feet NAVD88 along the southwest-western side of the inlet channel and in the area adjacent to the northern jetty. In comparison with last year's physical monitoring report (ATM 2019), the controlling depth of the channel inside the jetties is no longer uniform throughout the inlet channel at 12 feet NAVD88, and is instead divided into two distinct sections at 10 ft NAVD88 and 12 ft NAVD88. The position of the thalweg is generally along the center of the channel, except at the bend. At the bend in the channel, the thalweg is not along the center of the channel but closer to the southwest bank. Overall, the position of the inlet channel's thalweg is consistent with anticipated fluvial dynamics and does not show any areas of abnormal shoaling.



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Figure 2b
Hydrographic Survey (June 2020).

Compared to last year's physical monitoring report (ATM 2019), the channel that once existed at a depth of 12 ft NAVD88 within the ebb shoal has spread uniformly throughout the ebb shoal at a controlling depth of 8 ft NAVD88. The June 2020 survey shows depths across the shoal ranging from 8 to 22 feet NAVD88.

Figure 3 shows the changes in the bathymetry since the last survey (July 2019). The inlet channel has generally experienced areas of deposition, with minimal areas of deepening for this monitoring period (Figure 3a). The areas of deposition are discrete and, in some areas, contribute up to 7 feet of accumulation since July 2019; however, they are located primarily from the bend of the inlet channel to the A1A bridge, where dredging activity predominantly occurs. Material deposition appears to be the greatest along the southwestern side of the bend. In general, the depth in this area ranges from approximately 10 to 16 feet NAVD88. The areas of deepening are also discrete and are generally located along the inlet channel boundaries. Overall, bathymetric changes to the inlet channel have contributed to controlling depths of 10 and 12 feet NAVD88 for the June 2020 survey compared to a controlling depth of 12 feet NAVD88 in July 2019.

In Figure 3b, the area dredged as part of the South Boca Raton Project continues to experience depositions of up to 4 to 5 feet in the waters adjacent to the inlet entrance (region of dark blue). Compared to the July 2019 survey, where deposition within the ebb shoal occurred offshore from the inlet entrance, the June 2020 survey recorded deepening of the ebb shoal in the same area (region of dark red). The controlling depth of the ebb shoal is approximately 8 feet NAVD88. According to the June 2020 survey, no distinct channel exists within the ebb shoal. The channel that was present during the previous monitoring period has spread uniformly at a depth of 8 feet NAVD88 throughout the ebb shoal. It is anticipated that the ebb shoal will continue to experience deposition and should be closely monitored for safe ingress and egress of vessels in the next monitoring period.

Survey data and PDF copies of the deliverables are provided as electronic attachments to this report.

5. Aerial Photography

The figures in this report use the January 2019 aerial photography acquired by Palm Beach County. The aerial images show conditions that are consistent with the survey data. These aerial images are provided as electronic attachments to this report.

6. Sea Turtle Nesting

The City performs sea turtle nesting surveys and provides the data to FWC annually. In compliance with the regulatory permits, sea turtle nesting data were collected and submitted to the regulatory agencies. Table 3 [Table 19 of the FWS Statewide Programmatic Biological Opinion (SPBO)] provides project data and nesting data that were provided to FWC on December 26, 2019 for the Statewide Nesting Beach Survey (SNBS) database.

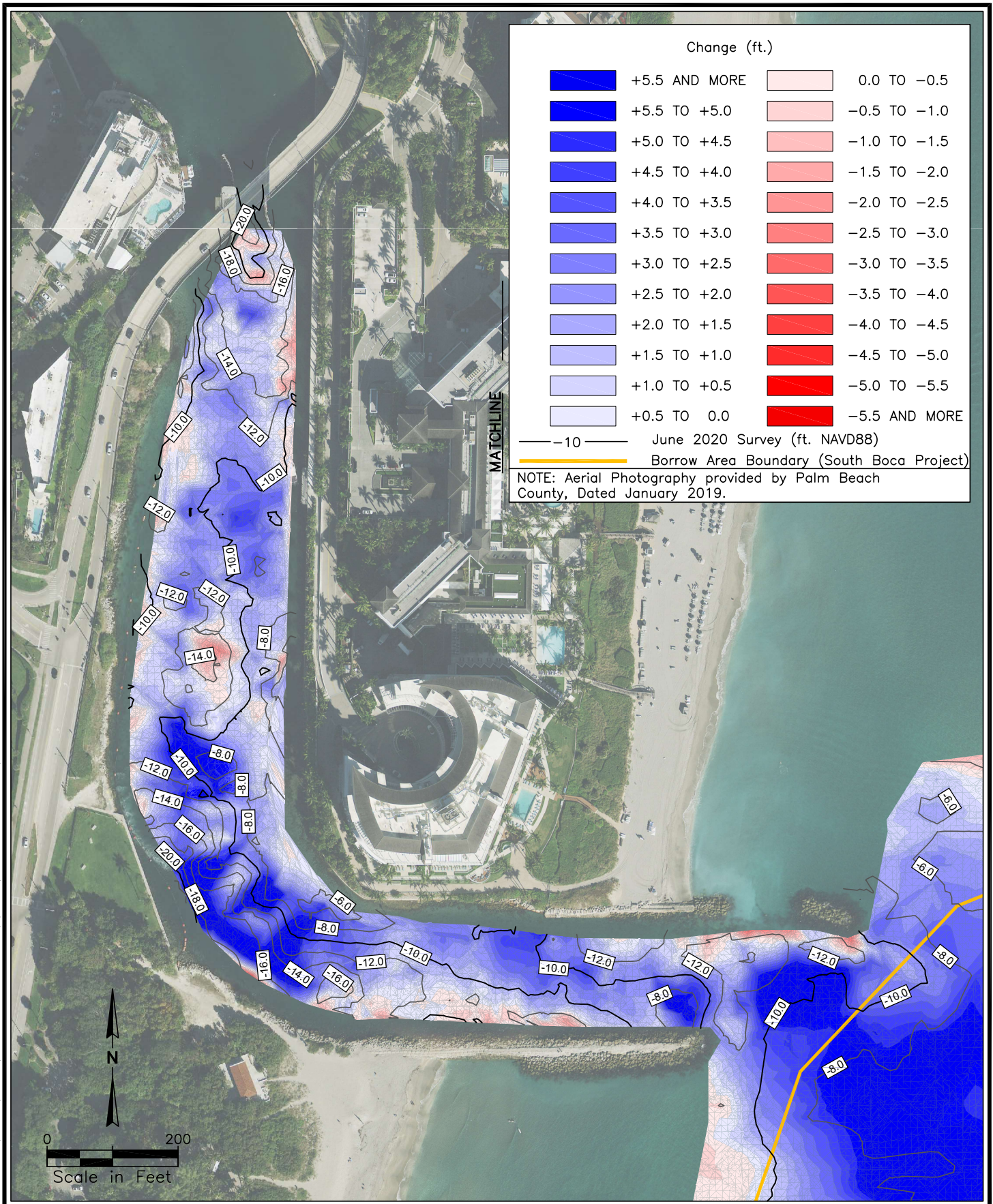


Figure 3a
 Bathymetric Changes (July 2019 to June 2020).

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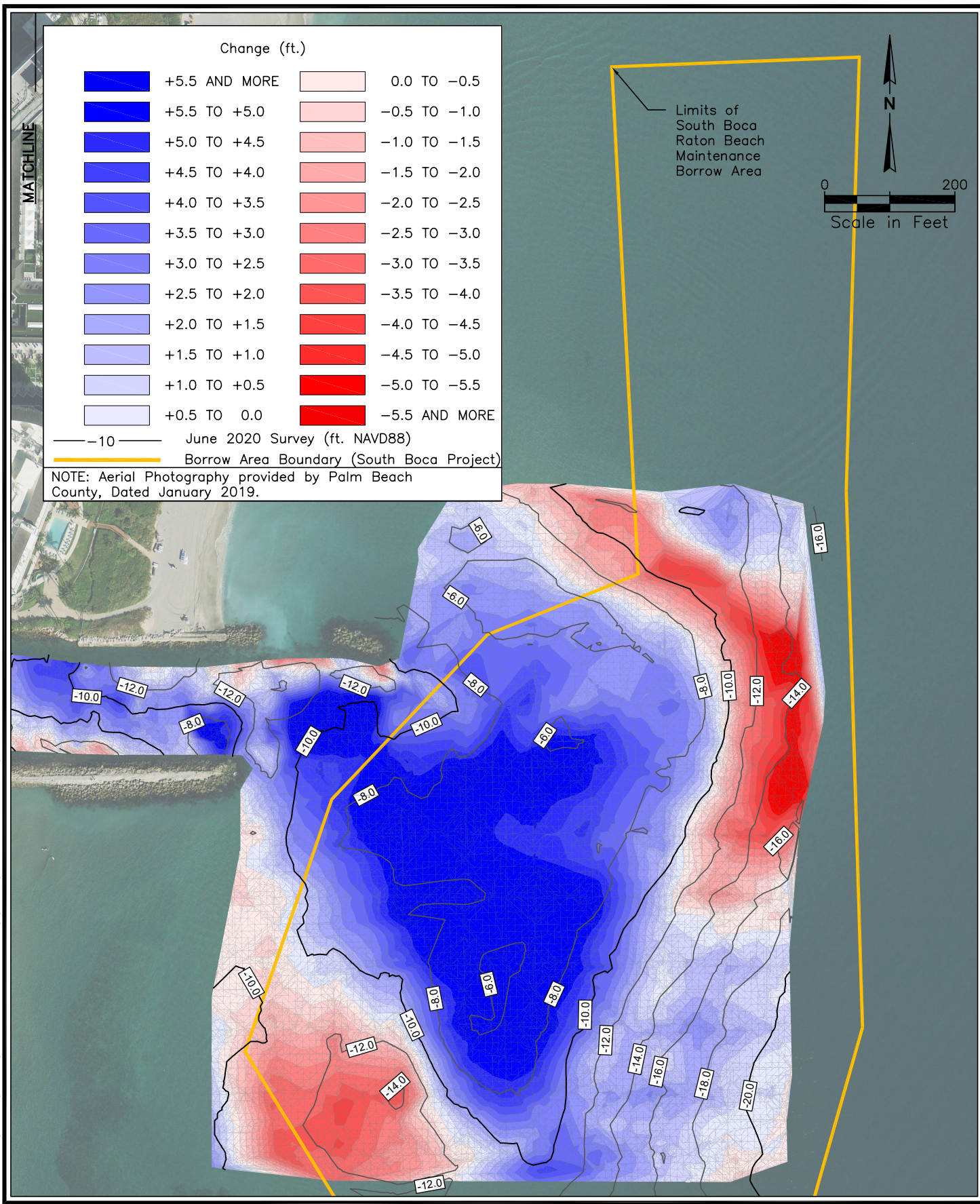


Figure 3b
Bathymetric Changes (July 2019 to June 2020).

Table 3. Project Information (Table 19 of the U.S. FWS SPBO)

Item	Project Information
Project location (include Florida DEP R monuments and latitude and longitude coordinates)	500 feet of shoreline adjacent to the south jetty of Boca Raton Inlet (R-223, 26.338°N, 80.071°S)
Project description (include linear feet of beach, actual fill template, access points, and borrow areas)	Conduct sand bypassing operations dredging sand from Boca Raton Inlet and placing it above MHW along the beach within 500 feet of the inlet's south jetty.
Dates of actual construction activities	Between sunrise and sunset as needed, year-round.
Names and qualifications of personnel involved in sea turtle nesting surveys and relocation activities (separate the nests surveys for nourished and non-nourished areas)	Kirt Rusenko, Ph.D., Marine Conservationist, Marine Turtle Permit Holder
Descriptions and locations of self-release beach sites	Red Reef Park. This is a City of Boca Raton ocean park approximately 2 miles north of the inlet with minimal, code-compliant lighting.
Sand compaction, escarpment formation, and lighting survey results by project shall be reported as listed in the Terms and Conditions by December 31 to the FWC and appropriate Service Field Office (Table 3)	The USACE-issued permit (SAJ-2002-08890 (IP-LCK) specifies only Reasonable and Prudent Measures and Term and Conditions A1, A2, A22 and A23 apply to this project. Thus, sand compaction, escarpment formation, and lighting survey data are not required due to the nature of this project.

7. Summary

Based on the dredge records and survey data collected for this monitoring period, the following conclusions and recommendations are offered.

- The inlet maintenance dredging bypassed approximately 75,900 cy of sand to the downdrift beaches within 500 feet of the jetty from July 2019 through June 2020.
- The annualized bypassing for this monitoring period (July 2019 through June 2020) is 98,250 cy.
- Since July 2004, the City has bypassed an annualized average of 96,790 cy/yr, taking into account the South Boca Raton Beach Maintenance Project placements. The City continues to meet the bypassing goal based on long-term records.
- The bypassed material has been observed to be beach-compatible sand.
- Based on hydrographic survey data, the controlling depth of the inlet channel is generally 10 and 12 feet NAVD88 (approximately 12 and 14 feet MLLW), with each depth favoring one side of the inlet channel.

- In comparison with last year's physical monitoring report (ATM, 2019), the channel that once existed at a depth of 12 ft NAVD88 within the ebb shoal has spread uniformly throughout the ebb shoal at a controlling depth of 8 ft NAVD88.
- It is anticipated that the ebb shoal will continue to experience deposition and should be closely monitored in the next monitoring period.

8. References

ATM, 2009. Physical Monitoring Plan, Boca Raton Inlet Sand Bypassing. West Palm Beach, FL.

ATM, 2017. 2017 Annual Physical Monitoring Report, Boca Raton Inlet, Sand Bypassing. West Palm Beach, FL.

ATM, 2019. 2019 Annual Physical Monitoring Report, Boca Raton Inlet, Sand Bypassing. West Palm Beach, FL.

City of Boca Raton, 2020. South Boca Raton Beach Maintenance Program, FY2021/22 Local Government Funding Request, Beach Projects Application. Boca Raton, FL. (In Progress)

FDEP, 2014. Monitoring Standards for Beach Erosion Control Projects. Division of Water Resource Management, Department of Environmental Protection, State of Florida. Tallahassee, FL.