

Strategic Beach Management Plan:
Southeast Atlantic Coast Region
Division of Water Resource Management
Florida Department of Environmental Protection
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Phipps Ocean Park Beach Nourishment Project being constructed in January 2016. Photo courtesy of the Town of Palm Beach.

INTRODUCTION - SOUTHEAST

The **Southeast Atlantic Coast Region** has a total of 91.1 miles of beaches of which, 71.9 miles are critically eroded and 47.9 miles are actively managed. There are also 10 inlets within the Southeast Atlantic Region and 7 of those inlets have an [inlet management plan](#). For additional beach management or project information, see the current [Critically Eroded Beaches Report](#), the [joint coastal permits](#) by County or the [local government funding requests](#) by County. Each subregion listed below will have the introductory paragraph listing miles of coastline and erosional events/ storms that have affected the subregion.

Each title within the subregion will list the coastal location, the County and the Department of Environmental Protection (Department or DEP) reference or range (R) monuments for the critical erosion area. For inlets, river entrances or passes; the title, the County and the adjacent range survey markers will be stated. In addition, there will be a subregion map highlighting the critical erosion areas and the managed project areas. Finally, references to coastal reports will also be listed at the end of each subregion.

For more specific information concerning projects or strategies along Florida's coastline, see the following links for the other six coastal regions of Florida and for background information, see the Strategic Beach Management Plan's Introduction.

[Strategic Beach Management Plan's Introduction](#)

[Northeast Atlantic Coast Region](#)

[Central Atlantic Coast Region](#)

[Florida Keys Region](#)

[Southwest Gulf Coast Region](#)

[Big Bend Gulf Coast Region](#)

[Panhandle Gulf Coast Region](#)

For additional information pertaining to beach and ocean conditions, coastal associations, educational institutions or government agencies, see the following [related coastal sites](#).

The state of Florida was significantly impacted by three hurricanes, Hermine, Matthew and Irma during the 2016 and 2017 Atlantic Hurricane Seasons. To see additional information for strategies and funding to address recovery for the beaches and dunes, see the "[Hurricane Damage Assessment Report for 2016: Florida's Beaches and Dunes](#)". For the 2017 Hurricane season, see the "[Hurricane Irma Post-Storm Beach Conditions and Coastal Impact in Florida](#)" report. The post-storm survey data has been fully

analyzed and an updated list of critically eroded beaches is in the Critically Eroded Beaches Report.

NORTHERN PALM BEACHES

There are 13.3 miles of beaches in the **Northern Palm Beaches** subregion, which extends from just north of the Martin-Palm Beach county line to Riviera Beach (R70) on Singer Island in Palm Beach County, as shown on Figure 1. There are 8.4 miles of critically eroded beaches in this subregion, of which 3.5 miles have been restored and maintained.

Erosion is attributed to frequent northeasters, occasional tropical storms and hurricanes, and the effects of Jupiter Inlet. The most erosive storms occurring in past years were Hurricane David (1979), the Thanksgiving Day Northeaster (1984), Hurricane Irene (1999), Hurricane Frances (2004), Hurricane Jeanne (2004), Hurricane Wilma (2005), Subtropical Storm Andrea (2007), October 2007 northeasters, Hurricane Noel (2007), Tropical Storm Fay (2008), Hurricane Sandy (2012), Hurricane Matthew (2016) and Hurricane Irma (2017).

STRATEGIES FOR INLETS AND CRITICALLY ERODED BEACHES

BLOWING ROCKS BEACH, MARTIN COUNTY, R126-R127.4

This is a 0.2-mile segment of critically eroded beach on southern Jupiter Island, south of the Blowing Rocks Preserve public access in Martin County, where private development is threatened. Anastasia formation creates an exposed rock headland within the Preserve. The area south of the Preserve is subject to dynamic erosion and accretion cycles on the downdrift side of the rock headland. In response to the 2004 hurricanes, a dune restoration project was constructed in 2008. Hurricane Sandy in 2012 caused erosion to the dunes and repairs to the dune were necessary. The dune work was completed in November of 2012 with placing approximately 8,600 cubic yards (cy) that restored 1,100 ft of dune between R126-R127. In addition, roughly 200 cy of sand was placed within the seaward edge of the dune along each of the nine properties in that area. The upper limits of the dune were re-vegetated with sea oats. The Town is planning to re-construct the dune at Blowing Rocks beach between R126 and R127.4 in 2018/2019.

Strategy: Maintain dune project and monitor.

CORAL COVE PARK, TEQUESTA, AND JUPITER INLET COLONY, PALM BEACH COUNTY, R1-R10

This is a 1.5-mile segment of critically eroded beach on southern Jupiter Island in Palm Beach County. It includes the communities of Tequesta and Jupiter Inlet Colony. A dune restoration project was completed within the boundaries of Coral Cove Park in 1989. Another dune restoration project was completed in Coral Cove Park (R5-R7.6) in 1993, using sand trucked to the site from an upland source. Armoring has been constructed along private development in Tequesta. This area was severely impacted by Hurricanes Frances and Jeanne in 2004. Following the 2004 hurricane season, emergency protective berms were constructed in 2005 using funds from FEMA and again in 2012 using state and local funds after the passage of Hurricane Sandy. A dune restoration project was completed in 2014 placing approximately 25,926 cy of material on the dune. The next dune project is scheduled for 2018/2019.

Strategy: Maintain dune project and monitor.

JUPITER INLET, PALM BEACH COUNTY, R12-R13

Jupiter Inlet is maintained by the Jupiter Inlet District. The 0.8 miles of inlet shoreline to the north and south of Jupiter Inlet have been designated as critically eroded inlet shoreline. The sediment impoundment basin located within the navigation channel is routinely dredged to a depth of -20 ft NGVD and the sand placed on the downdrift beach south of the inlet. The placement area (R12 – R19) is within the same template as the Jupiter-Carlin project limits. The Department adopted the [Jupiter Inlet Management Study Implementation Plan](#) in October 1997 that established an annualized bypassing objective of 75,000 cy. In 1999, the crests of both north and south jetties were raised, the south jetty was extended seaward, and the sediment impoundment basin was expanded as recommended in the adopted plan. Learn more about [Jupiter Inlet District projects](#) and history.

Strategy: Bypass sediment to downdrift beaches to meet an annualized bypassing objective of 75,000 cy; continue a physical monitoring program and, based on the results, update the sediment budget and then update inlet management plan.

JUPITER-CARLIN, PALM BEACH COUNTY, R13-R19

This is a 1.1-mile segment of critically eroded beach between Jupiter Beach Park and Carlin Park that is partially in the area of influence of Jupiter Inlet. The federal General Design Memorandum was

approved in 1994, and the project history for this segment of shoreline is described in Table 1. Construction of the federally authorized **Jupiter-Carlin Shore Protection Project** (R13.5-R19) was completed using sand from the ebb tidal shoal of Jupiter Inlet in April 1995. The project is authorized until 2039. The local sponsor is Palm Beach County. The project design consists of a beach berm at elevation +7.5 ft NAVD that constitutes seven years of advance nourishment to protect the existing dune and upland development. The project included construction of 3.5 acres of artificial reef to mitigate for adverse impacts to ephemerally exposed nearshore hardbottom. The project generally met its performance goal of protecting the dune and upland property, except in the Jupiter Beach Park, which experienced severe erosion. After the 1995 restoration project, periodic placement of sand in the area coincided with maintenance dredging of Jupiter Inlet and the Intracoastal Waterway. Jupiter Inlet District completed a 175 ft extension to the south jetty in 1998, possibly contributing to the migration of the erosion hotspot from Jupiter Beach Park south to Ocean Trail Condominium. The north jetty height and width were also increased. Beach nourishment was completed in March 2002, using sand from an offshore borrow site. A study to evaluate alternatives to address the erosional hotspot at Jupiter Beach Park was finalized in 2007. Dune restoration was completed in December of 2007 between R13-R17 to address damage from Subtropical Storm Andrea. The County completed a large-scale, non-federal dune maintenance project in January 2012, using 41,145 cy from an upland sand source. A dune maintenance project was completed in January 2013 to replace approximately 6,100 cy lost during Hurricane Sandy. Prior to the next federal nourishment, a federal Section 934 report was required to evaluate economic feasibility of the project and approval is expected in April 2018.

The project received Flood Control and Coastal Emergencies (FCCE) funding to repair damages sustained during Hurricane Sandy. In conjunction with the federal repair project that placed approximately 132,638 cy of sand, the local sponsor conducted a supplemental local project that placed approximately 282,084 cy from an upland sand source. Construction of the federal project began in February 2014 but was delayed until winter. The federal project was completed in January 2015 and the local project was completed in March 2015. Together the two projects placed a total volume of 423,084 cy on the beach. Additional dredged material from the inlet sand trap was placed on the beach totaling 45,300 cy. The Intracoastal Waterway and inlet sand trap were dredged again in 2017, placing a total of 164,931 cy on the beach. The Department recently issued a major permit modification in 2018 to the Jupiter Carlin Beach Nourishment project to incorporate dune restoration between R19 and R26, and to include the Juno Beach Nourishment Project under one authorization. The project will be referred to as the North Palm Beach County Comprehensive Shore Protection Project. The next beach nourishment is scheduled for 2018/2019.

Table 1. Jupiter-Carlin Shore Protection Project history

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
April 1995	604,000	Ebb Tidal Shoal	R13-R19	1.05
1995	2,000	Sand Transfer – trucked from R75	R13-R13.5 and R18-R18.5	0.3
March 2002	625,000	Offshore	R13-R19	1.05
January 2012	41,145	Upland	R13-R19	1.05
January 2013	6,100	Upland	Between R13-R19	0.4
January 2014	4,000	Offshore	Between R13-R19	0.4
January 2015	141,000	Offshore	R13-R15.5	0.4
March 2015	282,084	Upland	R15.5-R19	0.7
April 2015	45,300	Inlet Sand Trap	R13-R15.5	0.4
March 2017	102,068	AIWW	R14-R16.5	0.4
March 2017	62,863	Inlet Sand Trap	R14-R16.5	0.4

Strategy: Maintain the project through monitoring and nourishment.

TOWN OF JUPITER, PALM BEACH COUNTY, R19-R26

This is a 1.5-mile segment of critically eroded beach that is partially within the area of influence of Jupiter Inlet. No projects have been conducted in this segment of critically eroded beach. Nourishment projects at Jupiter/Carlin have provided a degree of stability to the shoreline in this segment through longshore transport of fill. Despite this influence, the shoreline in this segment has continued to retreat. During a period of high seas in 2015, multiple dune cross-overs were damaged or destroyed and the dunes were severely impacted, increasing the vulnerability of the hurricane evacuation route State Road A1A. The County placed approximately 3,530 cy of sand from an upland sand source in February 2016 to restore the dune from 230 ft north of R20 to 300 ft north of R 21 to increase storm protection to upland infrastructure. The Department recently issued a major permit modification in 2018 to the Jupiter Carlin Beach Nourishment project to incorporate dune restoration between R19 and R26, and to include

the Juno Beach Nourishment Project under one authorization. The project will be referred to as the North Palm Beach County Comprehensive Shore Protection Project.

Strategy: Monitor; conduct dune restoration.

JUNO BEACH, PALM BEACH COUNTY, R26-R38

This is a 2.4-mile segment of critically eroded beach. The project history for this segment of shoreline is described in Table 2 and the local sponsor is Palm Beach County. Initial construction of the **Juno Beach Nourishment Project** (R26-R38) was completed in 2001 using 1,500,000 cy of sand obtained from an offshore borrow area. The project restored the beach berm at +9 ft NGVD and provided additional fill material equivalent to six years' advance nourishment. A physical and environmental monitoring program was also required. The first nourishment for this segment was completed in April of 2010 with 916,192 cy of sand from an offshore borrow area.

The project initially required construction of 4.47 acres of artificial reef to mitigate for adverse impacts to 3.77 acres of nearshore hardbottom. Construction of the mitigation was completed in 2002. Post-construction aerial photography showed unanticipated coverage of hardbottom. The county proposed to construct an additional 0.75 acres within a permitted nearshore placement area near Singer Island to mitigate for the unintended impacts. Limestone rock boulders and experimental pre-fabricated reef modules were used in the reef design. The secondary impact mitigation was completed in 2011. The current permitted beach berm elevation is +7.5 feet NAVD, with a typical berm width of 200 feet. The next nourishment is scheduled for 2017. The Department recently issued a major permit modification in 2018 to the Jupiter Carlin Beach Nourishment project to incorporate dune restoration between R19 and R26, and to include the Juno Beach Nourishment Project under one authorization. The project will be referred to as the North Palm Beach County Comprehensive Shore Protection Project.

Table 2. Juno Beach Nourishment Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
March 2001	1,500,000	Offshore Borrow Site	R26-R38	2.4
April 2010	916,192	Offshore Borrow Site	R26-R38	2.4

Strategy: Maintain the project through monitoring and nourishment.

SINGER ISLAND, PALM BEACH COUNTY, R60.5-R69

This is a 1.7-mile segment of critically eroded beach on Singer Island, and the project history for this segment of shoreline is described in Table 3. The local sponsor is Palm Beach County. A large rock outcrop (R-67) influences littoral sand transport and the width of the beach at Ocean Reef Park (R67-R68). North of the rock outcrop, erosion of the dune bluff threatens upland structures. Beginning in 2000, the county placed sand along the eroded dune bluff to protect upland structures. The Department and the county initiated the first phase of a feasibility study of coastal erosion control structures in March 2001. Preliminary findings were inconclusive. An additional feasibility study was concluded in 2005, recommending the placement of beach erosion control structures. The county began permitting activities to construct 14 offshore breakwaters between R61-R68 in 2006. The project was modified to 11 breakwaters due to concerns of downdrift impacts. The breakwater design did not receive favorable approval by regulatory agencies. An alternatives analysis was completed in July of 2010 and a submerged breakwater design was proposed. The project was permitted by the Department, but was not pursued by the county. Since 2013, seven upland properties have constructed seawalls to armor approximately 2,300 linear feet. A dune restoration project for a new segment was authorized under a CCCL permit in 2015. The truck haul project was completed in April 2016 placing approximately 11,822 cy of sand.

Table 3. Dune maintenance events in Singer Island.

YEAR	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
2000-2001	10,000	Upland	R60.5 to R69	1.7
2003-2004	13,000	Upland	R60.5 to R69	1.7
2004-2005	56,000	Upland	R60.5 to R69	1.7
2005-2006	30,000	Upland	R60.6 to R63.5	0.5
2006-2007	49,338	Upland	R60.5 to R65.5	1.0
2007 Emergency Placement	49,955	Upland	R60.5 to R65.5	1.0
2007-2008	50,697	Upland	R60.5 to R65.5	1.0
2010-2011	30,313	Upland	R60.5 to R65.5	1.0
2012-2013	55,581	Upland	R60.5 to R65.5	1.0

YEAR	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
2014-2015	46,803	Upland	R60.5 to R65.5	1.0
2015-2016	11,822	Upland	R65.5 to R66.8	0.3

Strategy: Maintain the dune project and monitor; reevaluate beach erosion control alternatives.

REGIONAL STRATEGIES FOR BEACH AND INLET MANAGEMENT

SPONSORS AND FUNDING

[Palm Beach County](#), the local sponsor of both the Jupiter-Carlin Park and Juno Beach projects, constructed the Jupiter-Carlin Park project with reimbursement funding provided by the Department. Palm Beach County decided not to seek federal participation in the Juno Beach project in order to shorten the time between the planning phase and project construction. [Palm Beach County's Shoreline Protection Plan](#) dated 2014, highlights the Counties initiatives to preserve and manage their coastline. The Department also participates with [Jupiter Inlet District](#) on inlet management activities at Jupiter Inlet and with Palm Beach County on dune construction projects. Project cost estimates and schedules may be found in the [Beach Management Funding Assistance Program - Long Range Budget Plan](#).

PROJECT COORDINATION

Regionalization is the funding and coordination of multiple beach nourishment and inlet management activities to take advantage of identifiable cost savings through economies of scale, reduced equipment mobilization and demobilization costs, and elimination of duplicative administrative tasks.

Opportunities in this subregion include:

1. Coordination of maintenance dredging of Jupiter Inlet and the adjacent Atlantic Intracoastal Waterway with maintenance of the Jupiter-Carlin project.
2. Jointly soliciting bids for the nourishment of the Jupiter-Carlin Park and Juno Beach projects with other projects in the region.
3. A regional beach, inlet and offshore data collection and processing program to be used by the local sponsor for project monitoring is recommended.

ENVIRONMENTAL PROTECTION

The protection of marine turtles and hardbottom/reef habitat are the primary environmental concerns within this subregion. The projects have been designed and implemented to avoid or minimize adverse impacts to marine turtles and hardbottom and reef habitat. The timing of construction activities has been restricted during the sea turtle nesting season of March 1 through October 31. Some parts of Palm Beach County have been reporting record nesting events through 2015. Artificial reefs have been constructed as mitigation to offset adverse impacts to nearshore hardbottom caused by the Jupiter-Carlin and Juno Beach projects and are being monitored.

SAND SOURCES

Due to the fact that there are limited sand resources existing in state waters in Southeast Florida, the Department and the [United States Army Corps of Engineers](#) (USACE) completed the [Sediment Assessment and Needs Determination \(SAND\) study](#). This study was conducted in a collaborative manner and was reviewed by and vetted through all the participating stakeholders. The SAND study indicates that the regional offshore supply of sand in state and federal waters is more than adequate to meet the needs of all the beach nourishment projects in the five southeastern coastal counties, St. Lucie, Martin, Palm Beach, Broward, and Miami-Dade, for the next 50 years (year 2062), according to Ousley et al. (2014). Subsequently, the Department analyzed the need for sand over the next 10 to 20 years for the five southeastern counties and determined that approximately 20 to 30 million cy will be needed for beach nourishment projects. Due to the narrow continental shelf adjacent to Florida's southeastern shoreline, it is expected that some counties may need to look for sand resources in upland sand mines and/or offshore borrow sites in neighboring counties. Miami-Dade County has already initiated this process.

Coordination is recommended between the Department, the [USACE](#), [BOEM](#) and Local Governments to use best management practices with these offshore resources. For additional information on sand sources, the Department manages a database named the [Regional Offshore Sand Source Inventory \(ROSSI\)](#).

ADDITIONAL INFORMATION

The introduction of the state's Strategic Beach Management Plan provides additional background information on the Department's Beach Management Programs and includes overviews of:

- The principals and statutes followed to help guide the state's management strategies
- Comprehensive list of Florida's inlets
- The miles of critically eroded beaches under active management
- Statewide sand source studies
- Statewide monitoring programs
- Innovative technologies examined
- Basic suggestions for emergency response plans

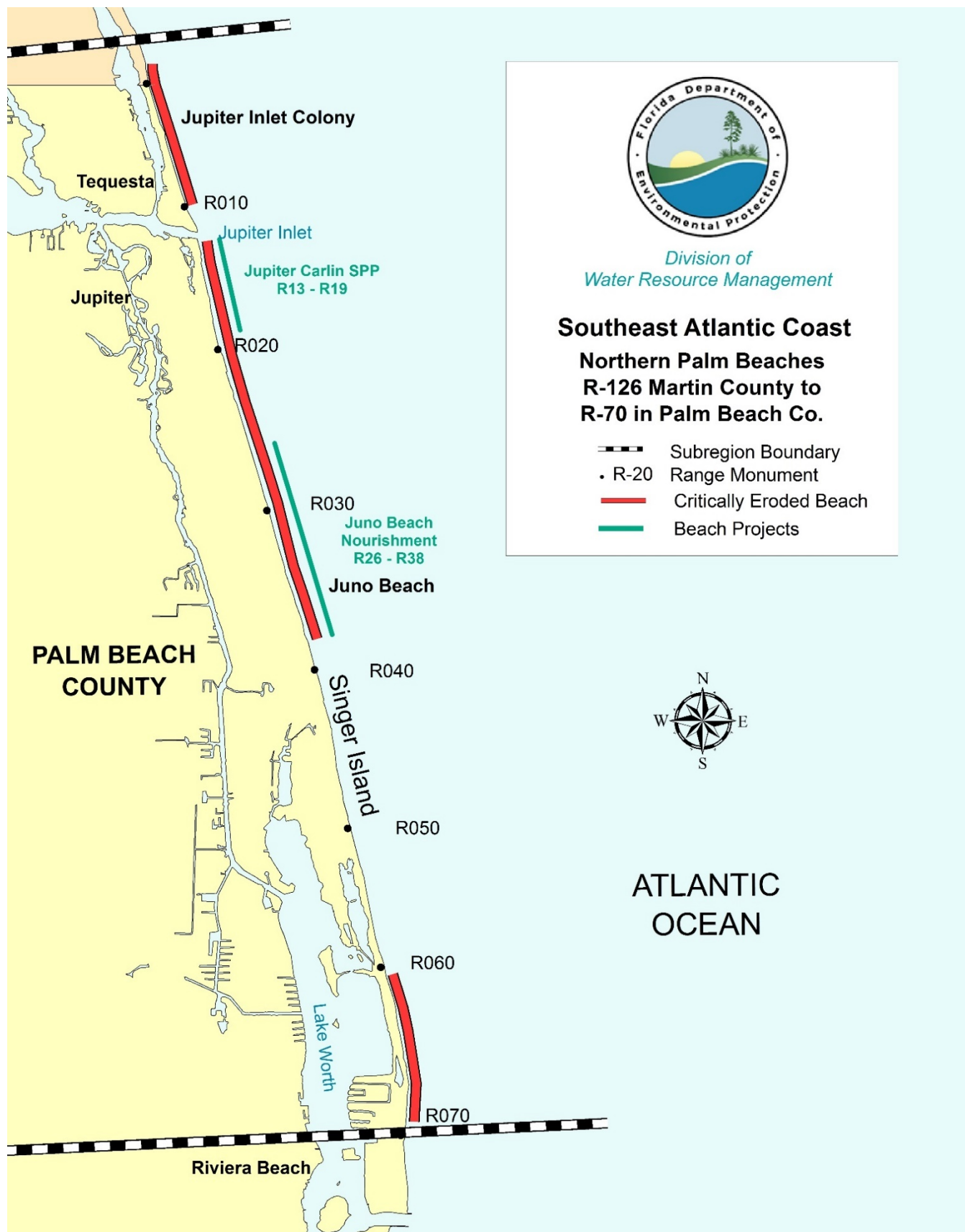


Figure 1. Map of Northern Palm Beaches subregion of the Southeast region of Florida. View an [interactive map](#) or [COASTS imagery](#).

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PALM BEACHES

There are 20.7 miles of beach in the **Palm Beaches** subregion, which extends from Palm Beach Shores (R70) on Singer Island to Gulfstream (R170) in Palm Beach County, as shown on Figure 2. There are 15.2 miles of critically eroded beaches in this subregion, of which 6.2 miles have been restored or maintained.

Erosion is attributed to frequent northeasters, occasional tropical storms and hurricanes, and the effects of Lake Worth Inlet and South Lake Worth Inlet. The most erosive storms occurring in past years were Hurricane David (1979), the Thanksgiving Day Northeaster of 1984, Hurricane Irene (1999), Hurricanes Frances (2004), Hurricane Jeanne (2004), Hurricane Wilma (2005), Subtropical Storm Andrea (2007), October northeasters (2007), Hurricane Noel (2007), Tropical Storm Fay (2008), Hurricane Sandy (2012), Hurricane Matthew (2016) and Hurricane Irma (2017).

STRATEGIES FOR INLETS AND CRITICALLY ERODED BEACHES

LAKE WORTH INLET, PALM BEACH COUNTY, R75-R76

Lake Worth Inlet, part of the federal **Palm Beach Harbor Navigation Project**, is periodically dredged to maintain a navigation channel depth of -35 ft MLLW. The channel is dredged typically every one or two years and the sand is placed either on the downdrift beach within 3,000 ft of the south jetty or in a permitted nearshore location. A sand transfer plant, maintained by the Town of Palm Beach and operated by Palm Beach County, was constructed on the north jetty in 1958 by the USACE. The USACE built a settling basin north of the north jetty between 1958 and 1968. The south jetty received repairs along with sand tightening in 1986. The sand transfer plant bypasses sand to the downdrift beach immediately south of the south jetty. The sand transfer plant continued to function until 1990 until it became inactive for 6 years due to a rusted transfer pipe. The sand transfer plant was upgraded in 1995 with a more powerful engine and pump and in May 1996 began to function again. The Department adopted the [Lake Worth Inlet Management Study Implementation Plan](#) in 1996, but a bypassing objective was not established at that time.

A sediment budget study completed in 2000 recommended bypassing an average annual volume of 202,000 cy to the downdrift beaches. This volume has been bypassed through the downdrift placement of material dredged from the navigation channel and operation of the sand transfer plant.

The USACE completed a navigation study in May 2001 that recommended sand tightening the north and south jetties, construction of a larger sediment impoundment basin, and renovation of the existing sand transfer plant to include a new motor, flood-proofing, and the southerly extension of the discharge pipeline. The study recommended that Palm Beach County design and construct the sand transfer plant with reimbursement funding from the federal government. In February 2003, design and permitting for sand tightening of the jetties was completed and the construction was completed later in 2003. The Department issued a joint coastal permit authorizing expansion of the settling basin on the north side of Lake Worth Inlet in 2006. The USACE expanded the sediment impoundment basin on the north side of the channel seaward of the north jetty in 2007. Lake Worth Inlet project activities receives regional sediment management (RSM) support by the USACE to manage the sediments in a manner that maximizes natural and economic opportunities for the coastal system. The Town of Palm Beach constructed a 3.1 acre artificial reef in 2004 to address anticipated impacts from the settling basin expansion. During the 2004 hurricane season, the sand transfer plant was damaged and became inoperable. To reestablish sediment bypassing, repair of the facility was completed in March of 2005 using FEMA emergency funds. Sand bypassing was suspended between August and December of 2009 to begin a full rehabilitation of the sand transfer plant. The rehabilitation was completed in April 2010. In October 2012, the sand transfer plant was damaged again by Hurricane Sandy and was rendered inoperable until September 2013. For 20 years or since 1996, the sand transfer plant has bypassed approximately 2.6 million cy of sand to the downdrift beaches. Palm Beach Harbor/ Lake Worth Inlet was dredged in 2016 with placement of 164,816 cy of beach quality sand between R76 and R78 and again the Palm Beach Harbor was dredged in February 2018 with placement of 237,923 cy of beach quality sand between R76 and R79.5.

Strategy: Bypass an average annual volume of 202,000 cy of sand to the downdrift beaches through a combination of the operation of the sand transfer plant and beach placement of maintenance dredge material from the federally authorized navigation channel; place all beach compatible material dredged during channel maintenance on downdrift beaches in Reach 1, in an extended beach placement in Reach 2, and when feasible, at Mid-Town and Phipps Ocean Park projects; dredging placement should be limited to dry beach; extension of the discharge pipeline to discharge points located at the south jetty, and approximately 3,600 ft south of the south jetty; comply with the Palm Beach Island Beach Management Agreement (BMA), 2013; monitor; update the sediment budget and the inlet management plan.

TOWN OF PALM BEACH, PALM BEACH COUNTY, R76-R134.4

This is a 12.2-mile segment of critically eroded beach where erosion is attributed to the effects of Lake Worth Inlet as far south as R121, approximately 50,000 ft. Most of this shoreline is armored with seawalls, bulkheads, and revetments. There are also numerous relic and functional groins. The Town of Palm Beach is the local sponsor for projects in this area. The area has been divided into eight reaches (Reaches 1 through 8). In 2001, the Palm Beach Island Feasibility Study was initiated for three areas including Reach 2, Reach 5, and Reach 8, to identify beach nourishment alternatives. Efforts underway in Reaches 2, 3, 4, 5, 7 and 8 are discussed below.

On September 26, 2013, a pilot [Beach Management Agreement \(BMA\)](#) was signed to promote regionalization and incorporate cell wide management of the Palm Beach Island. The cell on Palm Beach Island is 15.7 miles of beach and is between Lake Worth Inlet and South Lake Worth Inlet at R76 through R151. The BMA includes the Lake Worth Inlet maintenance dredging placement, the Mid-town project, Phipps Project, groin maintenance and rehabilitation, and dune work throughout the island. The BMA incorporates net ecosystem benefits such as annual hardbottom, turtle and physical monitoring throughout the cell, retrofitting and minimizing outfalls that release waters onto the coastal system, and improved inlet management practices. The BMA is a perpetual and adaptively managed agreement that is reviewed annually, with a more detailed review completed every 5 years. The Mid-Town beach nourishment project, as well as interim sand placement in Reach 7 and dune restoration in Reach 8, were constructed in 2015. The Phipps Ocean Park Beach Nourishment project, along dune restoration in Reaches 3 and 8, was constructed in 2016. To see a map and description of the different Reaches (1 through 11), see pages 6 and 7 of the BMA.

Reach 1 (R76-R78.5) is a 0.5-mile segment of critically eroded shoreline. This area is directly south of Lake Worth Inlet in the Town of Palm Beach. This project area is maintained by inlet sand bypassing. Sandy material is bypassed to this project area on an annual basis. Recent bypass activities have indicated a deficit of sandy material reaching the settling basin on the north side of Lake Worth Inlet. The Town of Palm Beach has indicated it will investigate why this sand deficit is occurring at the settling basin with goals of improving the annual bypassing objectives. Palm Beach Harbor/ Lake Worth Inlet was dredged in 2016 with placement of 164,816 cy of beach quality sand between R76 and R78 and again the Palm Beach Harbor was dredged in February 2018 with placement of 237,923 cy of beach quality sand between R76 and R79.5.

Reach 2 (R78.5-R90.4) is a 2.5-mile segment of critically eroded shoreline. This area includes the beach between Onondaga Avenue and El Mirasol in the Town of Palm Beach. The Mid-Town beach restoration project was recommended based upon studies conducted in association with the Lake Worth Inlet Management Plan to reestablish littoral transport and to mitigate the effects of the inlet. Restoration in Reach 2 has not been conducted due to the vicinity of nearshore hardbottom and lack of public access. Future beach management alternatives may include construction of a sand bypassing discharge pipe from the Lake Worth Inlet sand transfer plant and rehabilitation or removal of derelict groins.

The **Mid-Town Beach Nourishment Project, also known as Reach 3, (R90.4-R95) and Reach 4 (R95-R102.3)**, is a 2.6-mile segment of critically eroded shoreline in the Town of Palm Beach and the project history for this segment of shoreline is described in Table 4. In December 1995, restoration of the Reach 4 segment was completed using 880,000 cy of sand from an offshore borrow site located south of Lake Worth Inlet ebb shoal. The project included construction of eleven groins that were completed in April 1996. The beach fill design restores a 25-foot-wide beach at elevation +9 ft NGVD and provides eight years of advance nourishment to offset future erosion losses. The restoration maintained a beach berm along most of the project length during the nourishment interval but experienced significant erosion at the north and south limits of the project. In February 2003, the project was expanded (R90.4-R101.4) to include a restoration in Reach 3 and a nourishment in Reach 4. The expanded beach fill template included two segments (R90-R94) and (R95-R101). The gap between the two fill templates was intended to avoid potential impacts to artificial nearshore hardbottom. The 2004 hurricane season caused significant beach erosion to the project and, in 2005, FEMA provided emergency funding to replace the lost sand. Nourishment of the project was performed in 2006 and restored the beach to the design template. A physical and environmental monitoring program documented secondary impacts as a result of sand burial on nearshore hardbottom. Construction of artificial reef as mitigation for secondary impacts was required. Reconstruction of 6 T-groins along the midtown headland was completed in 2012 to protect upland properties along part of the gap area between the two beach fill segments. The Town constructed an expanded Mid-Town Project in 2015 that extended the project northward to R89 into Reach 2 and southward to R100 in Reach 4, placing approximately 966,587 cy of offshore material on the beach. Reach 3 dunes received 14,958 cy of trucked stockpile material from the Phipps offshore borrow area in April of 2016 between R91 and R93. A small dune restoration project, on the order of 6,000 cy, is planned for 2018 near Gulfstream Road (R-99). The next nourishment is scheduled for 2021/2022.

Table 4. Mid-Town (Reach 3) Beach Nourishment Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
December 1995	880,000	Offshore	R95 - R100	1.0
February 2003	1,273,100	Offshore	R90.4 - R101.4	2.2
February 2006	918,320	Offshore	R90.4 – 101.4	2.1
March 2011	52,000*	Upland	R95-R100	1.0
April 2015	966,587	Offshore	R89-R100.6	2.5
April 2016	14,958	Offshore – SP*	R90-R93	0.6

FEMA dune restoration in March 2011. SP represents stockpiled material from the Reach 7 Project that used an offshore borrow site for the dune restoration in Reach 3 in April 2016.

Reach 5 (R102.3-R110.1) is a 1.7-mile segment of critically eroded beach between Banyan Road and Widener's Curve in the Town of Palm Beach. Much of the shoreline along this segment is hardened by seawalls and revetments with no significant public access. Restoration has not been conducted along this segment. Future beach management alternatives may include rehabilitation or removal of derelict groins.

Reach 6 (R110.1-R116.5) is a 1.3-mile segment of critically eroded shoreline in the Town of Palm Beach. This shoreline segment has remained stable due to the downdrift effects of the Mid-Town nourishment projects that has provided a sediment source for both Reaches 5 and 6.

The **Phipps Ocean Park Beach Restoration Project, also known as Reach 7**, (R116.5-R128.5) is a 2.3-mile segment of critically eroded shoreline in the Town of Palm Beach. In 2002, the design of an extended project (R116-R126) was completed and permitted by the Department. Issuance of the final federal permit was delayed pending completion of an environmental impact statement required by a settlement agreement from an administrative hearing challenging construction of the project. The project was subsequently reduced in length (R119-R126) and volume. The 2006 project restored 1.4 miles of beach at elevation +7.5 ft NAVD using 1.1 million cy of sand and added the construction of a dune from 450 ft south of R116 to R119, and from R126 to R133.6 (excluding Lake Worth Pier Park). The beach fill design provides eight years of advance nourishment to offset future erosion. The project included construction of 3.1 acres of artificial reef to mitigate for adverse impacts to 3.1 acres of ephemerally exposed nearshore hardbottom. Another 0.8-acre deep-water mitigation reef was completed in 2006 as a federal requirement for the Project. This area experienced erosion during the

2008 storm season. Construction of a FEMA dune repair project using 56,000 cy from an upland sand source was completed in March 2011. Dune nourishment projects have been conducted to replace some of the sand losses. The Town constructed in January through February of 2015 for a beach nourishment project placing approximately 68,814 cy of upland material above the mean high water line within the Phipps project template. Reach 7 received an additional 1,022,318 cy in 2016 from an offshore borrow site. The next nourishment is scheduled for 2023/2024. See project history in Table 5.

Table 5. Phipps Ocean Park (Reach 7) Beach Nourishment Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
2006	1,100,000	Offshore	R119 - R126	1.4
March 2011	56,000*	Upland	R116.5-R125	1.7
February 2015	68,814	Offshore	R116.5-R121	0.9
April 2016	1,022,318	Offshore	R116.5-R127	2.1

*FEMA dune restoration in March 2011.

Reach 8 (R128.5-R134.1) is a 1.3-mile shoreline segment in the Town of Palm Beach with an approximate 1,335 ft gap along the City of Lake Worth and the City’s Municipal Pier area (R127.5-R128.7). The project segments between T125 and R128 and R128.8 through R134.1 are designated critically eroded. The Lake Worth Pier Park recreational area is not designated critically eroded (R128 through R128.8). A permit application for beach restoration was denied in July 2009, based upon the recommendation of an administrative law judge following an administrative hearing challenging the Department’s intent to issue a permit. The segment continued to experience erosion through storms and northeasters. Dune nourishment projects have been conducted to replace some of the sand losses. However, the segment has been combined in an environmental impact study along with the county’s South Palm Beach Island Restoration Project. Dune restoration was conducted in 2006 and 2011 with the placement of approximately 25,000 cy of material placed on the dune each year. Dune restoration was completed again in April 2015 placing approximately 34,902 cy on the dune. Of the total volume, 18,540 cy was excavated from the existing beach and the remainder, 16,362 cy was excavated from the dredge sand stockpile from offshore material. The Reach 8 dunes received an additional 8,466 cy of trucked stockpile material from the Phipps offshore borrow area in April 2016 between R129 and R134. See project history in Table 6.

Table 6. Reach 8 Beach and Dune Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
2006	25,000	Upland	R129-R134	1.0
2011	25,000	Upland	R129-R134	1.0
April 2015	34,902	Beach & Offshore	R129-R134	1.0
April 2016	8,466	Offshore – SP*	R129-R134	1.0

*Stockpiled material from the Reach 7 Project that used an offshore borrow site for the dune restoration in Reach 8.

Strategy: Maintain the Town’s restored projects through monitoring and nourishment using sand from offshore sources and upland sources; construct a feeder beach to reestablish littoral transport for Reach 2; and construct restoration projects in environmentally suited areas of Reach 5 and Reach 8. Comply with BMA (2013).

SOUTHERN PALM BEACH, LANTANA AND MANALAPAN, PALM BEACH COUNTY, R134.1-R145.8

The **Southern Palm Beach Island Comprehensive Shoreline Stabilization Project**, (formerly the South Palm Beach Island Restoration Project) has 2.3 miles of critically eroded beach along the shoreline of the Towns of South Palm Beach, Lantana, and Manalapan. The Local Sponsors are Palm Beach County with 0.67 miles (R134.1 - R137.4) of project area and the Town of Palm Beach with 1.24 miles (R128.8 - R134.1) of project area in Reach 8 (listed in section above). The project areas are listed in the [BMA](#) and are known as Reach 9 and 10, as described on page 7 in Table 2 of the BMA. The critical erosion area (R134.1-R145.8) is slightly shorter in length than the project area as listed in the BMA. The project has experienced severe erosion and has received six dune restoration projects. Hurricane Sandy in October of 2012 inflicted severe beach erosion and structural damages along 1.4 miles (R138.4-R145.8) of coastline at Manalapan. The entire segment is now designated critically eroded. Most of the project is armored by bulkheads and revetments, some of which were compromised during storms and other significant erosion events. Damage to the dune and the threat to upland structures at Lantana Public Beach resulted in the construction of a sheet pile wall at this location in 2009. Palm Beach County completed a feasibility study in 2008 to assess beach management alternatives. The selected project from the study was beach restoration with coastal erosion control structures to reduce the volume of fill material and thereby reduce adverse effects too extensive nearshore hardbottom. An interlocal agreement was executed between the Town of Palm Beach and Palm Beach County in 2013 to incorporate a 4,378 ft segment of the Reach 8 shoreline in the Town of Palm Beach into a consolidated Environmental Impact Statement (EIS) study for the project area. The

EIS study includes a design consisting of both sand fill and seven low-profile king-pile groins with a fill frequency of every 3 years to minimize the potential for downdrift impacts. The results of all the modeling alternatives were included in the Final Environmental Impact Statement, published by the Corps in June 2016. The project is scheduled for construction in 2019/2020.

Strategy: Conduct dune restoration where feasible; determine environmentally acceptable designs for beach restoration; comply with BMA (2013).

SOUTH LAKE WORTH INLET, PALM BEACH COUNTY, R151-R152

South Lake Worth Inlet (also known as Boynton Inlet) is a man-made inlet managed by Palm Beach County. A sand transfer plant was constructed in 1937 on the north jetty to bypasses sand to the downdrift beach south of the inlet. Strong tidal currents prevent shoaling of the channel, which has a hard rock bottom at a nominal depth of -12 ft NGVD. A sediment impoundment basin (sand trap) is located along the south side of the interior entrance channel. The Department adopted the [South Lake Worth Inlet Management Study Implementation Plan](#) in March 1999, which established an annualized bypassing objective of 88,000 cy of sand, including a minimum of 60,000 cy of sand bypassed by the sand transfer plant.

An engineering study was completed in July 2001 that identified design parameters and provided cost estimates to reconstruct the sand transfer plant. Construction was completed in August 2002 on an expansion of the sand trap, as recommended in the adopted inlet management plan. Construction of a new sand transfer plant in 2011, upgraded the engine from diesel to electric, increased the size of the discharge pipe, and improved the efficiency of the bypassing system at the inlet as recommended in the 1999 adopted inlet management plan. Dredging of the sand trap was completed in the winter of 2015. Seagrass pre-mitigation for future expansion of the sand trap was completed in 2014. Palm Beach County is currently working on developing a local updated inlet management plan. The fixed sand transfer plant located on the updrift jetty bypasses 100% of the sand trapped by the jetty, averaging annual bypass of 80,000 cy.

Strategy: Continue to bypass suitable sediment to the downdrift beaches to meet an annualized bypassing objective of 88,000 cy, including a minimum of 60,000 cy mechanically bypassed by the sand transfer plant; maintain the sand transfer plant and extend the discharge pipeline along the beach south of the inlet; provide multiple discharge points to optimize placement of fill; implement a comprehensive monitoring plan; update the sediment budget and the inlet management plan.

OCEAN RIDGE, PALM BEACH COUNTY, R152-R168

The **Ocean Ridge Beach Nourishment Project** is within a 3.3-mile segment of critically eroded beach that is partially within the area of influence of South Lake Worth Inlet. The project is within the limits of the Town of Ocean Ridge but the local sponsor is Palm Beach County. The project is authorized until 2039 and has a 6-year nourishment interval, and the project history for this segment of shoreline is described in Table 7. In April 1998, construction of the federally authorized **Ocean Ridge Beach Nourishment Project** (R152-R159) was completed along 1.4 miles of beach using 784,300 cy of sand from a borrow site located 2,100 ft offshore of the project area. The project included construction of eight groins. The project restored a beach berm at elevation +9 ft NGVD, and provided six years of advance nourishment (assuming a minimum of 60,000 cy of sand is bypassed annually by the inlet sand transfer plant). The project included construction of 2.0 acres of artificial reef to mitigate for adverse impacts to 2.0 acres of nearshore hardbottom. A physical and environmental monitoring program was conducted to verify the predicted impacts to nearshore hardbottom. Through 2004, the project met its performance goal of preserving a beach berm to the design parameters.

This area sustained impacts during the 2004 hurricane season. The USACE provided emergency funding to accelerate the maintenance nourishment and replace the material lost to storms. Construction of the nourishment project (R153-R159) was completed in December 2005 along 1.1 miles of beach using 558,000 cy of sand from the same offshore borrow site. The 2005 nourishment project excluded the R152-R153 project limits since the sand transfer plant maintained the beach in the groin field and to avoid additional coverage of the hardbottom areas located to the north of the project area (between R152 and R153) near the groin field. Environmental monitoring of the restoration project indicated additional impacts as a result of the 1998 project beyond the 2.0 acres of predicted impacts. Palm Beach County constructed 2.25 acres of artificial reef to mitigate for these impacts. The project was nourished in 2014 with placement of 503,690 cy of sand. The stems of the south five T-head groins (groins 4 through 8, were located south of the sand transfer plant's discharge pipe) at Ocean Ridge were reduced in elevation from +7.5 ft NAVD 88 to +4.5 ft NAVD 88 to increase littoral drift. The next nourishment is scheduled for 2021/2022.

Table 7. Ocean Ridge Beach Nourishment Project history

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
1998	784,300	Offshore	R152-R159	1.4
2005	558,000	Offshore	R153-R159	1.1
2014	503,690	Offshore	R153-R159	1.1

Strategy: Maintain the project through inlet bypassing, monitoring and nourishment using sand from offshore sources.

REGIONAL STRATEGIES FOR BEACH AND INLET MANAGEMENT

SPONSORS AND FUNDING

There are two federally-authorized Beach Erosion Control Projects that provide for federal cost sharing in Palm Beach County: a 1958 authorization for beach restoration and nourishment of Palm Beach Island, construction and operation of a sand transfer plant at Lake Worth Inlet; and a 1962 authorization for beach restoration and nourishment of the remainder of the county. The [Town of Palm Beach](#), the local sponsor of the Mid-Town Beach and Phipps Ocean Park projects, is not seeking federal participation in the costs of these projects, based upon the additional administrative expenses required to obtain the relatively small percentage of federal cost sharing in these projects. [Palm Beach County](#), the local sponsor of the Ocean Ridge project, constructs the project with reimbursement funding provided by the state and federal government. [Palm Beach County's Shoreline Protection Plan](#) dated 2014, highlights the Counties initiatives to preserve and manage their coastline. Project cost estimates and schedules may be found in the [Beach Management Funding Assistance Program - Long Range Budget Plan](#).

PROJECT COORDINATION

Regionalization is the funding and coordination of multiple beach nourishment and inlet management activities to take advantage of identifiable cost savings through economies of scale, reduced equipment mobilization and demobilization costs, and elimination of duplicative administrative tasks. Palm Beach County has been actively coordinating the management of inlets within this subregion with the USACE. The Town of Palm Beach has executed an agreement with the Corps to place dredged material from the maintenance of the Lake Worth Inlet navigation channel at the Mid-Town Beach project. The Ocean

Ridge beach restoration project is designed to use sand transferred by the plant at South Lake Worth Inlet to maintain the beach between nourishment events. A regional beach, inlet and offshore data collection and processing program is recommended to be used by the project sponsors in their monitoring programs.

ENVIRONMENTAL PROTECTION

The protection of marine turtles and hardbottom habitat are the primary environmental concerns within this subregion. The projects have been designed and implemented to avoid or minimize adverse impacts to marine turtles and hardbottom habitat. The timing of construction activities has been restricted during the marine turtle nesting season of March 1 through October 31. Artificial reefs were constructed as mitigation to offset adverse impacts to nearshore hardbottom caused by the Ocean Ridge project and for the Phipps Ocean Park project. Environmental impact statements will be prepared during the design phase of all projects selected from the Palm Beach Island Feasibility Study.

SAND SOURCES

Since there are limited sand resources existing in state waters in Southeast Florida, the Department and the USACE completed the [Sediment Assessment and Needs Determination \(SAND\) study](#). This study was conducted in a collaborative manner and was reviewed by and vetted through all the participating stakeholders. The SAND study determined that the regional offshore supply of sand in state and federal waters is more than adequate to meet the needs of all the beach nourishment projects in the five southeastern coastal counties, St. Lucie, Martin, Palm Beach, Broward, and Miami-Dade, for the next 50 years (year 2062), according to Ousley et al. (2014). Subsequently, the Department analyzed the need for sand over the next 10 to 20 years for the five southeastern counties and determined that approximately 20 to 30 million cy will be needed for beach nourishment projects. Due to the narrow continental shelf adjacent to Florida's southeastern shoreline, it is expected that some counties may need to look for sand resources in upland sand mines and/or offshore borrow sites in neighboring counties; Miami-Dade County has already initiated this process.

Coordination is recommended between the Department, the [USACE](#), [BOEM](#) and Local Governments to use best management practices with these offshore resources. For additional information on sand sources, the Department manages a database named the [Regional Offshore Sand Source Inventory \(ROSSI\)](#).

ADDITIONAL INFORMATION

The introduction of the state's Strategic Beach Management Plan provides additional background information on the Department's Beach Management Programs and includes overviews of:

- The principles and statutes followed to help guide the state's management strategies
- Comprehensive list of Florida's inlets
- The miles of critically eroded beaches under active management
- Statewide sand source studies
- Statewide monitoring programs
- Innovative technologies examined
- Basic suggestions for emergency response plans

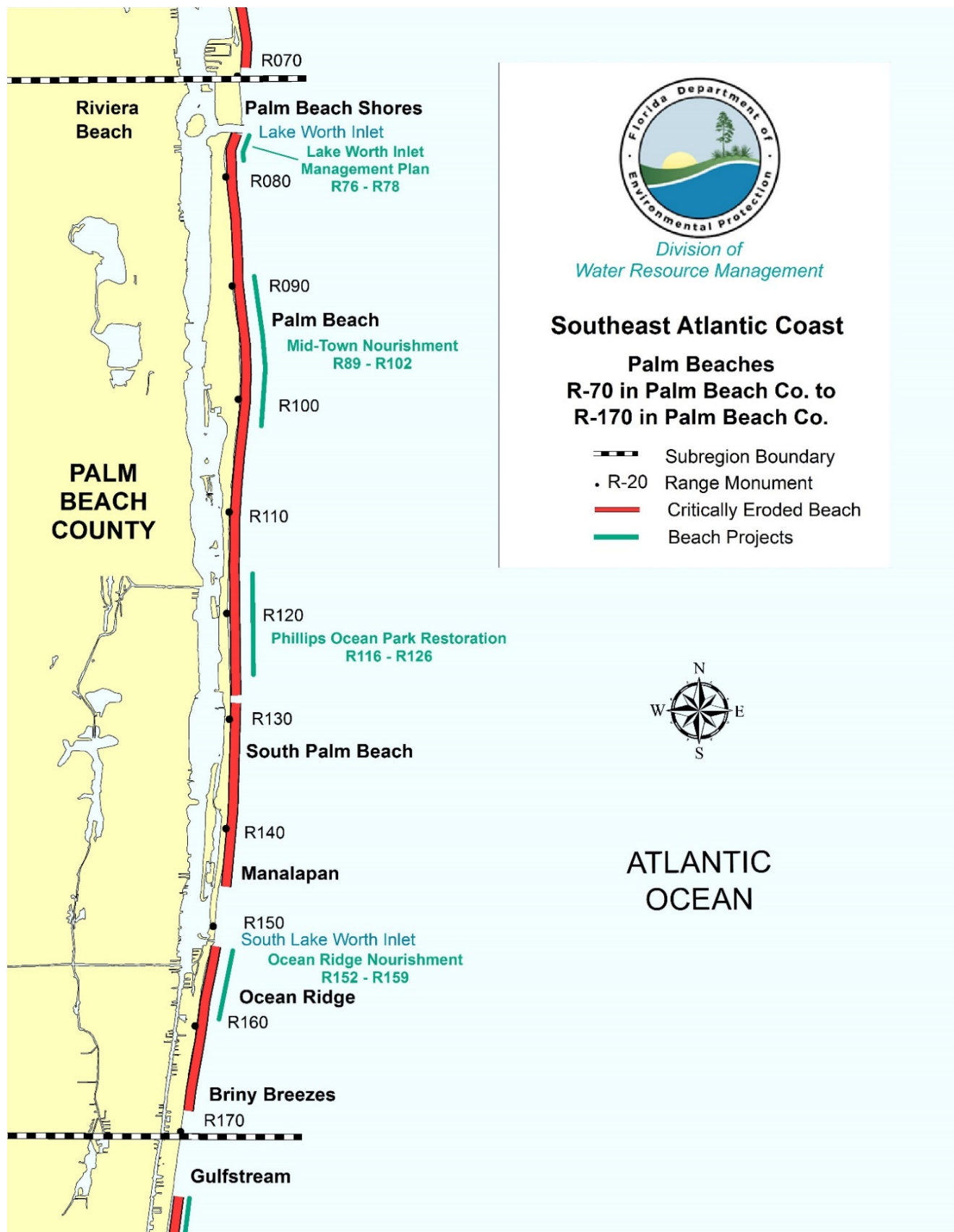


Figure 2. Map of Palm Beaches subregion of the Southeast region of Florida. View an [interactive map](#) or [COASTS imagery](#).

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SOUTHERN PALM BEACHES

There are 11.8 miles of beaches in the **Southern Palm Beaches** subregion, which extends from Gulfstream (R170) to the Palm Beach – Broward County line, as shown on Figure 3. There are 7.9 miles of critically eroded beaches in this subregion, of which 6.7 miles have been restored or maintained.

Erosion is attributed to frequent northeasters, occasional tropical storms and hurricanes, and the effects of Boca Raton Inlet. The most erosive storms occurring in past years were Hurricane Irene (1999), Hurricane Frances (2004) and Hurricane Jeanne in (2004), Hurricane Wilma (2005), Subtropical Storm Andrea (2007), October northeasters (2007), Tropical Storm Noel (2007), Tropical Storm Fay (2008), Hurricane Sandy (2012), Hurricane Matthew (2016) and Hurricane Irma (2017).

STRATEGIES FOR INLETS AND CRITICALLY ERODED BEACHES

DELRAY BEACH, PALM BEACH COUNTY, R176-R190

In July 1973, construction of the federally-authorized **Delray Beach Shore Protection Project** (R175-R188) was completed on this 2.9-mile segment of beach using sand from an offshore borrow area. The project is authorized until 2023, and the project history for this segment of shoreline is described in Table 8. The project restored a beach berm at elevation +9 ft NGVD and provided six years of advance nourishment. In addition to the restoration, six nourishments have been performed by the City of Delray Beach. Beginning with the 1992 beach nourishment, the design interval between beach nourishment events increased to eight years. The project has exceeded its performance goal of preserving a beach berm through the eight-year nourishment interval. This area was eroded during the 2004 hurricane season. The USACE provided emergency funding to replace the material lost to storms. Construction of the emergency nourishment project was completed in 2005. Beach nourishment was conducted in 2013 and again in 2014, due to erosion caused by Hurricane Sandy. The next nourishment event is scheduled for 2021/2022.

Table 8. Delray Beach Shore Protection Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
July 1973	1,635,000	Offshore	R175.5-R188.5	2.7
May 1978	701,000	Offshore	R177.2-R182.7 and R185.5-R188.5	1.8

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
October 1984	1,300,000	Offshore	R175.5-R188.5	2.7
December 1992	1,196,500	Offshore	R180-R188.5	1.7
April 2002	1,230,000	Offshore	R180-R188.5	1.7
April 2005	411,600	Offshore	R175.5-R188.5	2.7
April 2013	1,158,500	Offshore	R179 – R188A	1.9
April 2014	380,000	Offshore	R179 – R188A	1.0

Strategy: Maintain the project through monitoring and nourishment using sand from offshore or upland sources.

BOCA RATON, PALM BEACH COUNTY, R204-R223

This is a 3.8-mile segment of critically eroded beach in the City of Boca Raton. Beach restoration and nourishment have been conducted within a portion of this area, and the project history for this segment of shoreline is described in Table 9. In August 1988, construction of the federally-authorized **North Boca Raton Shore Protection Project** (R205-R212) was completed using sand from an offshore borrow site. The North segment of the project is authorized until 2038. The local sponsor is the City of Boca Raton. The project restored the beach berm at elevation +7.4 ft NAVD 88 and provided ten years of advanced nourishment. The project included construction of six artificial reef modules as mitigation for impacts to nearshore hardbottom and a rock groin to protect the nearshore hardbottom known as Red Reef Rock. In April 1998, beach nourishment was completed and no additional impacts to nearshore hardbottom were indicated by environmental monitoring; however, continued physical and environmental monitoring was conducted to measure the effects of the project. The project met its performance goal of preserving a beach berm through the ten-year nourishment interval. This area was eroded during the 2004 hurricane season. In 2006, the design and permitting of a maintenance nourishment event was initiated. Construction of the second nourishment was completed in March of 2010. The third nourishment was constructed in coordination with the federal Hurricane Sandy storm repair, initiated in spring 2014 and completed in December 2014. The next nourishment is planned for 2017/2018.

Table 9. North Boca Raton Beach Nourishment Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
August 1988	1,100,000	Offshore	R205-R212	1.5
April 1998	680,000	Offshore	R205-R212	1.5
March 2010	782,200	Offshore	R205-R212	1.5
December 2014	561,600	Offshore	R205-R212	1.5

In April 2004, construction of the **Central Boca Raton Beach Nourishment Project** (R216-R222) was completed using a borrow site located 2,500 ft offshore. The local sponsor of the project is the City of Boca Raton, and the project history for this segment of shoreline is described in Table 10. The project restored the beach berm at an elevation of +7.4 ft NAVD 88 and provided eight years of advance nourishment along 1.5 miles of shore using 747,000 cy of sand. The project included construction of a groin 1,500 ft north of the Boca Raton Inlet to stabilize a highly erosional area and reduce the spreading loss of fill material into the inlet. The north jetty was reconstructed and the weir was relocated 50 ft seaward to accommodate for the nourishment and extension of the MHW line. This area was eroded during the 2004 hurricane season. A maintenance nourishment event to refill the template was completed in March 2006 using sand from the Boca Raton Inlet ebb shoal that placed 325,000 cy on the beach. The first nourishment project commenced in March 2016 and ceased construction in April 2016 due to sea turtle nesting season. The Project then re-commenced in February 2017 and completed construction in March 2017 with a total placement of 514,000 cy.

Table 10. Central Boca Raton Beach Nourishment Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
April 2004	747,000	Offshore	R-216 to R-222	1.5
March 2006	325,000	Ebb Shoal	R-216 to R-222	1.5
March 2017	514,000	Ebb Shoal	R216 to R-222	1.5

Strategy: Maintain the North and Central projects through monitoring and nourishment using sand from offshore sources; monitor the remaining critically eroded beach located between the north and central project portions of Boca Raton.

BOCA RATON INLET, PALM BEACH COUNTY, R222-R223

This inlet is maintained by the City of Boca Raton. A city-owned hydraulic dredge transfers sand from the inlet channel to the downdrift beach south of the inlet maintaining an average channel depth of approximately -6 ft MLW. The Department adopted the [Boca Raton Inlet Management Study Implementation Plan](#) in 1997 that established an annualized bypassing objective of 71,300 cy, which has been achieved. The Department and local sponsor initiated a study in October 2002 to update the inlet sediment budget and validate the bypassing objective and inlet management practices. In 2004, the bypassing objective was revised and increased to 83,000 cy per year, which was formally adopted in the 2008 SBMP. The bypassing objective is achieved through a combination of maintenance dredging using the City-owned dredge and nourishment of downdrift beaches using the inlet ebb shoal as a borrow source. In conjunction with the Central Boca Raton Beach Restoration Project, the weir in the north jetty was relocated 50 ft seaward. The north jetty, which was damaged in the 2004 hurricane season, was rehabilitated in 2008. The Department conducted a regional sediment budget analysis in 2015 and determined the inlet sand bypassing activities have balanced the sediment budget of Boca Raton Inlet and Hillsboro Inlet with the adjacent beaches. It is recommended that biennial, synoptic surveys of the beaches and inlets be conducted, and after the collection of sufficient data, a sediment budget then be prepared using a methodology from the Army Corps of Engineers' Coastal Engineering Manual. The City continues to perform on-going maintenance dredging of the inlet bypassing of sand to the southern beaches of inlet.

Strategy: Through a combination of mechanical sand bypassing by the City-owned dredge and nourishment of the South Boca Raton project using the ebb shoal as a borrow source, bypass sediment to downdrift beaches to meet an annualized bypassing objective of 83,000 cy; update the sediment budget and the inlet management plan; evaluate options of beach placement locations at South Boca Raton Beach, Deerfield Beach and Hillsboro Beach.

SOUTH BOCA RATON, PALM BEACH COUNTY, R223-R227.9

This is a 1-mile segment of critically eroded beach in the City of Boca Raton, and the project history for this segment of shoreline is described in Table 11. In July 1985, the construction of the non-federal **South Boca Raton Beach Nourishment Project** was completed using sand from the ebb tidal shoal of Boca Raton Inlet. The local sponsor is the City of Boca Raton. The project restored a beach berm at elevation +8.4 ft NAVD 88 and consists entirely of advance nourishment to maintain the historic 1975

shoreline position and to serve as a feeder beach that bypasses sand to the downdrift shore. Subsequent nourishment in 1996 and 2002 also used the ebb tidal shoal. The length of the 2002 project was extended to the south county line and is the current project limits. Construction of 2.4 acres of artificial reef were completed in 2002 to mitigate for adverse impacts to 2.4 acres of nearshore hardbottom from the 1996 and 2002 project. The third nourishment was completed in March 2010. Significant erosion occurred in October 2012 due to Hurricane Sandy and the fourth nourishment was constructed in 2013 with the fifth nourishment following in 2017.

The project design specifies a six-year interval between nourishment events. A physical and environmental monitoring program is being conducted to verify the predicted impacts to nearshore hardbottom. The project has met its performance goal of preserving a beach berm seaward of the 1975 shoreline through the nourishments and inlet sand bypassing to the downdrift shore. The next nourishment is scheduled for 2022/2023.

Table 11. South Boca Raton Beach Nourishment Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
July 1985	221,000	Ebb tidal shoal	R223.3-R225.6	0.6
December 1996	220,000	Ebb tidal shoal	R223.3-R225.6	0.6
April 2002	343,000	Ebb tidal shoal	R223.3-R227.9	0.96
March 2010	183,800	Ebb tidal shoal	R223.3-R227.9	0.96
December 2013	168,900	Ebb tidal shoal	R223.3-R227.9	0.96
March 2017	134,100	Ebb tidal shoal	R223.3-R227.9	0.96

Strategy: Maintain the project through monitoring and nourishment using inlet channel and ebb shoal material.

REGIONAL STRATEGIES FOR BEACH AND INLET MANAGEMENT

SPONSORS AND FUNDING

Two federally-authorized Beach Erosion Control Projects in Palm Beach County provide for Federal cost sharing, although the majority of the county is federally authorized: Palm Beach Island between Lake Worth and South Lake Worth Inlets was authorized in 1958 and the remainder of the county north

of Lake Worth Inlet and south of South Lake Worth Inlet was authorized in 1962. The [City of Delray Beach](#) constructs its project with reimbursement funding provided by the State and Federal government. In 1991, the [USACE](#) federal participation in the Delray Beach project was extended to 50 years following completion of initial construction. The City of Boca Raton constructs the North Project with reimbursement funding provided by the State and Federal government, but has not sought federal funds for the Central or South projects. [Palm Beach County](#) has participated with the municipalities in the collection and processing of monitoring data in this subregion. [Palm Beach County's Shoreline Protection Plan](#) dated 2014, highlights the Counties initiatives to preserve and manage their coastline. Project cost estimates may be found in the [Beach Management Funding Assistance Program - Long Range Budget Plan](#).

PROJECT COORDINATION

Regionalization is the funding and coordination of multiple beach nourishment and inlet management activities to take advantage of identifiable cost savings through economies of scale, reduced equipment mobilization and demobilization costs, and elimination of duplicative administrative tasks.

Opportunities in this subregion include:

1. Jointly soliciting bids for the nourishment of Delray Beach and Boca Raton beach segments.
2. A regional monitoring data collection and processing program to be used by the local sponsors for project monitoring required by permits.
3. Studying bypassing alternatives at Boca Inlet with the Towns of Hillsboro and Deerfield Beach in Broward County.

ENVIRONMENTAL PROTECTION

The protection of marine turtles and hardbottom habitat are the primary environmental concerns within this subregion. The timing of construction is restricted during the marine turtle nesting season of March 1 through October 31. Project design and method of construction are restricted to avoid or minimize adverse impacts to marine turtles and hardbottom habitat. Artificial reefs were constructed as mitigation to offset impacts to nearshore hardbottom caused by the North and South Boca Raton projects. A physical and environmental monitoring program is being conducted to verify the expected effects of the projects.

SAND SOURCES

Upon completion of the 2016/2017 Central Boca Raton Beach Nourishment Project, the City of Boca Raton will have depleted all permitted and viable sand resources for the North and Central segments. The City is currently conducting a geotechnical sand search. The City anticipates permitting the new borrow areas in 2016/2017.

Since there are limited sand resources existing in State waters in Southeast Florida, the Department and the USACE completed the [Sediment Assessment and Needs Determination \(SAND\) study](#). This study was conducted in a collaborative manner and was reviewed by and vetted through all the participating stakeholders. The SAND study indicates that the regional offshore supply of sand in state and federal waters is more than adequate to meet the needs of all the beach nourishment projects in the five southeastern coastal counties, St. Lucie, Martin, Palm Beach, Broward, and Miami-Dade, for the next 50 years (year 2062), according to Ousley et al. (2014). Subsequently, the Department analyzed the need for sand over the next 10 to 20 years for the five southeastern counties and determined that approximately 20 to 30 million cy will be needed for beach nourishment projects. Due to the narrow continental shelf adjacent to Florida's southeastern shoreline, it is expected that some counties may need to look for sand resources in upland sand mines and/or offshore borrow sites in neighboring counties; Miami-Dade County has already initiated this process.

Coordination is recommended between the Department, the [USACE](#), [BOEM](#) and Local Governments to use best management practices with these offshore resources. For additional information on sand sources, the Department manages a database named the [Regional Offshore Sand Source Inventory \(ROSSI\)](#).

ADDITIONAL INFORMATION

The introduction of the state's Strategic Beach Management Plan provides additional background information on the Department's Beach Management Programs and includes overviews of:

- The principals and statutes followed to help guide the state's management strategies
- Comprehensive list of Florida's inlets
- The miles of critically eroded beaches under active management
- Statewide sand source studies

- Statewide monitoring programs
- Innovative technologies examined
- Basic suggestions for emergency response plans

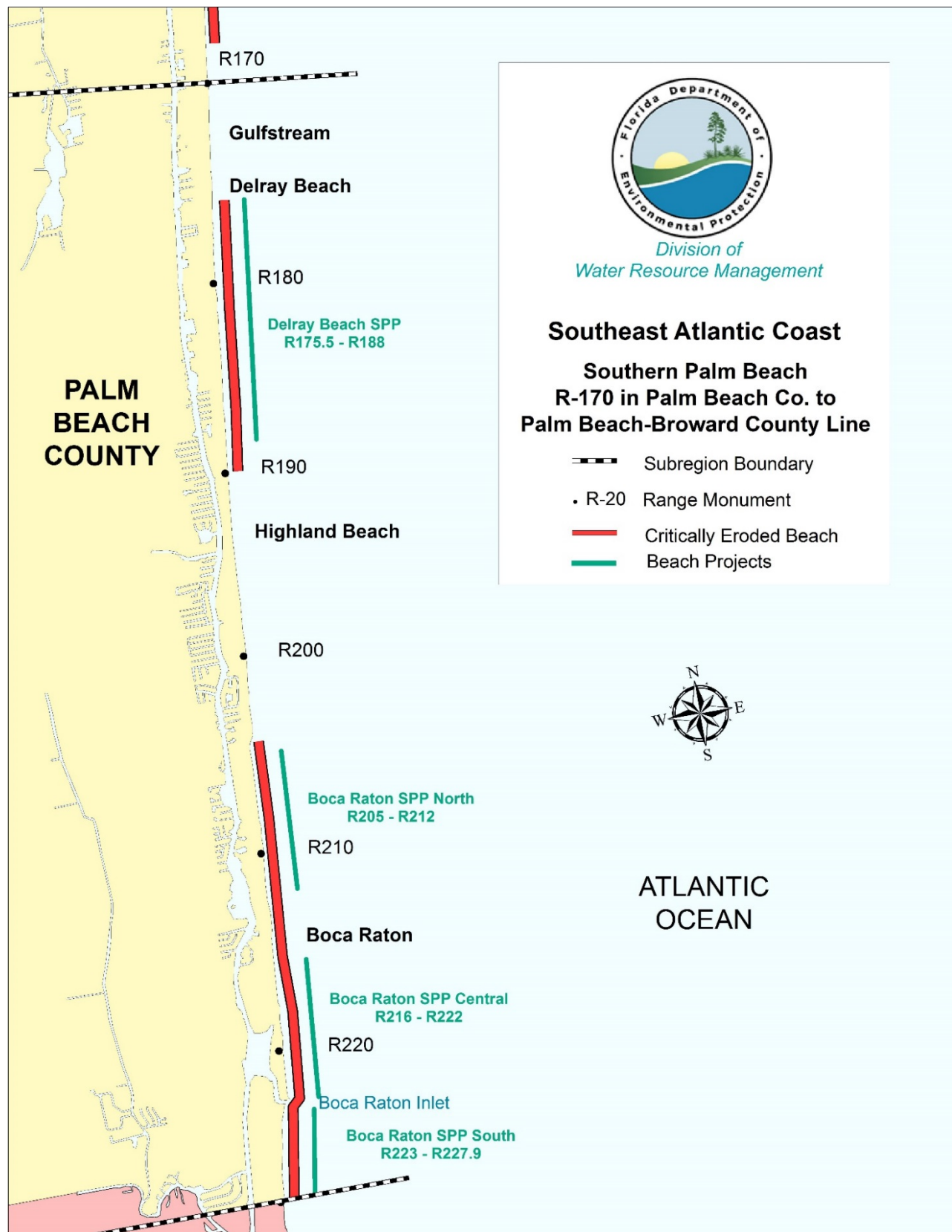


Figure 3. Map of Southern Palm Beaches subregion of the Southeast region of Florida. View an [interactive map](#) or [COASTS imagery](#).

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BROWARD – MIAMI-DADE BEACHES

There are 38.9 miles of beaches in the **Broward through Miami-Dade Beaches** subregion, which extends from the Palm Beach-Broward County line (R1) to Government Cut, in Miami-Dade County (R74.4), as shown on Figure 4. There are 21.3 miles of critically eroded beaches in Broward County, of which 13.5 miles are restored and maintained. There are 14.5 miles of critically eroded beaches in Dade County, of which 13.3 miles are restored and maintained.

Erosion is attributed to frequent winter northeasters, occasional tropical storms and hurricanes, and the effects of Boca Raton Inlet, Hillsboro Inlet, Port Everglades Entrance Channel, and Bakers Haulover Cut. The most erosive storms in recent years were Hurricane Andrew (1992), Hurricane Wilma (2005), Subtropical Storm Andrea, October northeasters, Tropical Storm Noel (2007), Hurricane Sandy (2012), Hurricane Matthew (2016) and Hurricane Irma (2017).

STRATEGIES FOR INLETS AND CRITICALLY ERODED BEACHES

HILLSBORO BEACH, BROWARD COUNTY, R6-R23

This is a 3.2-mile segment of critically eroded beach that includes south Deerfield Beach and Hillsboro Beach south to Hillsboro Inlet, and the project history for this segment of shoreline is described in Table 12. Some armoring exists in Hillsboro Beach and fifty-seven groins comprised of king piles approximately 100 ft. apart with rubble mounds acting as the “T” section of the groin exists in Deerfield Beach. An unknown number of the king pile/ concrete panel sections have been removed and the remaining ones have been buried beneath the surface of the beach. Beach restoration and nourishment has been conducted at Hillsboro Beach (R6-R12). The inlet sand bypassing activity at Boca Raton Inlet and material placed for the South Boca Raton project aids in maintaining the beach at Deerfield Beach, but the northern beaches of Hillsboro Beach require nourishment. The southern portion of Hillsboro Beach is relatively stable, but remains critically eroded. Segment I of Broward County is located Between R1 (Northern Broward County Line) and R24 (Hillsboro Inlet), but a federal feasibility study has not yet been completed for this segment.

The initial 1972 non-federal beach restoration project at Hillsboro Beach (R7-R12) was constructed using sand from an offshore borrow site. The non-federal **Hillsboro Beach Nourishment Project** (R6-R12) was completed again in 1998, 2008/ 2009, 2011 and 2015. The local sponsor is the Town of Hillsboro Beach. The project design consists of restoration of a 30-foot beach berm at an elevation of

+9 ft NGVD plus beach fill equivalent to ten years of advance nourishment. The beach nourishment event in 1998 placed 555,000 cubic yards along the project area from an offshore borrow site. The 1998 project also included modifications to three existing groin structures at the south end of Deerfield beach to improve project performance at the north end of the project. Significant material has been eroded from the beach berm, and monitoring surveys are continuing to determine if beach nourishment will be necessary in less than the ten-year cycle. The truck haul beach nourishment in 2008 placed a total of 10,350 cy at R7 and additional material was placed in Deerfield Beach due to Hurricane Wilma in 2008/2009. The beach nourishment event in 2011 placed 339,151 cy of material on Hillsboro Beach from an offshore borrow site. The most recent nourishment was completed in the spring of 2015 placing 45,600 cy of upland material on the beach. The next nourishment is scheduled for the spring of 2018.

Table 12. Hillsboro Beach Nourishment Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
August 1972	360,000	Offshore	R7 - R12	1.0
March 1998	555,000	Offshore	R6 - R12	1.2
June 2008	10,350	Upland	R7	0.1
2008/2009 ¹	15,692	Upland	R2.7-R6.6	0.75
April 2011	339,151	Offshore	R5.3-R-12.5	1.2
April 2015	45,600	Upland	R6 -R7	0.2

¹ Sand placement at Deerfield Beach – DFB, (Southern DFB in 2008 with 8,314 cy at SE 5th [R5] to SE 10th Street [R6.6] and (Northern DFB in 2009 with 7,378 cy at Pier [R-2.7] to SE 4th Street [R4.7]) due to Hurricane Wilma (2005) using FEMA funds.

Strategy: Maintain the project through monitoring and nourishment and in coordination with sand bypassing activities; conduct a feasibility study to clearly determine the causes of erosion and to develop design alternatives to address the erosion.

HILLSBORO INLET, BROWARD COUNTY, R24-R25

Hillsboro Inlet is a stabilized inlet maintained by the Hillsboro Inlet District. A district-owned hydraulic dredge transfers sand from the inlet channel and sediment settling basin to the downdrift beach south of the inlet. The Department adopted the Hillsboro Inlet Management Study Implementation Plan in September 1997. The plan established an annualized bypassing objective of 120,000 cy, which has been

achieved. In December 2002, the District completed the expansion of the exterior entrance channel and excavation of a sediment impoundment basin within the channel to elevation -20 ft NGVD. The project included construction of 1.6 acres of artificial reef to mitigate for adverse impacts to 0.4 acres of nearshore hardbottom. The Department conducted a regional sediment budget analysis in 2015 and determined the inlet sand bypassing activities have balanced the sediment budget of Boca Raton Inlet and Hillsboro Inlet with the adjacent beaches. It is recommended that biennial, synoptic surveys of the beaches and inlets be conducted, and after the collection of sufficient data, a sediment budget then be prepared using a methodology from the [USACE's Coastal Engineering Manual](#).

Strategy: Continue to bypass sediment to downdrift beaches to meet an annualized bypassing objective of 120,000 cy; implement a physical monitoring program and update the sediment budget and the inlet management plan.

POMPANO BEACH TO FT LAUDERDALE, BROWARD COUNTY, R25-R77

This is a 10-mile segment of critically eroded beach partially within the area of influence of Hillsboro Inlet. It includes the communities of Pompano Beach, Sea Ranch Lakes, Lauderdale-by-the-Sea, and Ft Lauderdale. Restoration and nourishment have been conducted within this segment, and the project history for this segment of shoreline is described in Table 13. Numerous bulkheads and retaining walls also exist along this stretch of coast. Minimizing or avoiding impacts to nearshore hardbottom may determine the feasibility and scope of beach restoration along remaining portions of the shoreline.

In 1970, restoration of Pompano Beach (R32-R49), **Segment II** of the [USACE's](#) federal **Broward County Shore Protection Project** was completed using sand from an offshore borrow site. The project is authorized until 2020. The beach berm was constructed at elevation +9 ft NGVD and extended the 1970 MHW shoreline seaward by 134 ft

In 1983, restoration and nourishment of Pompano Beach and Lauderdale-By-The-Sea (R25-R53) was constructed using sand from offshore borrow sites. The beach berm was constructed at elevation +9 ft NGVD and extended the existing MHW shoreline seaward by 45 ft. The 1983 nourishment project provided storm protection during Hurricane Andrew and the advance nourishment significantly exceeded the five-year performance expectation; however, nourishment is now needed to maintain storm protection and recreational benefits. Additional erosion occurred in this area during the 2004, 2005 and 2012 hurricane seasons.

Design and permitting were completed in 2004 for nourishment of Pompano Beach and Lauderdale-By-The Sea (R36-R43) and restoration of northern Fort Lauderdale (R51-R72) (also collectively known as Segment II of the **Broward County Shore Protection Project**) that expected to use 935,000 cy of sand from offshore borrow sites. The project was never constructed. The Pompano Beach design specified a berm at elevation +9 ft NGVD that would extend the MHW shoreline 100 ft seaward of the Erosion Control Line plus additional fill material equivalent to six years of advance nourishment. The beach fill design for the Fort Lauderdale reach called for a 20-foot seaward extension of the 1998 MHW shoreline plus fill material equivalent to six years of advance nourishment. The project plan included 3.0 acres of artificial mitigation reef for permanent coverage impacts to 2.5 acres of nearshore hardbottom. The Notice to Proceed (NTP) was withheld for the Segment II project to evaluate the performance of the 2006 beach nourishment for the Segment III project and the results of the post-project monitoring of the nearshore hardbottom offshore of Broward County. The permit expired for the Segment II reach prior to constructing this segment of shoreline.

Hurricane Sandy in 2012 contributed to significant erosion along most of the project shoreline and extensively damaged 2,000 ft of SR A1A (R-65 to R-67), the area's only hurricane evacuation route that is within the project limits. A small 20,000 cy beach fill project was constructed seaward of the damaged portion of SR A1A to offer limited protection to the roadway in advance of the proposed restoration project, which utilized an upland sand source. Also, a seawall was constructed by FDOT seaward of A1A between R65 and R67 to improve protection to the roadway following Hurricane Sandy impacts. Although this roadway continues to be vulnerable to coastal storm impacts, the significance of the seawall constructed by FDOT is designed to be sufficient to protect the road from a 25-yr storm event.

The Department issued a new permit for the Segment II (R25-R85) project in January 2014. This project began construction in January 2016 placing truck-hauled sand on two beach segments located at R36 to R41.3 and R51 to R72 including both beach and dune fill placement along 4.9 miles of critically-eroded shoreline. The dune features will have a crest width of 10 ft and a crest height of 11 ft NAVD. An FCCE construction project in 2014 was completed using 130,000 cy of upland material to restore the designed beach berm above the mean high water line (MHWL) along the Segment II project boundary. Also, the Segment II project will construct 6.8 acres of artificial reef in the nearshore between R44 and R46 as mitigation for direct impact to 4.9 acres of nearshore hardbottom. The permit also required a hardbottom monitoring plan to measure unanticipated impacts that could occur from the project. The 2016 Segment II Shore Protection Project was completed in two segments with approximately 1 mile (R36-R41.3) of beach and dune restored by using approximately 146,896 cy of upland sand in March

2016. The second segment of the project was completed in December 2016 after turtle season with placement of 546,348 from an upland mine. The next nourishment is scheduled for 2020/2021.

Table 13. Pompano Beach - Lauderdale-By-The-Sea - Ft Lauderdale Beach Nourishment (Segment II) Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
1970	1,076,000	Offshore	R32 - R49	3.2
1983	1,900,000	Offshore	R25 - R53	5.4
2012	20,000	Upland	R65 - R67	0.4
2014	130,000	Upland	R25 - R49	4.5
2015	865	Upland	R71	0.1
March 2016	146,896	Upland	R36 - R41.3	1.0
December 2016	546,348	Upland	R51 – R72	4.0

Strategy: Complete beach restoration and nourishment; maintain the project through monitoring and nourishment using offshore or upland sand source.

PORT EVERGLADES INLET, BROWARD COUNTY, R85-R86

Port Everglades Inlet (also known as the Port Everglades Entrance Channel) is a man-made, federally-maintained navigation project and the entrance to Port Everglades. The entrance channel depth is -45 ft MLW. Rock spoil from a 1962 excavation of the inlet entrance channel was placed in the nearshore north of the inlet and acts as a partial littoral barrier to shoaling of the navigation channel. The Department adopted the [Port Everglades Inlet Management Study Implementation Plan](#) in May 1999. The plan established an annualized bypassing objective of 44,000 cy which has been historically done by periodic maintenance dredging of the channel. In 2002, design of a spur groin attached to the south jetty and two groins located on the shore south the inlet (in lieu of breakwaters) was completed as recommended in the adopted inlet management plan. Construction was conducted as part of the 2005/06 Broward County Shore Protection Project - Segment III described below. The most recent maintenance dredging events have occurred in 2006 and 2013. Learn more about [Port Everglades projects](#) and history.

The Department and Broward County completed a feasibility study in 2004 of structural improvements to facilitate inlet sand bypassing. This study recommended modifications to the north jetty, construction of a sediment impoundment basin, and removal of the rock spoil located north of the inlet as recommended in the inlet management plan. Preliminary engineering was initiated in 2006 to refine the recommendations of the feasibility study and a JCP application was submitted in 2008. However, the application was withdrawn and the project was redesigned to address the blasting concerns of property owners immediately adjacent to the project and inlet. In order to address these concerns, a new application was resubmitted to the Department in summer of 2014 that redesigned the sand trap in order to eliminate the need for blasting during construction. The project has completed the design and permitting phase and construction is scheduled for 2017/2018.

Strategy: Place all beach compatible inlet maintenance material from channel or sand trap material on the downdrift beaches in areas of greatest need to meet an annualized bypassing objective of at least 44,000 cy; implement a physical monitoring program; update the inlet management plan using the updated sediment budget from 2014; construct a sediment impoundment basin and modifications to the north jetty and other improvements to facilitate mechanical bypassing of sand, including removal of the rock spoil located in the nearshore north of the inlet.

DR. VON D. MIZELL-EULA JOHNSON STATE PARK – DANIA BEACH - HOLLYWOOD – HALLANDALE BEACH, BROWARD COUNTY, R86-R128

This is an 8.1-mile segment of critically eroded beach partially within the area of influence of Port Everglades Inlet. This area includes Dr. Von D. Mizell-Eula Johnson Beach State Park (formerly known as John U. Lloyd Beach State Park) and the communities of Dania Beach, Hollywood, and Hallandale Beach, and the project history for this segment of shoreline is described in Table 14.

The City of Hallandale Beach first restored the southernmost 4,000 ft of Broward County shoreline with 360,000 cy of sand from an offshore borrow site in 1971.

Beach restoration of Dr. Von D. Mizell-Eula Johnson Beach State Park (R86-R93, **Broward County Shore Protection Project – Segment III**) was constructed in 1976 using sand from offshore borrow sites and placement of 1.09M cy. The federal project is authorized until 2026. The beach berm was constructed at elevation +10 ft NGVD and extended the MHW shoreline 140 ft seaward. For the purposes of estimating costs, a five-year nourishment interval was considered. Nourishment occurred again in 1979 along with sand tightening of the south jetty. The beach berm was constructed at

elevation +10 ft NGVD and extended the MHW shoreline 100 ft seaward, which included fill material equivalent to five years of advance nourishment. The project in 1989 provided storm protection during Hurricane Andrew, but the advance nourishment did not meet the five-year performance expectation.

Beach restoration of Hollywood - Hallandale Beach (R101-R128, **Broward County Shore Protection Project-Segment III**) was constructed in 1979 using 2M cy of sand from offshore borrow sites. The beach berm was constructed at elevation +7 ft NGVD and extended the MHW shoreline 178 ft seaward. For the purposes of estimating costs, a five-year nourishment interval was considered. Nourishment was conducted in 1991 with placement of 1.1M cy. The beach berm was constructed at elevation +7 ft NGVD and extended the MHW shoreline 51 ft seaward. Additional fill material equivalent to eight years of advance nourishment was placed seaward of the design berm. The 1991 nourishment project provided storm protection during Hurricane Andrew and the advance nourishment met the eight-year performance expectation, even though the beach berm had eroded significantly during the delay in nourishment.

Approximately 25,000 cy of upland sand was placed along 0.4 miles of shoreline in Hollywood in 2001, between R121 and R123.

Nourishment of Dr. Von D. Mizell-Eula Johnson Beach State Park (R86-R92) and Dania Beach-Hollywood-Hallandale Beach (R98 - R128) was completed in March 2006 using 1,850,000 cy of sand from offshore borrow sites along 6.82 miles of shoreline. The beach fill at the state park is constructed at an elevation +9 ft NGVD and constitutes six years of advance nourishment. The beach fill design for Dania Beach - Hollywood - Hallandale consisted of a 50-foot extension of the MHWL shoreline seaward of the Erosion Control Line (ECL) plus fill material equivalent to six years of advance nourishment. The project included construction of 8.9 acres of artificial reef as mitigation for impacts to 7.6 acres of nearshore hardbottom. A physical and environmental monitoring program was conducted to verify avoidance of impacts to nearshore hardbottom and the performance of the mitigation. The 2006 project also constructed a spur groin connected to the south jetty of Port Everglades Inlet, installed two T-head groins offshore of Dr. Von D. Mizell-Eula Johnson State Park to retain beach fill and constructed 8.9 acres of artificial reef as mitigation.

The City of Hollywood in February 2012 completed an interim truck haul beach nourishment project (R107 to R109 and R119 to R124) to address hot spot erosion by placing 69,000 cy of sand on the beach and dune. The beach berm elevation was + 7 ft NGVD. An additional 116,000 cy was placed in 2013. Broward County evaluated beach management strategies in 2015 to direct future management of

Segment III. The Hollywood Truck Haul Project was completed in December 2017 for the North Segment in the amount of 6,020 cy and the South Segment was completed in February 2018 in the amount of 59,840 cy.

Table 14. Dr. Von D. Mizell-Eula Johnson State Park - Hollywood - Hallandale Beach Nourishment (Segment III) Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
1971	360,000	Offshore	R124 - R128	0.8
1976-1977	1,090,000	Offshore	R86 (S. Jetty) - R93	1.4
November 1979	2,000,000	Offshore	R101 - R128	5.2
1989	604,000	Offshore	R86 (S. Jetty) - R93	1.4
August 1991	1,100,000	Offshore	R101 - R128	5.2
2001	25,000	Upland	R121 - R123	0.38
2005-2006 ¹	1,850,000	Offshore	R86 (S. Jetty) - R92 and R98.3 - R128	6.8
2005-2006	44,200	Inlet	R87 – R90	0.75
February 2012 ²	69,400	Upland	R107 - R109 and R119 - R124	1.3
2013	116,000	Inlet	R87 - R90	0.75
December 2017	6,020	Upland	R100-R102	0.38
February 2018	59,840	Upland	R118.7 - R123.8	0.97

¹ Includes the placement of 550,000 cy of sand along the State Park shoreline (R86-R92) and 1,300,000 cy along the Dania Beach, Hollywood, and Hallandale Beach shoreline (R99 and R128). Of the sand volume placed between R101 and R128, 188,000 cy was placed under a USACE contract as part of the 2004 FCCE (PL 84-99) Post-Storm Rehabilitation Project.

² The north segment of beach at R107 to R109 had a placement of 8,200 cy and in the south segment from R119 to R124, there was 61,200 cy placed on the beach.

Strategy: Maintain the project through monitoring and nourishment using sand from offshore, upland and inlet sources.

GOLDEN BEACH - SUNNY ISLES - HAULOVER BEACH PARK, MIAMI-DADE COUNTY, R1-R26.7

This is a 5.1-mile segment of critically eroded beach between the Broward-Dade County line and Baker’s Haulover Cut/Inlet. Restoration and nourishment have been conducted in Sunny Isles (R7-R20) and Haulover Beach Park (R20-R26.7) as part of the federally-authorized **Miami-Dade County Shore Protection Project**, and the project history for this segment of shoreline is described in Table 15. The Sunny Isles segment of the project is authorized until 2038. The critically eroded beaches within Golden Beach (R1-R7) receive sand from spreading of the adjacent nourishment projects.

In 1987, restoration of the 1.3-mile long Haulover Park (R20-R26.7) was completed using 235,000 cy of sand from an offshore borrow area. The project restored a 50-foot-wide beach berm at elevation +8.2 ft NGVD. In 2002, the first nourishment of the project was deferred based upon monitoring surveys that indicated additional beach fill was not needed at that time.

In 1988, restoration of Sunny Isles (R7-R20) was constructed using sand from an offshore borrow area. The project restored a 20-foot-wide beach berm at elevation +8.2 ft NGVD. Additional fill material equivalent to ten years of advance nourishment was placed seaward of the design berm. The loss of fill material spreading into Golden Beach required interim nourishment of northern Sunny Isles in 1994, but the project was delayed until 1997 following settlement of a legal challenge to the federal environmental authorization. Overall, the project has met performance expectations, except for the loss of beach fill at the north end of the project area. Nourishment was completed in December 2001 and a submerged nearshore breakwater was constructed at R7 in February 2002 to improve the longevity of the project. Truck haul nourishment was conducted in 2009 in Sunny Isles using an upland sand source.

The [USACE](#) completed a Limited Re-evaluation Report (LRR) and a National Environmental Policy Act (NEPA) Environmental Assessment in 2016 to utilize upland mined sand and Outer Continental Shelf sand for the Sunny Isles project area. Permitting, design and construction utilizing upland sand are scheduled for the fall of 2017 and expected to be completed by the spring 2018.

Table 15. Sunny Isles and Haulover Park Beach Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
1955 to 1959	418,214	Baker’s Haulover Inlet	R19–R26	1.4

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
1960	180,000	Offshore	R19-R26	1.4
1978	300,000	Offshore	R20-R26	1.1
1980	43,163	Baker's Haulover Inlet flood shoal	R19-R26	1.4
1984	35,000	Baker's Haulover Inlet flood shoal	R19-R26	1.4
1987	235,000	Offshore	R19-R26	1.4
1988	1,320,000	Offshore	R7-R20	2.5
1990	32,000	Baker's Haulover Inlet ebb shoal	R7-R9	0.4
1994	24,560	Baker's Haulover Inlet	R20-R25	0.9
July 1997	80,000	Offshore	R7-R10	0.6
1997	9,000	Upland	R7-R8 & R10 & R16	0.3
2001-2002 ¹	737,152	Offshore	R7-R19	2.4
July 2009	10,000	Upland	R7-R10.5	0.6
March 2014	35,000	Baker's Haulover Inlet AIWW	R12-R16	0.8
2015	2,600	Upland	R7-R9	0.4

¹ The volumes for Sunny Isles in 2001/2002 includes placement of 704,353 cy between R7-R19, with an additional amount of 2,799 cy placed northward to R6 for a 1000' taper into Golden Beach and an additional 30,000 cy placement along R7 to R8.5 following a 30-day stabilization period of the salient behind the newly constructed breakwater.

Strategy: Maintain the project through monitoring and nourishment.

BAKER'S HAULOVER INLET, MIAMI-DADE COUNTY, R26-R27

The entrance channel depth is -11 ft MLW at **Baker's Haulover Inlet**, a man-made inlet within a federally-maintained navigation project. Extension of the south jetty was completed in 1975 during the Bal Harbour nourishment. Sand tightening and extension of the north jetty was completed in December 1986. Maintenance dredging of the navigation channel and the flood shoal has been conducted

periodically and the material placed on the adjacent beaches. The Department adopted the [Baker's Haulover Inlet Management Study Implementation Plan](#) in September 1997, but a specific volume of sand as an average annual bypassing objective was not established. The county is planning to complete an inlet management study by the summer of 2018 with the intent of updating the sediment budget and inlet management plan.

Strategy: Place all beach compatible maintenance dredging material on adjacent beaches in areas of greatest need; update the sediment budget and the inlet management plan.

BAL HARBOUR, MIAMI-DADE COUNTY, R27-R31

This is a 0.75-mile segment of critically eroded beach from Baker's Haulover Inlet to Surfside municipal boundary. Beach restoration was completed for the segment as part of the federally-authorized **Miami-Dade County Shore Protection Project**. The project is authorized until 2025, and the project history for this segment of shoreline is described in Table 16.

In 1975, restoration at Bal Harbour (R27-R31) was completed by the local government on a federal reimbursement basis. The project included restoration of a 20-foot-wide dune at elevation +10.7 ft NGVD and a 50-foot-wide level berm at elevation +8.2 ft NGVD. Additional fill material equivalent to ten years of advance nourishment was placed seaward of the design berm. Though nourishment of several areas of the initial project was conducted between 1987 and 1990, the overall project has exceeded performance expectations. Nourishment of discreet segments of the project was conducted between 1997 and 2001 with subsequent full nourishments in 2003 using offshore material. The 2014 nourishment event (USACE Contract G) was completed using dredge material from the Baker's Haulover ebb shoal.

The USACE completed a Limited Re-evaluation Report (LRR) and a National Environmental Policy Act (NEPA) Environmental Assessment in 2016 to utilize upland mined sand and Outer Continental Shelf sand for the Bal Harbor project area.

Table 16. Bal Harbour Segment, Miami-Dade County Shore Protection Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
1960	86,000	Offshore	R27-R31	0.8
1961-1964	83,000	Offshore	R27-R31	0.8

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
1968-1969	136,000	Offshore	R27-R31	0.8
July 1975	1,625,000	Offshore	R27-R31	0.8
1990	225,000	Offshore	R27-R31	0.8
1998	282,852	Bakers Haulover Inlet & flood shoal	R28-R31	0.6
2002	35,000	Offshore	R27-R31	0.8
2003	188,000	Bakers Haulover Inlet ebb shoal	R27-R31	0.8
2007	30,000	AIWW	R27-R31	0.8
2009	15,000	Upland	R27-R28.8	0.34
2010	33,080	AIWW	Unknown	Unknown
2014	235,733	Bakers Haulover Inlet ebb shoal	R27-R31	0.8
December 2017	37,000	AIWW	Unknown	0.2

Strategy: Maintain the project through monitoring and nourishment; transfer sand from accreted beaches in areas of greatest need.

SURFSIDE, MIAMI-DADE COUNTY, R31-R38

This is a 1.3-mile segment of critically eroded beach from the southern boundary of Bal Harbour to Miami Beach municipal boundary. Beach restoration was completed for the segment as part of the federally-authorized **Miami-Dade County Shore Protection Project**, and the project history for this segment of shoreline is described in Table 17. The restoration of the federally-authorized Miami-Dade County Shore Protection Project at Surfside (R31-R38) was completed in January 1978 using sand from offshore borrow sites. The project included restoration of a 20-foot-wide dune at elevation +10.7 ft NGVD and a 50-foot-wide level berm at elevation +8.2 ft NGVD. Additional fill material equivalent to ten years of advance nourishment was placed seaward of the design berm. Though nourishment of several areas of the initial project was conducted between 1987 and 1990, the overall project has

exceeded performance expectations. Nourishment of discreet segments of the project was conducted between 1997 and 2001.

The USACE completed a Limited Re-evaluation Report (LRR) and a National Environmental Policy Act (NEPA) Environmental Assessment in 2016 to utilize upland mined sand and Outer Continental Shelf sand for the Surfside project area. The next nourishment is scheduled for 2018/2019 by placing approximately 120,000 cy of material within the Surfside Segment.

Table 17. Surfside Segment, Miami-Dade County Shore Protection Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
August 1978	2,640,000	Offshore	R31-R38	1.5
August 1999	590,000	Offshore	R32-R36	0.8
April 2014	12,800	Upland	R32-R36	0.8

Strategy: Maintain the project through monitoring and nourishment; transfer sand from accreted beaches in areas of greatest need.

MIAMI BEACH, MIAMI-DADE COUNTY, R38-R74.4

This is a 7.35-mile segment of critically eroded beach from the southern boundary of Surfside to Government Cut, within the municipal boundary of Miami Beach. Beach restoration was completed for this segment as part of the federally-authorized **Miami-Dade County Shore Protection Project**, and the project history for this segment of shoreline is described in Table 18.

The restoration of the remaining federally-authorized Miami-Dade County Shore Protection Project at Miami Beach (R38-R74) began in 1978 and was completed in January 1982 using sand from offshore borrow sites. The project included restoration of a 20-foot-wide dune at elevation +10.7 ft NGVD and a 50 ft wide level berm at elevation +8.2 ft NGVD. Additional fill material equivalent to ten years of advance nourishment was placed seaward of the design berm. Though nourishment of several areas of the initial project was conducted between 1987 and 1990, the overall project has exceeded performance expectations. Nourishment of discreet segments of the project was conducted between 1997 and 2001.

The performance of the beach fill along the segment of shore north of 32nd Street, Miami Beach has not maintained the design beach width. Erosion by storm waves and tides is exacerbated by the seaward

encroachment of the upland development relative to the adjacent shore. A 1994 nourishment project, interrupted by a legal challenge to the federal environmental authorization, was completed in 1997. In order to improve the longevity of the beach fill and maintain the design beach width of the project, three shore-attached breakwaters were constructed at 32nd Street (R59-R60) during May-July 2002. Concurrently, transfer via truck-haul was completed using 125,000 cy of sand from south Miami Beach (R67-R72) to the breakwater site and to a hotspot erosional area (R53.5-R56). In 2005 and 2007, approximately 35,000 and 30,000 cy of sand respectively were placed via truck haul downdrift of the structures (R60-R61).

The performance of the beach fill along the segment of shore located near 55th Street, Miami Beach and 44th Street, Miami Beach has not maintained the design beach width. Erosion by storm waves and tides is exacerbated by the seaward encroachment of the upland development relative to the adjacent shore. During 2006, the county truck hauled and placed approximately 30,000 cy of sand at the 55th Street segment (R48.7-R50.7) and placed approximately 50,000 cy of sand at the 44th Street segment (R53.7-R55.5).

In 2007, a sand transfer project was completed to excavate sand from the accretional beach at Lummus Park (R67-R72) and pump it north for placement between R53.5-R56. The sand transfer event was followed by a truck haul event in 2009 as an interim measure preceding the federal nourishment. Sand from an upland mine was placed in recurrent hotspots at 55th and 44th Streets and a new hotspot at 67th Street (R43-R44.5). A total of 23,000 cy of sand was placed.

In March of 2011, DEP issued a joint coastal permit for the construction of the federal Contract E project. The permit authorized placement of sand from an offshore source onto the Miami Beach segment from R37.75-R46.25. The permit again authorized sand transfer from the dry sandy beach at Lummus Beach Park to hotspot locations at R53.7-R55.5 and R60-R61.1. Placement of the offshore material was completed in April of 2012 with 206,042 cy of material placed. Transfer of material from Lummus Park was completed in September of 2012 with a total of 141,159 cy of material placed.

In June 2003, the Army Corps of Engineers selected a conceptual design through its innovative erosion control technology program (Section 227) for a Submerged Artificial Reef Structure to be located at 63rd Street, Miami Beach (R46). DEP issued a Notice of Intent to issue a Joint Coastal Permit for the construction of the **Reefball Breakwater Structures**, known as Contract H, in November 2011 and federal funding has been secured for initial construction of the reef modules. Installation of the modules is pending upon future federal appropriations, but is anticipated in 2017.

The [USACE](#) has completed a Limited Re-evaluation Report (LRR) and a National Environmental Policy Act (NEPA) documentation in 2016 to utilize upland and Outer Continental Shelf sand for the Miami Beach project area. A truck haul nourishment was completed in March 2017 and placed 233,330 cy in two project segments at 55th street area (R48.7-R50.7) and 46th street area (R53.7-R55.5). The next truck haul beach nourishment is scheduled for 2019/2020.

Table 18. Miami Beach Segment - Miami-Dade County Erosion Control Project history.

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
August 1979	1,530,000	Offshore	R38-R46	1.5
October 1980	3,177,100	Offshore	R46-R59	2.4
December 1981	2,200,000	Offshore	R59-R66	1.4
January 1982	2,400,000	Offshore	R66-R74	1.9
1985	110,000	Offshore	R42-R46	0.8
1985	50,000	Offshore	R57-R60	0.6
September 1994	122,096	Offshore	R54-R57	0.2
1994	30,000	Upland	R54-R59	0.4
1996	8,000	Sand Transfer from R59-R60	R54-R60	0.8
July 1997	479,069	Offshore	R53-R58	1.0
1997	35,000	Upland	R54-R56	0.4
1997	50,000	Upland	R57-R59	0.4
1998	18,000	Upland	R44-R45	0.2
August 1999	132,000	Offshore	R73-R74	0.3

Date Completed	Volume (cy)	Source	Project Location (by R monument)	Length (mi)
2001-2002	167,662	Offshore	R44-R46.5A	0.4
2002	125,000	Sand Transfer from R59-R60	R53.5-R56 and R60-R61	0.7
2005	35,000	Upland	R60-R61	0.2
2006	30,000	Upland	R48.7-R50.7	0.4
2006	50,000	Upland	R53.7-R55.5	0.4
December 2007	30,000	Upland	R60-R61	0.2
2007	70,000	Sand Transfer from R67-R72	R43-R45	0.4
2009	10,000	Upland	R43-R44.5	0.29
2009	10,000	Upland	R48.7-R50.7	0.38
2009	3,000	Upland	R53.7-R55.5	0.34
2012	206,042	Offshore	R37.75-R46.25	1.6
2012	141,159	Sand Transfer from Lummus Park (R64-R71).	R53.7-R55.5 R60-R61.1	0.55
2013	6,296	Upland	Unknown	Unknown
2014	31,365	Upland	Unknown	Unknown
May 2015	19,259	Upland	R53.7-R55.5	0.34
March 2017	233,330	Upland	R48.7-R50.7 and R53.7-R55.5	0.72

Strategy: Maintain the project through monitoring and nourishment; transfer sand from accreted beaches in areas of greatest need.

GOVERNMENT CUT, MIAMI-DADE COUNTY, R74 – R75

Government Cut, a man-made inlet that is part of the federally authorized **Miami Harbor Navigation Project**, is the entrance to the Port of Miami. The navigation channel depth in Government Cut is -44 ft MLW. In 1983, the sand tightening of 1,200 ft of the seaward end of the north jetty was completed. In 1999, the remainder of the north jetty was sand tightened. The inlet channel and jetties act as a barrier to littoral sand transport to the downdrift beaches south of the inlet by trapping sand in the channel or deflecting it offshore. Net southerly littoral drift arriving at Government Cut has been estimated to range from 24,000 cy per year to 49,000 cy per year. The low longshore transport rate and long jetties, coupled with sand transfer from the Lummis Park beach, have prevented significant shoaling of the navigation channel. Maintenance dredging is not frequent, but has coincided with channel deepening projects. The dredged material from deepening of the exterior and interior navigation channels and expansion of the turning basin has been used to create spoil islands that now contain residential or port facilities.

Strategy: Place all beach-compatible dredged material from maintenance of the navigation channel on the adjacent beaches.

REGIONAL STRATEGIES FOR BEACH AND INLET MANAGEMENT

SPONSORS AND FUNDING

The Broward County Shore Protection Project was authorized in 1965 for federal participation in beach erosion control for the entire county in three designated segments. The local sponsor is [Broward County](#). The project provides for a navigation feature at [Hillsboro Inlet](#), which is inactive due to the non-federal improvements to the inlet. Segment I (R1-R24, north county line to Hillsboro Inlet) has not been constructed under the federal authorization. In 1996, extension of federal participation in Segment II (R25-R85) and Segment III (R86-R128) was approved for fifty years following the date of initial beach restoration to 2020 and 2026, respectively. The local-state sponsors are authorized to design, permit and construct the project, then seek reimbursement of the federal cost-share.

The Miami-Dade County Beach Erosion Control and Hurricane Protection Project was authorized in 1968 for federal participation in shore protection projects from Haulover Beach Park (R20) through Miami Beach to Government Cut (R74). In 1985-1986, Sunny Isles was included in the authorized project and is federally authorized until 2038 while the Miami-Dade portion of the project is federally

authorized until 2025. The local sponsor is [Miami-Dade County](#). Design, permitting and construction are conducted by the [USACE](#) with reimbursement or advance payment by the local and state sponsors. Project cost estimates may be found in the [Beach Management Funding Assistance Program - Long Range Budget Plan](#).

PROJECT COORDINATION

Regionalization is the funding and coordination of multiple nourishment and inlet management activities to take advantage of identifiable cost savings through economies of scale, reduced equipment mobilization and demobilization costs, and elimination of duplicative administrative tasks.

Opportunities in this subregion include:

1. Broward County is attempting to implement this concept through contracting the construction of the next nourishment activities at three different segments of beach.
2. In Miami-Dade County, nourishment has been routinely conducted for different segments of beach under a single construction contract. Previous maintenance dredging material from Bakers-Haulover Inlet has been placed on the beach. In the future, the schedule of maintenance dredging should be coordinated with the need for nourishment.
3. Coordination with the USACE and Port of Miami and Port Everglades to minimize beach impacts of proposed Port improvements.

ENVIRONMENTAL PROTECTION

The protection of marine turtles, hardbottom and coral reef habitat, and seagrass beds are primary environmental concerns within this subregion. The timing of construction is restricted during the marine turtle nesting season of March 1 through October 31 in Broward County north of Port Everglades. In south Broward and Miami-Dade County, projects have been approved for construction during the nesting season. Project design and method of construction are restricted in order to avoid or minimize adverse impacts to marine turtles and hardbottom and reef habitat. Mitigation is required to offset permitted impacts to nearshore hardbottom caused by the restoration projects in Broward County and a county-wide physical and environmental monitoring program is conducted to identify potential impacts to hardbottom and reef communities. Miami-Dade County conducts a county-wide marine turtle monitoring and protection program. Bakers-Haulover Inlet and Government Cut are located within the limits of the [Biscayne Bay Aquatic Preserves](#). Projects located within and near the aquatic preserve

boundaries require additional protection, including more stringent water quality standards than in non-aquatic preserve waters, during permitting and construction to ensure preservation of the existing conditions.

SAND SOURCES

Since there are limited sand resources existing in State waters in Southeast Florida, the Department and the USACE completed the [Sediment Assessment and Needs Determination \(SAND\) study](#). This study was conducted in a collaborative manner and was reviewed by and vetted through all the participating stakeholders. The SAND study indicates that the regional offshore supply of sand in state and federal waters is more than adequate to meet the needs of all the beach nourishment projects in the five southeastern coastal counties, St. Lucie, Martin, Palm Beach, Broward, and Miami-Dade, for the next 50 years (year 2062), according to Ousley et al. (2014). Subsequently, the Department analyzed the need for sand over the next 10 to 20 years for the five southeastern counties and determined that approximately 20 to 30 million cy will be needed for beach nourishment projects. Due to the narrow continental shelf adjacent to Florida's southeastern shoreline, it is expected that some counties may need to look for sand resources in upland sand mines and/or offshore borrow sites in neighboring counties; Miami-Dade County has already initiated this process. The [USACE](#) has completed a Limited Re-evaluation Report (LRR) and a National Environmental Policy Act (NEPA) documentation in 2016 to utilize upland and Outer Continental Shelf sand for the Miami Beach project area.

Coordination is recommended between the Department, the [USACE](#), [BOEM](#) and Local Governments to use best management practices with these offshore resources. For additional information on sand sources, the Department manages a database named the [Regional Offshore Sand Source Inventory \(ROSSI\)](#).

Miami-Dade County is investigating the use of non-domestic sand sources (Bahamian) as a potential source of material for their beach projects.

ADDITIONAL INFORMATION

The introduction of the state's Strategic Beach Management Plan provides additional background information on the Department's Beach Management Programs and includes overviews of:

- The principals and statutes followed to help guide the state's management strategies

- Comprehensive list of Florida's inlets
- The miles of critically eroded beaches under active management
- Statewide sand source studies
- Statewide monitoring programs
- Innovative technologies examined
- Basic suggestions for emergency response plans

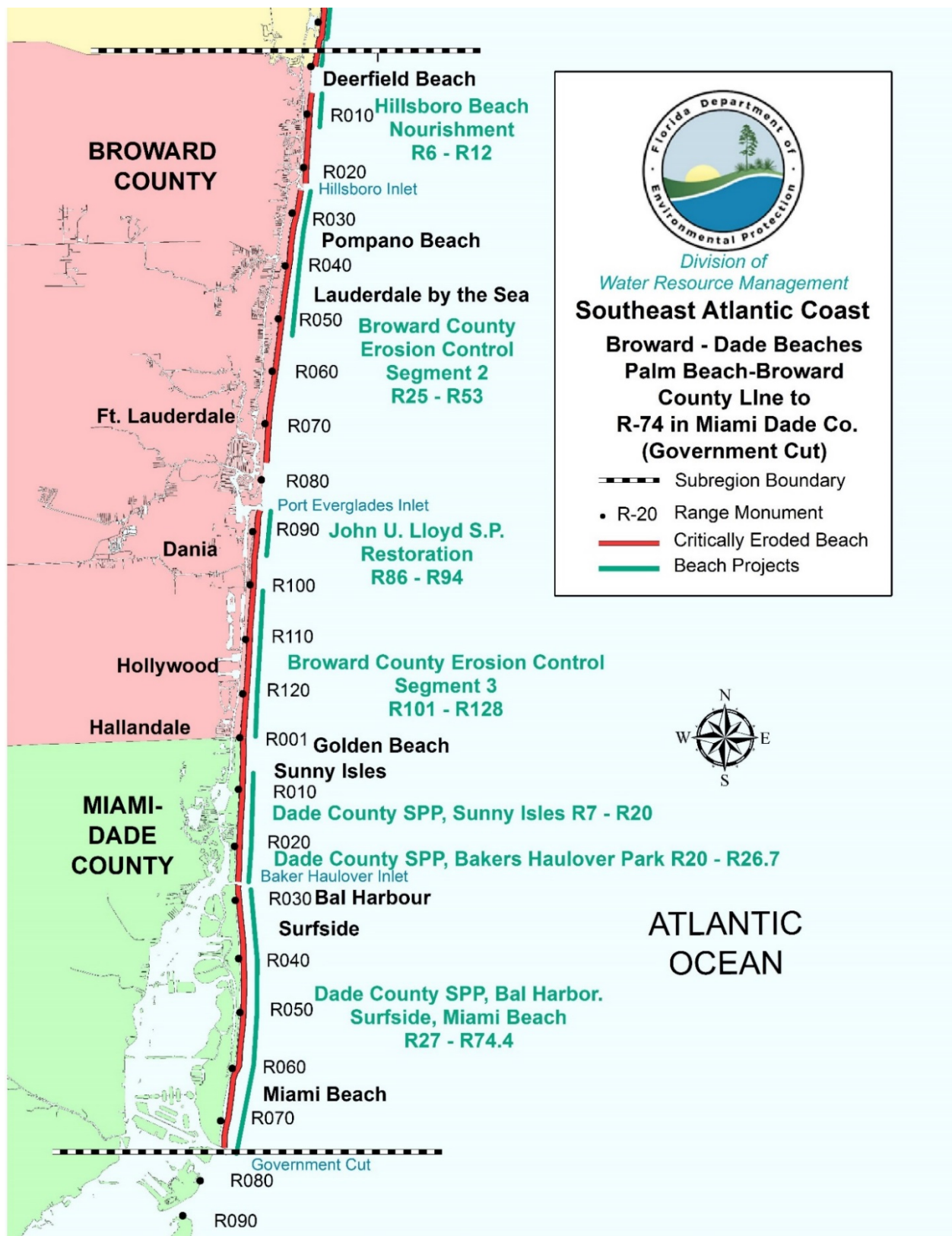


Figure 4. Map of Broward and Miami-Dade Beaches subregion. View an [interactive map](#) or [COASTS imagery](#).

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SOUTHERN BARRIERS

There are 6.4 miles of beaches in the **Southern Barriers** subregion, which extends from Fisher Island (R75) to Cape Florida (R113), as shown on Figure 5. The area includes Fisher Island, Virginia Key, and Key Biscayne, which are separated by Norris Cut and Bear Cut and from the mainland by Biscayne Bay. There are 2.5 miles of critically eroded beaches in this subregion on Key Biscayne, all of which are restored.

Erosion is attributed to occasional tropical storms and hurricanes, the downdrift influence of shore protection structures, and the effects of the inlets. The most erosive storms in recent years were Hurricane Andrew (1992) and Hurricane Rita and Wilma (2005) and Subtropical Storm Andrea, October northeasters (2007), Tropical Storm Noel (2007), Hurricane Matthew (2016) and Hurricane Irma (2017).

STRATEGIES FOR INLETS AND CRITICALLY ERODED BEACHES

NORRIS CUT (R78-R79) AND BEAR CUT (R88-R89), MIAMI-DADE COUNTY

Norris Cut and Bear Cut are stable, natural coastal inlets. Navigational dredging has not been conducted at Norris Cut and Bear Cut, although terminal groins have been constructed on Norris Cut to stabilize beaches on Fisher Island and Virginia Key, and two separate groin fields have been installed along the Bear Cut shoreline of Virginia Key.

The federally-authorized **Virginia Key Beach Erosion Control Project** (R79-R88) restored a 50-foot wide beach berm at elevation +6 ft MLW along 1.3 miles of the beach using 176,800 cy of sand obtained from an offshore borrow area in 1969. Groins were constructed and 110,000 cy of beach compatible dredged material from Government Cut was placed between R79 and R84 in April 1974. Timber groins (R84-R87) were constructed along the Bear Cut inlet shore of Virginia Key, some in 1948 and the remainder in 1956. Dade County installed concrete pilings and wood panel groins on the inlet shore of southern Virginia Key fronting Bear Cut in 1965. The rehabilitation of the existing groins, construction of three additional groins, and placement of a small amount of beach fill placed by truck from an existing stockpile was completed in 2003. This project is not located within the bounds of a critically eroded beach but is described here as a previous beach management project near the critically eroded beaches.

A privately funded beach erosion control project on **Fisher Island** (R75-R78) was constructed in 1991. The project consisted of the placement of 25,000 cy of imported oolitic aragonite sand and construction

of eight rock T-head groins. This project is not located within the bounds of a critically eroded beach but is described here as a previous beach management project near the critically eroded beaches.

KEY BISCAIYNE, MIAMI-DADE COUNTY R101-R113

This is a 2.5-mile segment of critically eroded beach that includes the Village of Key Biscayne and Bill Baggs-Cape Florida State Park. Beach restoration has been conducted, and the project history for this segment of shoreline is described in Table 19.

The federally authorized **Biscayne Beach Erosion Control Project** was constructed at Crandon Park on northern Key Biscayne in conjunction with the Virginia Key project in 1969. The project restored a 50-foot-wide berm at elevation +7 ft NGVD along two segments of shore (R92.5-R96, R99-R101) using 196,300 cy of sand from a borrow area located immediately offshore.

Under the provisions of the 1965 Rivers and Harbors Act, the **Key Biscayne Shore Protection Project** was federally authorized in 1985. The federal Key Biscayne Shore Protection Project (R101-R113.7) restored 2.4 miles of beaches (excluding a gap at R111-R112.3) using 420,000 cy of sand from an offshore borrow area located one mile southeast of Cape Florida in 1987. The project restored a 25-foot-wide berm at the Village of Key Biscayne and a 20-foot-wide berm at Cape Florida State Park, both at an elevation of +7 ft MLW, and provided additional beach fill equivalent to seven years of advance nourishment. A terminal groin was also constructed at the south end of Bill Baggs Cape Florida State Park (R113.7). The project met its performance expectations by preserving a beach through the seven-year nourishment interval. Damage caused by Hurricane Andrew to the terminal groin and adjacent revetment protecting the Cape Florida Lighthouse was repaired in 1994. The federal project was deauthorized in 1990.

A non-federal beach nourishment project at **Village of Key Biscayne** (R101-R108) was completed along 1.3 miles of beaches using 121,000 cy of sand from an offshore borrow site approximately 4,000 ft offshore from the southern tip of Key Biscayne in August 2002. The beach fill has a construction berm width of 35 ft at elevation +7 ft NGVD. A physical and environmental monitoring program was conducted to verify avoidance of impacts to nearshore seagrass beds.

Significant erosion was sustained in 2005 along Key Biscayne from Hurricanes Rita and Wilma. In addition, the seawall and revetment protecting the Cape Florida Lighthouse was damaged by Wilma. The Village nourished portions of the dune in 2008 using an upland sand source. The next nourishment

of the project shoreline between R101+300 and R107+600 was completed in 2012 using 37,500 cy of sand from an upland sand source. Due to Hurricane Matthew, nourishment was completed in May 2017 with placement of 27,064 cy of upland material on the beach between R101.7 and R107.8. The Village has begun a beach management feasibility study in 2017 to determine a more prudent path forward in combating beach erosion. The next beach nourishment is scheduled for 2019.

Table 19. Key Biscayne Beach Nourishment Project history.

Date Completed	Volume (cy)	Borrow Source	Project Location (by R Monument)	Length (mi)
1969	196,300	Offshore	R92.5-R96 and R99-R101	1.0
1987	420,000	Offshore	R101-R113.7	2.4
2002	121,000	Offshore	R101-R108	1.3
2008	2,400	Upland	R103-R107	0.75
2012	37,500	Upland	R101.3-R107.6	1.2
May 2017	27,064	Upland	R101.7-R107.8	1.2

Strategy: Maintain the project through monitoring and nourishment.

REGIONAL STRATEGIES FOR BEACH AND INLET MANAGEMENT

SPONSORS AND FUNDING

In 1962, a federally authorized shore protection project by the [USACE](#) was approved for 1.8 miles of beaches on Virginia Key and 1.9 miles of beaches on northern Key Biscayne. The project was authorized for ten years from completion of initial construction, which occurred in 1969. In 1985, under the provisions of the 1965 Rivers and Harbors Act, nourishment of 2.3 miles of beaches on southern Key Biscayne and construction of a terminal groin was federally authorized. The project was de-authorized in 1990. The local sponsor was [Miami-Dade County](#). Subsequent activities on Virginia Key have been sponsored by the [City of Miami](#), owner of the island. The [Village of Key Biscayne](#) was the local sponsor since the 2002 nourishment. Project cost estimates may be found in the [Beach Management Funding Assistance Program - Long Range Budget Plan](#).

PROJECT COORDINATION

Regionalization is the funding and coordination of multiple nourishment and inlet management activities to take advantage of identifiable cost savings through economies of scale, reduced equipment mobilization and demobilization costs, and elimination of duplicative administrative tasks.

Coordination of nourishment at Key Biscayne with other projects in the area may not be practical because a pipeline dredge is used for this project and a hopper dredge is used for other projects in the area. When future maintenance dredging of Government Cut is required, then placement of beach compatible sand on the beach of Key Biscayne should be considered.

ENVIRONMENTAL PROTECTION

The protection of marine turtles, shorebirds and seagrass beds are primary environmental concerns within this subregion. Project design and method of construction are restricted to avoid or minimize adverse impacts to marine turtles and seagrass beds; however, construction of the Key Biscayne project during the marine turtle nesting season has been approved. Norris Cut and Bear Cut are located within the limits of the [Biscayne Bay Aquatic Preserves](#). Projects located within and near the aquatic preserve boundaries require additional protection, including more stringent water quality standards than in non-aquatic preserve waters, during permitting and construction to ensure preservation of the existing conditions.

SAND SOURCES

Upland sand has been identified and permitted as an alternative to offshore sand for the Key Biscayne Project. For additional information on sand sources, the Department manages a database named the [Regional Offshore Sand Source Inventory \(ROSSI\)](#).

ADDITIONAL INFORMATION

The introduction of the state's Strategic Beach Management Plan provides additional background information on the Department's Beach Management programs, including overviews of:

- The principles and statutes followed to help guide the state's management strategies
- Comprehensive list of Florida's inlets
- The miles of critically eroded beaches under active management

- Statewide sand source studies
- Statewide monitoring programs
- Innovative technologies examined
- Basic suggestions for emergency response plans

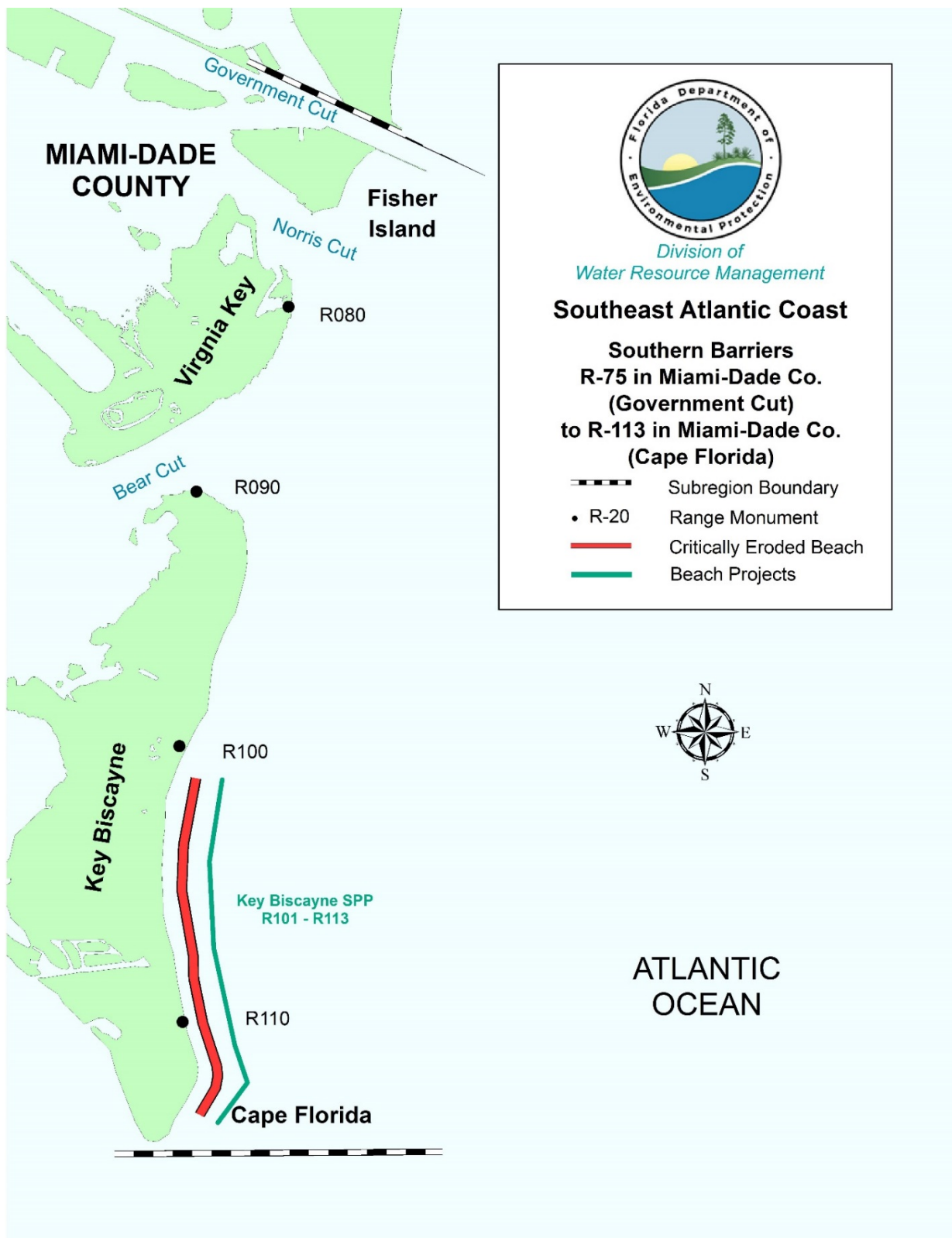


Figure 5. Map of Southern Barriers subregion of the Southeast region of Florida. View an [interactive map](#) or [COASTS imagery](#).

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APPENDIX - ACRONYMS

Acronyms associated with the Florida Department of Environmental Protection’s Strategic Beach Management Plan:

Coastal Associations Acronyms:

- ASBPA – American Shore & Beach Preservation Association
- FSBPA – Florida Shore & Beach Preservation Association
- DCA – Dredging Contractors of America

Federal Agencies Acronyms:

- BOEM – Bureau of Ocean Energy Management
- CBRA – Coastal Barrier Resources Act
- CHL – Coastal and Hydraulics Laboratory
- CIRP – Coastal Inlets Research Program
- CMS – Coastal Modeling System
- CSRSM – Coastal Storm Risk Management
- CZMA – Coastal Zone Management Act
- EA – Environmental Assessment
- EIS – Environmental Impact Statement
- ERDC - Engineer Research and Development Center
- FCCE – Flood Control and Coastal Emergency
- FEMA – Federal Emergency Management Agency
- FRF – Field Research Facility
- GRR – General Reevaluation Report
- HSDR – Hurricane and Storm Damage Reduction
- LPP – Locally Preferred Plan
- LRR – Limited Reevaluation Report
- MMP – Marine Minerals Program
- NGVD 29 – National Geodetic Vertical Datum of 1929
- NAVD 88 – National American Vertical Datum of 1988
- NPS – National Park Service
- NWF – National Wildlife Refuge

- NEPA – National Environmental Policy Act
- NOAA – National Oceanic and Atmospheric Administration
- NHC – National Hurricane Center
- NWF – National Wildlife Refuge
- ODMDS - Ocean Dredge Material Disposal Site
- OCS – Outer Continental Shelf
- RSM – Regional Sediment Management
- SAJ – South Atlantic District, Jacksonville
- SPP – Shore Protection Project
- SLC – Sea Level Change
- SLR – Sea Level Rise
- TSP – Tentatively Selected Plan
- USACE – United States Army Corps of Engineers
- USFWS – United States Fish and Wildlife Service
- WRDA – Water Resources Development Act

State Agencies Acronyms:

- AIWW - Atlantic Intracoastal Waterway
- BCS – Beaches and Coastal Systems
- BIP – Beaches, Inlets and Ports Program
- BMA – Beach Management Agreement
- BMFA – Beaches and Mines Funding Assistance Program
- BMP – Best Management Practices
- BSM – Bureau of Survey and Mapping
- CCCL – Coastal Construction Control Line
- COASTS – Collection of Aerials and Shoreline Trends Systems
- DEP – Department of Environmental Protection
- DMMA – Dredge Material Management Area
- DSL – Division of State Lands
- DWRM – Division of Water Resource Management
- ECL – Erosion Control Line
- EOC – Emergency Operation Center

- FAC – Florida Administrative Code
- FAR – Florida Administrative Register
- FDEM – Florida Department of Emergency Management
- FDFS – Florida Department of Financial Services
- FDOT – Florida Department of Transportation
- FHCF - Florida Hurricane Catastrophe Fund
- FIND – Florida Inland Navigation District
- FPS – Florida Park Service
- FS – Florida Statutes
- FWC – Florida Wildlife Commission
- IMP – Inlet Management Plan
- IWW – Intracoastal Waterway
- JCP – Joint Coastal Permit
- LABINS – Land Boundary Information System
- LGFR – Local Government Funding Request
- LRBP – Long Range Budget Plans
- MHWL – Mean High Water Line
- MLLW – Mean Lower Low Water
- MLW – Mean Low Water
- MOA – Memorandum of Agreements
- MOU – Memorandum of Understandings
- OCULUS – DEP’s Electronic Document Management System
- OGC – Office of General Counsel
- R – Range or Reference Survey Monument/ Survey Marker
- ROSSI – Regional Offshore Sand Source Inventory
- SAND – Sediment Assessment and Needs Determination Study
- SBMP – Strategic Beach Management Plan
- SOP – Standard Operating Procedures
- SOW – Scope of Work
- TAC – Technical Advisory Committee
- TIITF – Trustees of the Internal Improvement Trust Fund
- WCIND – West Coast Inland Navigation District