

FINAL ORDER ADOPTING

ST. LUCIE INLET MANAGEMENT PLAN

WHEREAS on August 7, 1995, the Florida Department of Environmental Protection (Department) adopted the St. Lucie Inlet Management Study Implementation Plan, which established inlet sand bypassing objectives, calling for studies to modify jetties and expand the sediment basin, and calling for implementation of a comprehensive beach and offshore monitoring program and to revalidate the adopted sediment budget, and

WHEREAS the existing inlet protocol to bypass all beach compatible dredged material to downdrift beaches in eroded¹ areas was determined by the sediment budget developed in the study, *St. Lucie Inlet Management Plan* (ATM, 1995), which was conducted in partnership with Martin County, and

WHEREAS the sand bypassing objectives of the St. Lucie Inlet Management Study Implementation Plan directed the placement of the inlet maintenance dredging material on the Jupiter Island beaches south of the inlet, and

WHEREAS in 2008, the Florida Legislature amended Section 161.142, Florida Statutes, finding, “It is in the public interest to replicate the natural drift of sand which is interrupted or altered by inlets to be replaced and for each level of government to undertake all reasonable efforts to maximize inlet sand bypassing to ensure that beach-quality sand is placed on adjacent eroding beaches. Such activities cannot make up for the historical sand deficits caused by inlets but shall be designed to balance the sediment budget of the inlet and adjacent beaches and extend the life of proximate beach-restoration projects so that periodic nourishment is needed less frequently”, and

WHEREAS Martin County contracted with Applied Coastal Research and Engineering, Inc., to compile new and historical data and information regarding coastal processes and inlet and shoreline dynamics, and to update the inlet sediment budget as reported in *2014 Updated St. Lucie Inlet Sediment Budget* (Ramsey et al, 2014), and

¹ As used in this document, the term “erosion” means wearing away of land or the removal of consolidated or unconsolidated material from the coastal system by wind or wave action, storm surge, tidal or littoral currents or surface water runoff. As used in this document, the term “accretion” means the buildup of land or accumulation of unconsolidated material within the coastal system caused by wind and wave action, storm surge, or tidal or littoral currents. The description of coastal processes in this document are not intended to affect title to real property or real property boundaries.

WHEREAS the Department has developed an updated inlet management plan that contains corrective measures to mitigate the identified impacts of the inlet, and

WHEREAS, Martin County is the entity that is responsible for the maintenance dredging and sand bypassing at St. Lucie Inlet and therefore responsible for implementation of the updated inlet management plan, and

WHEREAS this updated inlet management plan is consistent with the Department's program objectives under Chapter 161, Florida Statutes,

THEREFORE:

The Department does hereby adopt the following implementation strategies, as set forth in the attachment, "St. Lucie Inlet Management Plan – 2015 Update," hereby incorporated by reference. Future inlet management activities shall be consistent with the following five strategies:

- 1) Continue the existing comprehensive beach and inlet hydrographic monitoring program** to evaluate performance and impact of existing bypassing and nourishment projects and to update and define the inlet sediment budget. Periodic additional bathymetric surveys shall be conducted of the ebb shoal and active flood shoals of the inlet.
- 2) Modify the inlet sand transfer protocol to permit the placement of inlet dredge material along the Atlantic beaches both to the north and to the south of the inlet** within designated critically eroded areas between R34.5 and R111. The quantity of allowable fill placement in each area shall be based upon observed erosion patterns and beach erosion quantities documented through the monitoring protocol of Strategy #1. The Town of Jupiter Island and the Bathtub Beach – Sailfish Point beach restoration projects shall be given first priority in the placement of inlet bypass material. In addition, the Peck's Lake area shall be prioritized for fill placement when necessary to mitigate the potential for a breach in the barrier during storm conditions. Bypassing quantities shall be accounted for by the net volume of material removed by the dredging contractor from the excavation/borrow areas, as determined by surveys or bin measurement, but may be supplemented with fill placement surveys when it is indicated that shoaling occurs during dredging.
- 3) The initial target bypassing quantities shall be the average annual placement of 161,000 cubic yards to the south and 34,000 cubic yards to the north.** These target quantities shall be updated based upon a minimum of five years of monitoring and a more definitive determination of the sediment gains and losses within the ebb shoal and active flood shoals. These target bypassing quantities shall not be considered limitations upon sediment material removal from the inlet system; the affected parties may be allowed to remove additional material as necessary to mitigate critical erosion consistent with Strategy #4.
- 4) Material excavated from the inlet system, including the sediment impoundment basin, the federal navigation channel and transition area, the Sailfish Point Marina channel and the inlet's ebb, flood and interior shoals, shall generally be the source of sediment for meeting the target bypassing quantities in Strategy 3.** The bypassing of material from the

sediment impoundment basin and other inlet areas to the Jupiter Island beaches shall be conducted in a quantity and at a frequency that meets or exceeds the target bypassing quantities in Strategy #3. Sand transfer from the basin to Bathtub Beach and Sailfish Point may also be conducted; however, the volume of excavation cannot result in a deficit of sand bypassing from the basin to Jupiter Island, unless permits and funding have been secured for an equivalent quantity of sand from an alternative location. Acceptable beach quality sand may be obtained from inland sand mines or offshore sources to supplement or facilitate these target bypassing quantities.

5) The nearshore placement of inlet dredge material shall generally not be conducted except for emergency dredging in the federal navigation channel only, and when placed in nearshore water depths less than -12 feet (MLW). Nearshore placement of material excavated from the impoundment basin is not recommended; however, the offshore placement of material into a future borrow site or holding area may be conducted. Nearshore placement shall not be included in meeting the target bypassing quantities of Strategy #3.

Inlet management actions that implement the five strategies contained in this plan are subject to further evaluation, and subsequent authorization or denial, as part of the Department's permitting process. Activities that implement these adopted strategies shall be eligible for state financial participation pursuant to Section 161.143, Florida Statutes, subject to Department approval and an appropriation from the Florida Legislature. The level of State funding shall be determined based upon the activity being conducted and the Department's applicable statutes and rules. The Department may choose not to participate financially if the proposed method of implementation is not cost effective or fails to meet the intent of Section 161.142, Florida Statutes, and the adopted inlet management strategies. Nothing in this plan precludes the evaluation and potential adoption of other strategies for the effective management of St. Lucie Inlet and the adjacent beaches through further revision to that plan as may be properly adopted.

Execution of this Final Order constitutes agency action. Any person whose substantial interests will be determined or affected by the Final Order may petition the Department for a formal or informal administrative hearing pursuant to Section 120.569 or 120.57, Florida Statutes, as set forth in the attached Notice of Rights, to challenge the provisions of this Final Order.

APPROVED FOR ADOPTION



Frederick L. Aschauer, Jr.
Director, Division of Water Resource Management
Florida Department of Environmental Protection

1/8/16

Date

FILING AND ACKNOWLEDGEMENT

FILED, on this date with the designated Department Clerk, pursuant to
Section 120.52, F.S., receipt of which is hereby acknowledged.



Deputy Clerk

1/11/16

Date

NOTICE OF RIGHTS

The Department's proposed agency action shall become final unless a timely petition for an administrative hearing is filed under Sections 120.569 and 120.57, Florida Statutes, before the deadline for filing a petition. The procedures for petitioning for a hearing are set forth below.

A person whose substantial interests are affected by the Department's proposed action decision may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, Florida Statutes. The petition must contain the information set forth below and must be filed (received by the clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000. Petitions must be filed within twenty-one days of receipt of this written notice.

Under Rule 62-110.106(4), Florida Administrative Code, a person whose substantial interests are affected by the Department's action may request an extension of time to file a petition for an administrative hearing. Requests for extension of time must be filed (received by the clerk) with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, before the end of the time period for filing a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

Petitions filed by any persons other than those entitled to written notice under Section 120.60(3), Florida Statutes, must be filed within twenty-one days of publication of the notice or within twenty-one days of receipt of the written notice, whichever occurs first. Under Section 120.60(3), Florida Statutes, however, any person who asked the Department for notice of agency action may file a petition within twenty-one days of receipt of such notice, regardless of the date of publication.

The failure of any person to file a petition or request for extension of time within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, Florida Statutes, or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, Florida Administrative Code.

A petition that disputes the material facts on which the Department's action is based must contain the following information:

- (a) The name and address of each agency affected and each agency's file or identification number, if known;
- (b) The name, address, any e-mail address, and telephone number of the petitioner, if the petitioner is not represented by an attorney or qualified representative; the name, address, e-mail address, facsimile number, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes

during the course of the proceeding; and an explanation of how the petitioner's substantial interests will be affected by the determination;

- (c) A statement of when and how the petitioner received notice of the agency decision;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action;
- (f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

A petition that does not dispute the material facts on which the Department's action is based shall state that no such facts are in dispute and otherwise shall contain the same information as set forth above, as required by Rule 28-106.301, Florida Administrative Code.

Because the administrative hearing process is designed to formulate final agency action, the filing of a petition means that the Department's final action may be different from the position taken by it in this notice. Persons whose substantial interests will be affected by any such final decision of the Department have the right to petition to become a party to the proceeding, in accordance with the requirements set forth above.

Mediation under Section 120.573, Florida Statutes, is not available.

Once this decision becomes final, any party to the final agency action has the right to seek judicial review of it under Section 120.68, Florida Statutes, by filing a notice of appeal under Rule 9.110 of the Florida Rules of Appellate Procedure with the clerk of the Department in the Office of General Counsel, Mail Station 35, 3900 Commonwealth Boulevard, Tallahassee, Florida 32399-3000, and by filing a copy of the notice of appeal accompanied by the applicable filing fees with the appropriate district court of appeal. The notice of appeal must be filed within thirty days after this decision is filed with the clerk of the Department.

Table of Contents

Introduction.....	1
Statutory Responsibilities and Program Objectives.....	3
History of St. Lucie Inlet	4
Implementation of the Adopted Inlet Management Plan – 1995.....	8
1995 Sediment Budget (ATM, 1995)	11
Sediment Budget Analyses – 2000, 2006, and 2011 (USACE, 2000; Ramsey et al, 2006; 2011).....	13
Update 2014 Sediment Budget (Ramsey et al, 2014)	14
Additional 2014 Sediment Budget Analyses (Kriebel, 2014a; Kriebel, 2014b; Bodge, 2014)	17
Additional Comments on the Sediment Budget Analyses	18
Recommended Inlet Management Plan	20
Implementation Discussion.....	22
Implementation Strategy #1	22
Implementation Strategy #2	22
Implementation Strategy #3	22
Implementation Strategy #4	23
Implementation Strategy #5	23
References	24

ST. LUCIE INLET MANAGEMENT PLAN

2015 UPDATE

Introduction

Pursuant to Subsection 161.101(2), Florida Statutes, the Florida Department of Environmental Protection (Department) is the beach and shore preservation authority for the State of Florida. As part of the Departments' statewide beach management plan adopted pursuant to Section 161.161, Florida Statutes, the Department is adopting this inlet management plan for St. Lucie Inlet in Martin County, Florida (Figure 1). This plan updates an existing plan for St. Lucie Inlet to make the plan consistent with current statutes and observed erosion¹ conditions.

On August 7, 1995, the Department adopted the *St. Lucie Inlet Management Study Implementation Plan*. This plan was based upon recommendations and supporting data compiled in the study report, *St. Lucie Inlet Management Plan [Technical Report]* (Applied Technology and Management, Inc., 1995). The study was conducted in partnership with Martin County, under the provisions of Section 161.161, Florida Statutes, for the purposes of evaluating the erosive impact of the inlet on adjacent beaches, and to recommend corrective measures to mitigate identified impacts. ATM (1995) determined a net deficit to the Jupiter Island shoreline south of the inlet to be 173,000 cubic yards per year.

The adopted plan (FDEP, 1995) established inlet sand bypassing objectives and called for implementation of a comprehensive beach and offshore monitoring program. The sand bypassing objectives of the 1995 inlet management plan directed the placement of the inlet channel maintenance dredging material on the beaches south of the inlet and by dredging suitable material located within the inlet's interior shoals for beach placement on Jupiter Island. The plan also called for an investigation to modify the north jetty and expand the sedimentation basin. The *Strategic Beach Management Plan* (FDEP, 2008) further adopted a minimum average annual bypassing objective of 185,000 cubic yards to be placed at least 5,000 feet to the south of St. Lucie Inlet.

¹ As used in this document, the term "erosion" means wearing away of land or the removal of consolidated or unconsolidated material from the coastal system by wind or wave action, storm surge, tidal or littoral currents or surface water runoff. As used in this document, the term "accretion" means the buildup of land or accumulation of unconsolidated material within the coastal system caused by wind and wave action, storm surge, or tidal or littoral currents. The description of coastal processes in this document are not intended to affect title to real property or real property boundaries.



Figure 1. St. Lucie Inlet and vicinity (2009 aerial photo from Florida Department of Transportation).

In 2014, Martin County sponsored an update study of St. Lucie Inlet, to compile new and historical data and information regarding coastal processes, inlet and shoreline dynamics. In June 2014, *2014 Updated St. Lucie Inlet Sediment Budget* (Ramsey et al, 2014) was completed by Applied Coastal Research and Engineering, Inc., and developed an updated sediment budget for the inlet for the 12-year period between 2002 and 2014.

Statutory Responsibilities and Program Objectives

In 2008, the Florida Legislature amended Section 161.142, Florida Statutes, finding,

“It is in the public interest to replicate the natural drift of sand which is interrupted or altered by inlets to be replaced and for each level of government to undertake all reasonable efforts to maximize inlet sand bypassing to ensure that beach-quality sand is placed on adjacent eroding beaches. Such activities cannot make up for the historical sand deficits caused by inlets but shall be designed to balance the sediment budget of the inlet and adjacent beaches and extend the life of proximate beach-restoration projects so that periodic nourishment is needed less frequently.”

Pursuant to Section 161.143, Florida Statutes,

“Studies, projects and activities for the purpose of mitigating the erosive effects of inlets and balancing the sediment budget on the inlet and adjacent beaches must be supported by separately approved inlet management plans or inlet components of the statewide comprehensive beach management plan.”

Subsection 161.142(6), Florida Statutes, states, “The entity that is responsible for maintenance dredging of an inlet may be deemed responsible for the erosion caused by the inlet...”

On February 20, 1997, the Department issued Joint Coastal Permit No. 43-294982-9 to Martin County for the periodic maintenance dredging of the navigation channel, the sedimentation basin, and the inlet interior flood shoal. On April 18, 2001, the Department issued Joint Coastal Permit No. 0129368-002-JC to Martin County for 5 years authorizing a number of inlet improvement activities, including the excavation of the existing impoundment basin, extension of the south jetty, and elevation and sand tightening of the north jetty. On November 3, 2006, the Department issued Joint Coastal Permit No. 0269814-001-EM to Martin County for various inlet dredging and sand bypassing activities. On October 7, 2011 the Department issued Joint Coastal Permit Modification No. 0269814-006-JN to Martin County, which granted a two year statutory time extension, extending the expiration date of the

permit to February 20, 2014. On September 24, 2014, the Department issued an Intent to Issue Joint Coastal Permit No. 0269814-007-JC to Martin County for 15 years to conduct maintenance dredging of the St. Lucie Inlet navigation channel, sedimentation basin, and bypass sand to the beaches and dunes of Jupiter Island or to an offshore storage area. And on August 21, 2015, the Department issued an Intent to Issue Joint Coastal Permit No. 0326938-001-JC to Martin County and Sailfish Point Property Owner's and Country Club Association, Inc., for 15 years to conduct beach and dune restoration with future maintenance nourishment between R34.3 and R39.5 on southern Hutchinson Island at Bathtub Beach and Sailfish Point.

Martin County is the local sponsor of the federally-authorized St. Lucie Inlet Federal Navigation Project. In 1976, a Federal Project Cooperation Agreement was executed between the U.S. Army Corps of Engineers and Martin County identifying federal responsibility for maintenance dredging. The U.S. Army Corps of Engineers and Martin County have been the entities responsible for maintenance dredging of the inlet navigation channel and sedimentation basin and consequently, mitigating the extent of erosion caused by the inlet, as specified in Subsection 161.142(6), Florida Statutes.

History of St. Lucie Inlet

St. Lucie Inlet is located on the southeast Atlantic coast of Florida separating the barrier islands of Hutchinson Island to the north and Jupiter Island to the south (Figure 2). The inlet connects the Atlantic Ocean to several lagoon and estuarine tidal systems, including the Indian River Lagoon to the north, St. Lucie River to the west, and Hobe Sound and the Atlantic Intracoastal Waterway to the south.

The inlet was originally opened in 1892 by local residents seeking navigable access with the Atlantic Ocean. The initial cut was 30 feet wide and five feet deep, however, after six years, the inlet had widened by 1,700 feet and had deepened to 6 to 7 feet. In 1922, the channel had grown to a width of 2,600 feet. Between 1892 and 1926, the Atlantic beach shorelines north and south of the inlet had retreated roughly -2,000 feet. During the early part of the 20th century, St. Lucie Inlet included multiple shallow, dynamic sand bars and an unstable narrow channel with navigable depths between -4.5 and -6 feet MLW (mean low water). [Walton, 1974]

In 1909, *House Document 1312* of the 60th U.S. Congress, recommended federal participation in the excavation of an 18-foot channel through the inlet and construction of a jetty on the north side of the inlet. The River and Harbor Act of 1913 funded experimental excavation of an 18-foot deep channel across the ocean bar and reef seaward of the inlet's entrance, and construction commenced in 1916.

This channel shoaled rapidly, but was not officially abandoned. In 1928, another project was constructed by the Martin-St. Lucie Counties Improvement District that included excavation of an 18-foot deep channel 4,500 feet long and 200 feet wide between the inlet entrance and the outer bar and reef, and an interior channel 10,000 feet long and 150 feet wide between the inlet's entrance and a terminal at Port Sewall. The 10,000-foot channel segment and a turning basin at Port Sewall involved the excavation of 1.1 million cubic yards of sand, shell, mud, and rock, which were disposed at the terminal and to the south of the inlet. A special act of the Florida Legislature created the St. Lucie Inlet District and Port Authority, a special taxing district for the development and operation of the port. Between 1926 and 1929, local interests also constructed a 3,325-foot long coquina stone jetty on the north side of the inlet. [Walton, 1974]

The inlet channel continued to shoal to depths of 4 feet across the entrance by 1941. In 1945, the Rivers and Harbors Act authorized modification of the project to excavate a channel 10 feet deep by 200 feet wide. This project stabilized the position of the channel as the inlet width narrowed to 1,800 feet. The inlet channel was dredged again in 1965 to a minimum of 6 feet deep to alleviate emergency conditions under the 1945 Rivers and Harbors Act. In 1966, the 89th U.S. Congress modified the project through *House Document 508*, to include maintenance of a 6-foot deep channel along “the best natural deep water alignment”, instead of the previous fixed alignment.

In 1974, the 93rd U.S. Congress authorized additional construction through *House Document 294*, calling for the excavation of a sand impoundment basin adjacent the north jetty, a 500-foot long and 10-foot deep entrance channel through the outer bar and reef tapering to a 150-foot width through the inlet, an interior channel 100 feet wide and 7 feet deep extending from the inlet to the Atlantic Intracoastal Waterway, a south jetty, an extension to the north jetty, and a weir section added to the north jetty. This project was constructed between 1978 and 1982, except for the north jetty extension, and included the construction of an offshore breakwater south of the entrance channel.

Inlet dredge records from the Corps of Engineers totaled 849,777 cubic yards of material dredged between 1965 and 1979, of which, 86,168 cubic yards was bypassed to adjacent beaches and 399,220 cubic yards were side-cast adjacent to the navigation channel. Between 1980 and 1989, inlet dredge quantities totaled 1,438,326 cubic yards.

In 1990, the Martin County Board of County Commissioners initiated a study to develop an inlet management plan in cooperation with the Department. This study was conducted by Applied Technology and Management, Inc. (ATM), and was concluded in 1993. Based upon the results

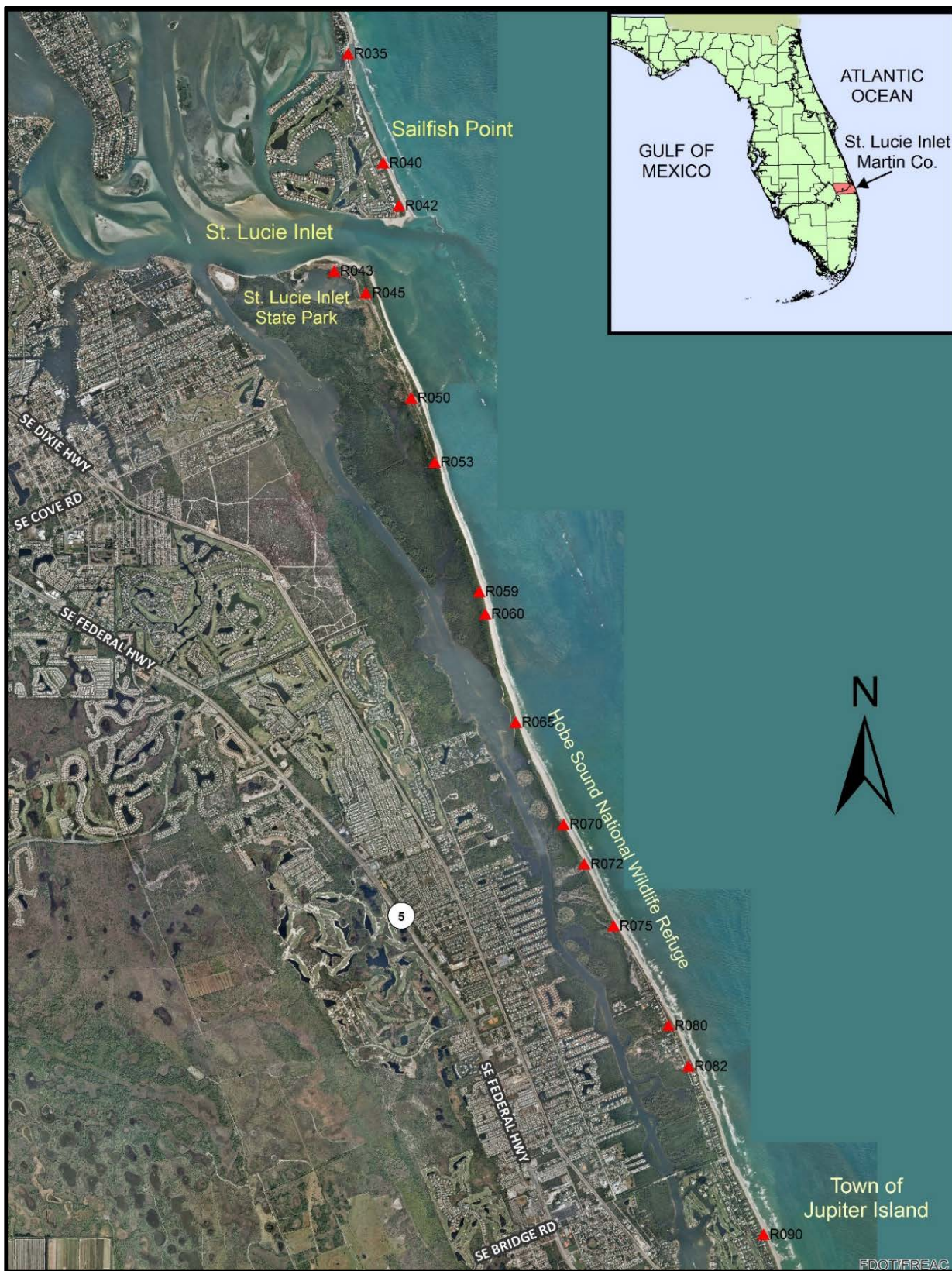


Figure 2. St. Lucie Inlet, Sailfish Point, and northern Jupiter Island (2009 aerial photo from Florida Department of Transportation).

documented by ATM (1995), the Department adopted the *St. Lucie Inlet Management Study Implementation Plan* (FDEP, 1995). In 1997, inlet sand bypassing included the transfer of 624,935 cubic yards of beach compatible dredged material from the Florida Inland Navigation District's M-5 Dredged Material Management Area and from the adjacent Intracoastal Waterway channels to the beaches between 2.8 to 6.7 miles south of the inlet (R59-R65, R75-R82) (Coastal Tech, 1998). In 1999, approximately 714,000 cubic yards of sand from a portion of the inlet flood shoal as well as the channel and sedimentation basin, was transferred to the beaches between 6.0 and 9.8 miles south of the inlet (R78-R84, R92-R100) within the Town of Jupiter Island (GBA, 2003).

St. Lucie Inlet Design Memorandum and Final Environmental Assessment (USACE, 2000) identified both navigation and sand bypassing improvements. The project modifications included elevating the crest height of the north jetty beginning seaward of the weir section and ending at the southeasterly jetty extension, constructing a larger modified sediment impoundment basin, and disposing of maintenance dredge material in the following order of priority: on the beach beginning 5,000 feet south of the inlet or into the nearshore south of the inlet at a depth of less than -16 feet NGVD. Figure 3 shows the locations of the sediment impoundment basin, existing jetties and breakwater, the federal navigation channel, and the access area between the channel and basin.

Hurricanes Frances and Jeanne in September 2004, inflicted severe damage to the beaches and coastal construction of Martin County (Clark et al, 2004). The geometric center of the eyes of both hurricanes made landfall about a mile apart at R29 and R35 immediately north of St. Lucie Inlet. Since the hurricanes, maintenance dredging projects have been conducted in 2007, 2012, and 2013-14. Each project has involved the excavation of the sediment impoundment basin, the navigation channel, and the transition area between the channel and basin. The 2007 project involved the excavation of 560,000 cubic yards with placement on Jupiter Island between R59 and R69 (Kremkau et al, 2011). A comparable project in 2012 involved the excavation of 474,188 cubic yards with placement on Jupiter Island between R60 and R72 (Tabor and Roberts, 2012). And most recently in the winter of 2013-14, following significant shoaling from the offshore passage of Hurricane Sandy, an additional 384,000 cubic yards were excavated with placement on Jupiter Island. In 2014, Martin County and the Town of Jupiter Island signed an interlocal agreement to monitor the inlet basin and channel, to calculate the infill rate of the impoundment basin and to determine an estimate of supplemental sand volumes.



Figure 3. Authorized federal navigation channel, sediment impoundment basin, jetties and breakwater (Kremkau et al, 2013).

Implementation of the Adopted Inlet Management Plan – 1995

The following implementation actions were adopted in the *St. Lucie Inlet Management Study Implementation Plan* (FDEP, 1995):

1) Continue measures to mitigate the identified impacts of the inlet, channel and sedimentation basin.

An optimum dredging plan including the most beneficial dredging cycle, in terms of bypassing sand at the inlet, should be established for current conditions as well as for conditions with the proposed expanded sedimentation basin. Place all beach compatible dredged material on downdrift beaches in eroded areas. Location for placement of material shall be on areas most in need and environmentally suited. As a minimum, bypassing of material shall meet average annual placement objectives as stated in the sediment budget (see 4) below).

2) Dredge interior inlet flood tidal shoal and place beach quality material on downdrift beaches.

Sediment quality and method of transportation to spoil site must be resolved prior to application for permit.

3) Investigate options which include modifications to the north jetty and expansion of the sedimentation basin.

Proposed alternatives must facilitate the continued bypassing of sand, consistent with Section 161.142, Florida Statutes.

4) Investigate options which include modifications to the north jetty and expansion shall be formally validated or redefined based on a comprehensive monitoring plan by December 31, 2000.

5) Implement a comprehensive beach and offshore monitoring program subject to the approval of the Department.

6) Evaluate the feasibility and need for an extension of the south jetty.

These actions were supplemented in the *Strategic Beach Management Plan* (FDEP, 2008), with the following strategy:

Place all beach compatible maintenance dredged material on downdrift beaches at least 5,000 feet south of the inlet in eroded areas of greatest need; at a minimum, bypassing of material shall meet average annual objective of 185,000 cubic yards; dredge interior inlet flood tidal shoal and place beach quality material on downdrift beaches; modify the north jetty; evaluate the feasibility and need for an extension of the south jetty; implement a comprehensive beach, inlet and offshore monitoring program and, based on the results, formally validate or redefine the sediment budget.

Implementation action 1, modified in 2008, requires all beach compatible dredge material to be placed on the beaches at least 5,000 feet to the south of the inlet with a minimum target bypassing objective of 185,000 cy/yr. This strategy updated in the *Strategic Beach Management Plan* preceded the revisions to Section 161.142, Florida Statutes, which called for balancing the sediment budget. Between 1995 and 2014, an effective quantity of 2,847,411 cubic yards was bypassed to the beaches of Jupiter Island, or 149,864 cy/yr. For the period of the adopted target bypassing objective, between 2007 and 2014, a quantity of 1,418,188 cubic yards was bypassed to the beaches of Jupiter Island, or 202,598 cy/yr. However, assuming a three-year dredge cycle, a before-dredge ten-year (2007-2016) quantity would average 141,819 cy/yr.

Implementation action 2, restated in 2008, called for dredging the interior inlet flood tidal shoal with beach placement on the downdrift beaches. A project in 2010 involved the excavation of an unvegetated portion of the flood shoal with placement of 25,000 cubic yards of beach quality sand at Bathtub Beach and Sailfish Point over one mile north of the inlet. While the project was not consistent with the intent of the strategy to bypass flood shoal sand to beaches of Jupiter Island; never the less, the strategy was consistent with the 2008 statutory amendments that called for a balancing of the sediment budget. Resource protection and diminishing sediment supply are among the greatest obstacles to future flood shoal dredging. Potential dredge areas may be limited to unvegetated interior shoal areas.

Implementation action 3 called for an investigation of modifying the north jetty and sedimentation basin. As previously noted, the Corps of Engineers investigated these jetty and basin improvements and presented design recommendations in USACE (2000). The sediment impoundment basin enlargement was completed in August 2002.

Implementation action 4 was a typographical error, which should have read, “~~Investigate options which include modifications to the north jetty and expansion~~ The sediment budget, as presently contained in the report, is adopted as an interim measure only. It shall be formally validated or redefined in subsequent revisions of the plan based on a comprehensive monitoring plan by December 31, 2000.” An update sediment budget was not adopted by the Department by the end of 2000; however, Appendix A of the *St. Lucie Inlet Design Memorandum and Final Environmental Assessment* (USACE, 2000) provided a wave refraction and sediment transport modeling study, which was a grid-based refraction analysis that considered detailed nearshore bathymetry and 40 years of hindcast wave data. Potential transport rates were determined from the CERC Formula and the SEDTRAN model, which resulted in a southerly to northerly transport ratio of 2.7 to 1, or 73% to the south and 27% to the north. Subsequently, update sediment budgets were developed by Applied Coastal Research and Engineering, Inc., for Martin County (Ramsey et al, 2006; 2011; 2014) that considered the latest best available data.

Implementation action 5 called for the implementation of a comprehensive beach and offshore monitoring program. Since adoption of the inlet management plan, beach profile surveys have been obtained annually on south Hutchinson Island, and for most years since 1997 on northern Jupiter Island. In addition, Gahagan and Bryant, Inc., has conducted annual surveys for the Town of Jupiter Island since plan adoption. Inlet bathymetric data sets exist for most years; however, much of the data prior to 2002 was either incomplete or represented condition surveys of the channel or impoundment basin. Since 2002, inlet bathymetric data has been obtained annually through the “bank to bank” hydrographic

surveys which document detailed changes of the inlet system. Data deficiencies are seen in the outer ebb and inner flood shoals, leading to assumptions in the sediment budget computations.

Implementation action 6 has been conducted. Martin County conducted the St. Lucie Inlet Management Alternatives Analysis Project (January, 2014), and the analysis concluded that a south jetty extension would not provide significant benefits over the status quo.

In summary, the six actions adopted in the 1995 inlet management plan have collectively been substantially completed. The inlet management strategies updated in the *Strategic Beach Management Plan* (2008) have (to the extent that they are not in conflict with the 2008 amendments to Section 161.142, Florida Statutes) likewise been substantially completed.

1995 Sediment Budget (ATM, 1995)

The 1995 inlet management plan study considered a conceptual time period between 1980 and 1990, using bathymetric surveys of 1967 and 1990, and beach profile surveys by the Florida Department of Natural Resources obtained in 1971, 1976, and 1982, and a survey by ATM in 1990. The graphic representation of the sediment budget adopted with the 1995 plan is shown in Figure 4.

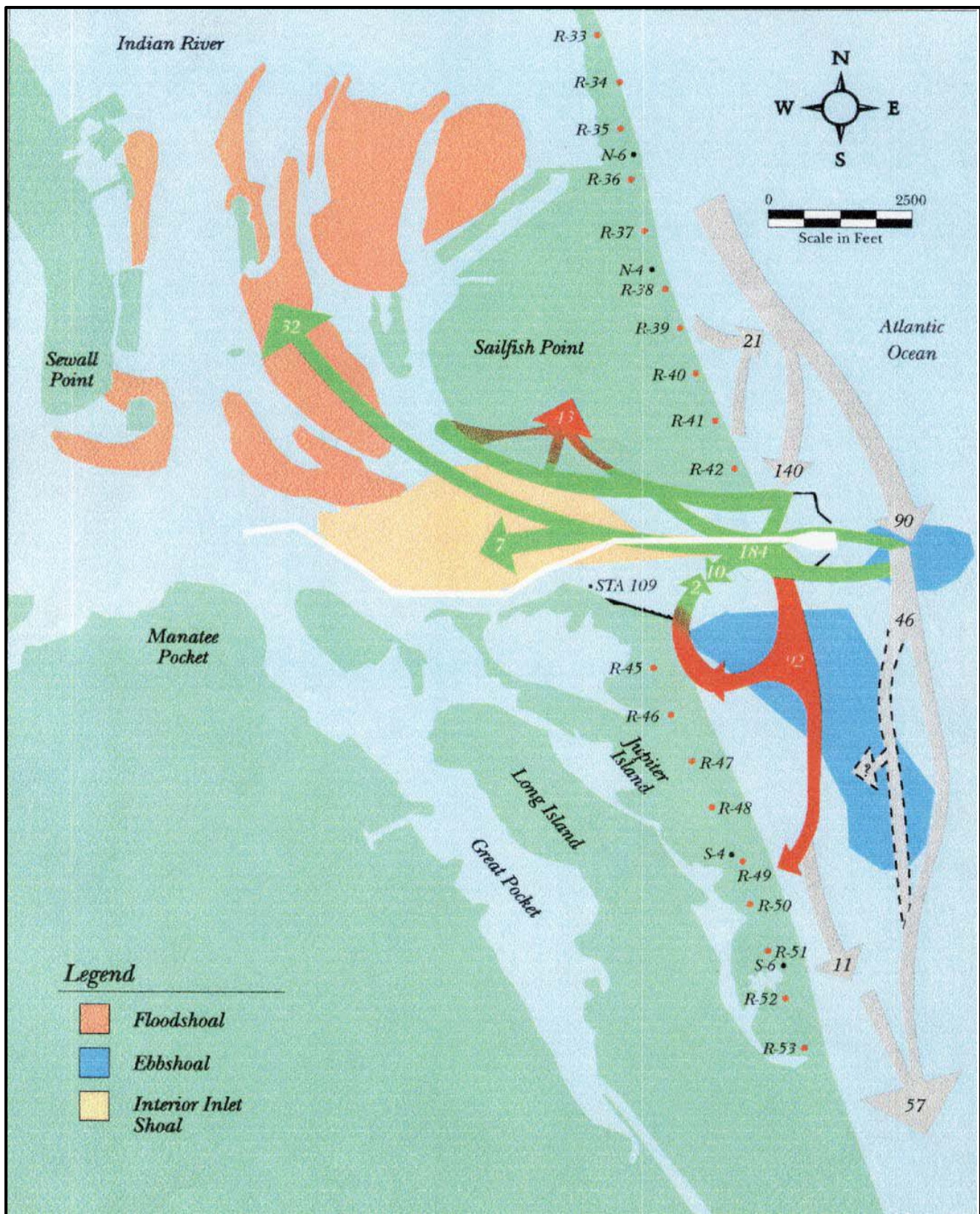


Figure 4. Sediment budget developed by Applied Technology & Management, Inc. (ATM, 1995), and adopted by the St. Lucie Inlet Management Study Implementation Plan (FDEP, 1995).

Sediment Budget Analyses – 2000, 2006, and 2011 (USACE, 2000; Ramsey et al, 2006; 2011)

As previously mentioned, while an update sediment budget was not adopted by the end of 2000, Appendix A of the *St. Lucie Inlet Design Memorandum and Final Environmental Assessment* (USACE, 2000) estimated *potential* transport rates at the 40-foot depth contour, which resulted in a southerly to northerly transport ratio of 2.7 to 1, or 73% to the south and 27% to the north. The improvements to the sediment impoundment basin in 2002 represented a significant morphological change to the inlet system. Subsequently, Martin County sponsored update sediment budgets developed by Applied Coastal Research and Engineering, Inc. (Ramsey et al, 2006; 2011; 2014).

Ramsey et al (2006) provided updated sediment transport pathways based upon numerical modeling of inlet currents as indicated in Figure 5, which show southerly directed sediment transport north of the inlet and northerly longshore transport south of the inlet. The green arrows represent the wave induced sediment transport around and into the inlet, as well as the flood tidal transport within the inlet. The red arrows represent the ebb tidal transport.



Figure 5. General flood and ebb sediment transport pathways (Ramsey et al, 2006).

Wave and longshore transport modeling for the 2006 sediment budget determined an input net annual southward longshore transport quantity from the north of the inlet's influence to be 260,000 cubic yards $\pm$ 50,000 cubic yards. Modeling also determined an annual quantity of 150,000 cubic yards $\pm$ 29,000 cubic yards of sand passing south into the inlet over the north jetty weir. The 2011 sediment budget increased the net annual southward longshore transport quantity from the north to be 277,000 cubic yards. The annual quantity of sand passing over the north jetty weir was also increased to 170,000 cubic yards.

Update 2014 Sediment Budget (Ramsey et al, 2014)

The 2014 update sediment budget represents the time period between 2002 and 2014, and supersedes the prior sediment budgets that were more significantly affected by the bathymetric changes of the inlet shoals as they adjusted to the basin excavation of 2002 and the hurricanes of 2004. The graphic representation of this 2014 update sediment budget is shown in Figure 6, and represents updated information obtained from bathymetric and topographic surveys, dredging records, and additional coastal processes analysis.

Between 2002 and 2013, volumetric change data for south Hutchinson Island north of the inlet's influence (R1-R34), computed a loss of -144,000 cubic yards per year. A sediment budget analysis from St. Lucie County (Rodriguez and Dean, 2009) provided a computed transport from the north of 57,000 cubic yards per year. Assuming all the erosion losses result in southward longshore transport, an input net southward longshore transport quantity north of the inlet's influence was estimated to be 201,000 cubic yards per year. This quantity was less than the 230,000 cubic yards per year adopted in the 1995 plan and less than the 260,000 and 277,000 cubic yards per year estimated respectively in the 2006 and 2011 sediment budget updates. However, it has been argued that the 201,000 cubic yards figure does not affect the outcome of the inlet's sediment budget, because it is sufficiently large enough to not mathematically affect the figures determined for shoreline erosion, the inlet's sink effect, or the bypassing deficit to the south.

The volumetric change computations between 2002 and 2013 also determined the Bathtub Beach and Sailfish Point segment north of the inlet (R35-R42) to be losing -31,000 cubic yards per year notwithstanding nourishment volumes of 33,000 cubic yards per year (25,000 cubic yards per year dredged from the inlet flood shoals or channel and 8,000 cubic yards per year trucked from inland sand mines). These figures sum to a total annual erosion of -64,000 cubic yards along Bathtub Beach and Sailfish Point. This figure represents both inlet impacts and non-inlet impacts.

Near R35, the Bathtub Reef system attaches to the beach and creates a convenient north point for determining inlet effects. This location is also where there is a split in sediment transport paths. Longshore transported sediment either crosses the reef from the north, and continues southward along Bathtub Beach and Sailfish Point, or it fails to cross the reef and is transported along the seaward side of the reef. The offshore transport of beach sediments north of R35 (e.g., between R1 and R34) during the 2004 hurricanes likely influenced the accelerated erosion conditions seen at Bathtub Beach and Sailfish Point in more recent years. The less beach sediment that is available to “jump” the reef would certainly cause a deficit in sediment south of R35. This condition would suggest that a portion of the measured - 64,000 cubic yards per year loss measured along Bathtub Beach and Sailfish Point is not directly related to the contemporary effects of the inlet.

South of the inlet between R45 and R53, which is the general location of bypassing bar reattachment, volumetric change computations determined a loss of -24,000 cubic yards per year. The 2014 sediment budget projects an annual quantity of 34,000 cubic yards per year being transported northward into the inlet from this beach segment south of the inlet. Subsequent discussion provided by Ramsey and Quan (2014) clarifies that this quantity alone was intended to represent the inlet’s impact to the beaches to the north of the inlet.

The 2014 sediment budget takes the 201,000 cubic yards of longshore transport from the north and adds the 64,000 cubic yards of erosion at Bathtub Beach and Sailfish Point to result in 265,000 cubic yards per year of southward sediment transport into St. Lucie Inlet. Measurements indicate that 160,000 cubic yards per year are trapped by the sediment impoundment basin and the navigation channel. This quantity also represents a recorded 139,000 cubic yards per year of dredging and a measured 21,000 cubic yards per year of loss from the sediment basin area. The design of the sediment impoundment basin anticipated complete filling over a three-year time period before sediments overflow into the channel and adjacent shoals. However, the local governments have defined a process for calculating the efficiency of sediment basin filling. This includes recognition that the basin filling slows down and overflows prior to reaching capacity. At the point where the basin losses efficiency, calculations are made to determine what should be trapped.

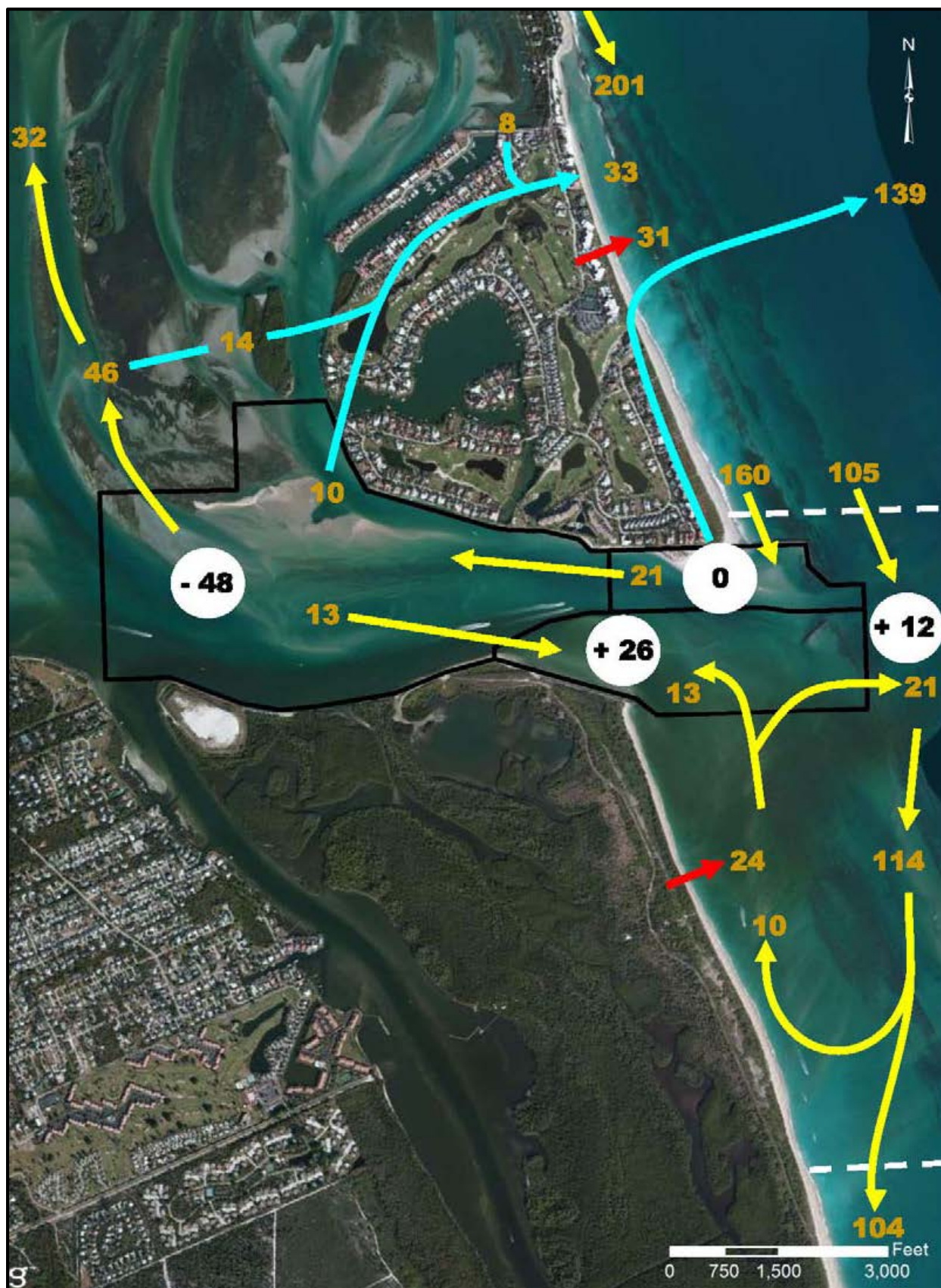


Figure 6. Updated 2014 sediment budget for St. Lucie Inlet (Ramsey et al, 2014).

The remainder of longshore transport seaward of the Bathtub Reef that continues southward beyond the north jetty, and contributes to natural inlet bypassing, has been estimated to be 105,000 cubic yards per year. From this natural bypassing quantity, an ebb shoal growth of 12,000 cubic yards per year has been estimated using projections from the 1995 sediment budget due to a lack of recent ebb shoal bathymetric data. Certainly, future monitoring of the ebb shoal should provide a better indication of the ebb shoal growth rate, which could substantially exceed this estimate.

Southward transport at R53, the general location of bypassing bar attachment to the beach south of the inlet, has been estimated to be 104,000 cubic yards per year to the south. Ramsey et al (2014) reasons the net impact of the inlet to the south is represented by the difference between the quantity being transported past the north jetty (265,000 cubic yards per year) less the quantity continuing southward from R53 on Jupiter Island (104,000 cubic yards per year). The resulting impact would be 161,000 cubic yards per year. The 2014 update sediment budget has therefore estimated an annual inlet impact of 161,000 cubic yards to the south and 34,000 cubic yards to the north, which represents a southerly to northerly transport ratio of 4.7 to 1, or 82.5% to the south and 17.5% to the north.

Additional 2014 Sediment Budget Analyses (Kriebel, 2014a; Kriebel, 2014b; Bodge, 2014)

In response to the preparation of an update 2014 sediment budget conducted by Applied Coastal Research & Engineering, Inc., additional sediment budget analyses were sponsored by stakeholders north and south of St. Lucie Inlet. To the south, the Town of Jupiter Island sponsored additional analyses by Coastal Analytics LLC, and to the north, the Sailfish Point Property Owners' and Country Club Association, Inc. sponsored additional analyses by Olsen Associates, Inc.

These additional sediment budget analyses resulted in greater insight and attention to the details of the update 2014 sediment budget sponsored by Martin County. In particular, they provided great service in flushing out the weakest data and assumptions, which elevates the need for improved data acquisition in certain areas. Ebb shoal growth is certainly a weakness in the sediment budget and should be a targeted strategy in an update inlet management plan. An improved understanding of the interior flood shoal changes has also been identified as an area for improved future data acquisition.

Kriebel (2014a) discussed the data obtained from the bank-to-bank surveys noting the years with dredging showed the inlet lost material beyond that which was dredged, and recommended deleting those years from the sediment budget computations since the inlet normally acts as a sediment sink

showing material gained. Kriebel (2014b) further discussed removing background erosion, which is erosion not caused by inlet effects. This analysis used a background erosion rate obtained between 2002 and 2013 for the north county beach segment (R1-R34) that was computed to be -4.9 cubic yards per linear foot of shoreline per year according to Ramsey et al (2014). Kriebel (2014b) applied this representative background erosion rate to the inlet affected beach segments to the north (R35-R42) and south (R44-R53) of the inlet. With the removal of this representative background erosion, the recalculated sediment budget determined an annual inlet impact of 168,000 cubic yards to the south and 31,000 cubic yards to the north, which represents a southerly to northerly transport ratio of 5.4 to 1, or 84.4% to the south and 15.6% to the north.

Bodge (2014) employed the same format and data as Ramsey et al (2014) and Kriebel (2014a; 2014b), with the exception that the actual volumetric changes on the inlet affected beaches were used. The sediment budget also considered the effects of uncertainty in all the input variables and computed an ensemble of probable solutions to the sediment budget. In contrast to Ramsey et al (2014) and Kriebel (2014a; 2014b), Bodge (2014) also noted the net impact of the inlet to the south is represented by the difference between the input quantity from the north (201,000 cubic yards per year) less the quantity continuing southward from R53 on Jupiter Island (104,000 cubic yards per year), which would be 97,000 cubic yards per year. Using a broad range of input uncertainties, Bodge (2014) developed a sediment budget with median values having an annual inlet impact of 130,000 cubic yards to the south and 63,400 cubic yards to the north, which represents a southerly to northerly transport ratio of about 2 to 1, or 67.3% to the south and 32.7% to the north.

Additional Comments on the Sediment Budget Analyses

The Department staff generally agrees with the overall scope and development of the update 2014 sediment budget as set forth in Ramsey et al (2014). While the argument against using the volumetric change data from the dredge years is noteworthy, the Department staff does not wish to discard the actual survey data from any year. Possible reasons for the dredge year anomaly include hydrographic survey technology limitations and the redistribution of shoal material into the dredge areas. Certainly maintenance dredging will continue, so any dredge year effects will remain integral to the long term sediment budget. Likewise, background erosion effects will continue to influence the volumetric changes along the beaches north and south of the inlet. However, these background erosion effects cannot currently be apportioned, and they vary along the coast depending on the degree of exposure and hydrographic influenced wave attenuation and refraction. The more highly exposed north county coast

(R1-R34) is not comparable to the segment sheltered by the Bathtub Reef (R35-R42) and therefore both segments should not share the same background rate of erosion. Still, there should be an erosion quantity that is not attributable to the effects of the inlet, and thus the total inlet induced erosion along the Bathtub Beach and Sailfish Point segment would be less than the measured 64,000 cubic yards per year. Ramsey and Quan (2014) discusses this issue and recommends that the inlet influenced impact on Bathtub Beach and Sailfish Point should be the 34,000 cubic yards per year entering the inlet from the south.

The Department staff recognizes the substantial data and rationale put forth in the different sediment budgets developed by each party. Different methodologies and assumptions have created significant differences in each of these sediment budgets. Should a better determination of the ebb shoal and flood shoal losses be achieved through future monitoring, the County's development of a sediment budget should improve. There is significant variability in conditions observed from one time period to another, and it is difficult to generalize an average or representative transport value for any time period. That said, consistent with the statutory goal of balancing the sediment budget, given the sediment trapping effects of the inlet and the resulting erosion of the adjacent beaches, it is reasonable to adopt a sediment bypassing strategy that sets forth target placement quantities pursuant to the County's update sediment budget. These target placement quantities would match the 34,000 cubic yards per year entrapment of sediment from the south, and the 161,000 cubic yards per year net quantity of loss of material to the south along Jupiter Island.

Such a bypassing strategy would be designed to mitigate the contemporary impacts of the inlet, but would not limit the affected parties from exceeding bypassing targets when economically necessary to use the inlet as a source of sediment to mitigate critical erosion on adjacent beaches.

In other words, the bypassing strategy can require balancing the sediment budget as a minimum requirement, while still meeting the statutory objective of Section 161.142, Florida Statutes, where it says, "...and extend the life of proximate beach-restoration projects so that periodic nourishment is needed less frequently." A minimum bypassing target will account for the inlet's sink effect, and transfer to adjacent eroding beaches the quantity of material actually entrapped by the inlet system. Additional material may be obtained from within the inlet system when necessary to maintain a beach restoration project. However, excavation from the more passive shoals within the inlet that are environmentally acceptable to dredge, may be a diminishing resource over time.

The statutory goals of balancing the sediment budget and extending the life of proximate beach-restoration projects can also work together in the development of a sand placement protocol. Dean (2013) documents the need for inlet bypass material along the project reach within the Town of Jupiter Island. While the sediment budgets identified an area between R35 north of the inlet to R53 south of the inlet for direct inlet effects, the net reduction in the natural southward longshore transport has had a profound impact on the beaches further south through the Town of Jupiter Island. Placement of inlet bypass material south of R89 along the Town of Jupiter Island would satisfy the intent of Section 161.142, Florida Statutes, to reduce periodic nourishment of a proximate beach restoration project. This would also apply to the placement of material between R34.5 and R40 along the Bathtub Beach-Sailfish Point beach restoration project. Placement of material between R59 and R72 on northern Jupiter Island, does not appear to significantly benefit the Town of Jupiter Island's beach restoration project in the near term, but may be necessary on a periodic basis to preclude a breach in the barrier island at Peck's Lake, and for the protection of threatened wildlife habitat and the important cultural resources surrounding the Joseph Reed Mound archeological site.

Recommended Inlet Management Plan

The Department staff recommends the following implementation plan be adopted to meet the requirements of Chapter 161, Florida Statutes. Future inlet management activities shall be consistent with the following five implementation strategies.

- 1) Continue the existing comprehensive beach and inlet hydrographic monitoring program** to evaluate performance and impact of existing bypassing and nourishment projects and to update and define the inlet sediment budget. Periodic additional bathymetric surveys shall be conducted of the ebb shoal and active flood shoals of the inlet.
- 2) Modify the inlet sand transfer protocol to permit the placement of inlet dredge material along the Atlantic beaches both to the north and to the south of the inlet** within designated critically eroded areas between R34.5 and R111. The quantity of allowable fill placement in each area shall be based upon observed erosion patterns and beach erosion quantities documented through the monitoring protocol of Strategy #1. The Town of Jupiter Island and the Bathtub Beach – Sailfish Point beach restoration projects shall be given first priority in the placement of inlet bypass material. In addition, the Peck's Lake area shall be prioritized for fill placement when necessary to mitigate the potential for a breach in the barrier during storm conditions. Bypassing quantities shall be accounted for by the net volume of material removed by the dredging contractor

from the excavation\borrow areas, as determined by surveys or bin measurement, but may be supplemented with fill placement surveys when it is indicated that shoaling occurs during dredging.

- 3) The initial target bypassing quantities shall be the average annual placement of 161,000 cubic yards to the south and 34,000 cubic yards to the north.** These target quantities shall be updated based upon a minimum of five years of monitoring and a more definitive determination of the sediment gains and losses within the ebb shoal and active flood shoals. These target bypassing quantities shall not be considered limitations upon sediment material removal from the inlet system; the affected parties may be allowed to remove additional material as necessary to mitigate critical erosion consistent with Strategy #4.
- 4) Material excavated from the inlet system, including the sediment impoundment basin, the federal navigation channel and transition area, the Sailfish Point Marina channel and the inlet's ebb, flood and interior shoals, shall generally be the source of sediment for meeting the target bypassing quantities in Strategy 3.** The bypassing of material from the sediment impoundment basin and other inlet areas to the Jupiter Island beaches shall be conducted in a quantity and at a frequency that meets or exceeds the target bypassing quantities in Strategy #3. Sand transfer from the basin to Bathtub Beach and Sailfish Point may also be conducted; however, the volume of excavation cannot result in a deficit of sand bypassing from the basin to Jupiter Island, unless permits and funding have been secured for an equivalent quantity of sand from an alternative location. Acceptable beach quality sand may be obtained from inland sand mines or offshore sources to supplement or facilitate these target bypassing quantities.
- 5) The nearshore placement of inlet dredge material shall generally not be conducted** except for emergency dredging in the federal navigation channel only, and when placed in nearshore water depths less than -12 feet (MLW). Nearshore placement of material excavated from the impoundment basin is not recommended; however, the offshore placement of material into a future borrow site or holding area may be conducted. Nearshore placement shall not be included in meeting the target bypassing quantities of Strategy #3.

Implementation Discussion

Implementation Strategy #1

A comprehensive beach and inlet hydrographic monitoring program is the most important element to managing the future sediment budget at St. Lucie Inlet. Topographic and bathymetric surveys provide the most reliable data to estimate the volumetric impact of the inlet and to establish a placement protocol that complies with the statutory mandate of Section 161.142, Florida Statutes. The current approved inlet monitoring program conducted by Martin County will continue to provide excellent monitoring data for future inlet management. The addition of periodic bathymetric surveys conducted of the ebb shoal and active flood shoals will facilitate improvements in developing future sediment budgets.

Implementation Strategy #2

There are currently two designated critically eroded beach segments north and south of St. Lucie Inlet located between R34.5 and R111 (FDEP, 2015). Most of Jupiter Island south of the inlet through the Town of Jupiter Island is designated critically eroded (R45-R111). North of the inlet, Hutchinson Island is designated critically eroded between R1 and R40, including the entire Bathtub Beach – Sailfish Point beach and dune restoration project. In the future, areas currently not listed may become designated critically eroded or areas currently designated critically eroded may lose that designation and become delisted. However, priorities at the time of fill placement will be those areas designated critically eroded at the time of the inlet dredging project. Various placement methodologies, including hydraulic pipeline and truck-haul, may be conducted. Hydraulic fill placement from the Sailfish Point marina and navigation channel and outer flood shoals may be the most feasible means to nourish Bathtub Beach and Sailfish Point, but this would not exclude truck haul projects from inland sand mines. Nothing in this plan precludes a methodology that might be more cost effective or less impactful. Also, contractor “pay volumes” of material removed from the borrow areas may be 10 to 20 percent less than actual placement or excavation volumes, and therefore do not provide for an accurate accounting of bypassing quantities, especially when shoaling occurs during dredging operations.

Implementation Strategy #3

The bypassing quantities of Implementation Strategy #3 represent minimum target placement quantities that balance the sediment budget between the inlet and the adjacent beaches. The actual inlet sediment budget will be expected to vary somewhat over time and the total volume and/or the proportion of fill placement may need to be modified from that adopted in Implementation Strategy #3. A minimum of

five years of data, obtained in Implementation Strategy #1, is selected as necessary to represent the latest trend in inlet sediment processes. Also, the target bypassing quantity does not limit the excavation of additional material from the inlet when it may be necessary for maintenance nourishment of adjacent beach restoration projects. Historical accumulations of material in the inlet shoals are available for use as borrow areas for beach nourishment of Bathtub Beach and Sailfish Point.

Implementation Strategy #4

It is recognized that the areas typically dredged for bypassing include the navigation channels, the sedimentation basin, and the transition area between the basin and the federal navigation channel. This does not exclude inlet shoal areas where the material is determined to be beach quality and where environmental resources are not impacted. Nor does it exclude inland sand mines or offshore sources when determined necessary to supplement or facilitate the target bypassing quantities.

Implementation Strategy #5

Nearshore disposal of navigation channel maintenance dredge material is a viable alternative at many locations in Florida where the material is placed between mean high water and the edge of the normal wave breaking zone. Because of the need to mitigate the erosion effects of inlets, Florida law requires the placement of this material directly onto beaches, with the exception being made for the emergency excavation of federal channels. In recent years, the commonly accepted definition for the nearshore has been broadened to include areas well offshore from the surf breaker zone in water depths where sand has little chance to return to the beach. Such projects were constructed in the past at St. Lucie Inlet with little success in material returning to the beach. It would be better to place material in a temporary holding area such as an existing offshore borrow area than in a so-called nearshore area beyond the influence of the normal wave climate. It is certainly not consistent with the intent of Section 161.142, Florida Statutes, to place inlet dredge material at locations that clearly do not have a beneficial effect on the impacted beaches.

References

- Applied Technology and Management, Inc., 1995. *St. Lucie Inlet Management Plan*, 260 p.
- Bodge, K.R., 2014. *A Proposed Sediment Budget for St. Lucie Inlet, Florida*, Olsen Associates, Inc., 22 p.
- Clark, R.R. et al, 2004. *Hurricane Frances & Hurricane Jeanne: Post-storm Beach Conditions and Coastal Impact Report with Recommendations for Recovery and Modifications of Beach Management Strategies*, Florida Department of Environmental Protection, Bureau of Beaches and Coastal Systems, 93 pp.
- Coastal Tech, Inc., 1998. *Florida Inland Navigation District MSA M-5 Sand Transfer Project, 6 Month Monitoring Report*, 9 p. plus appendices.
- Dean, R.G., 2011. *Effectiveness of Nearshore Sand Placement with Special Reference to Jupiter Island, Florida*, 18 p.
- Dean, R.G., 2012. *Effectiveness of Post-1995 Sand Placements on Jupiter Island: Interpretation and Prediction*, 33 p.
- Dean, R.G., 2013. *Placement Locations for Bypassed Sand from St. Lucie Inlet: Rationale and Recommendations*, 16 p.
- Florida Department of Environmental Protection, 1995. *St. Lucie Inlet Management Study Implementation Plan*, 8 p.
- Florida Department of Environmental Protection, 2008. *Strategic Beach Management Plan*.
- Florida Department of Environmental Protection, 2015. *Critically Eroded Beaches in Florida*, 87 p.
- Gahagan and Bryant Associates, Inc., 2003. *St. Lucie Inlet Sand Transfer Projects*, 22 p.
- Kremkau, K. et al, 2011. *St. Lucie Inlet Federal Navigation Project: 2011 Annual Physical Monitoring Report*, Gahagan and Bryant Associates, Inc., and Applied Coastal Research and Engineering, Inc., 88 p.
- Kriebel, D.L., 2014a. *Re-Analysis of St. Lucie Inlet Sediment Budgets*, Coastal Analytics LLC, 31 p.

Kriebel, D.L., 2014b. *Analysis of Background Erosion for St. Lucie Inlet*, 12 p.

Martin County, 2014. *St. Lucie Inlet: Inlet Management Alternatives Analysis Project*, 134 p. plus appendices.

Ramsey, J. et al, 2006. *Physical Monitoring and Numerical Modeling Analysis to Support the St. Lucie Inlet Management Plan, Martin County, Florida*, Applied Coastal Research and Engineering, Inc., and Gahagan and Bryant Associates, Inc., 210 p. plus appendices.

Ramsey, J. et al, 2011. *Updated St. Lucie Inlet Sediment Budget*, Applied Coastal Research and Engineering, Inc., 32 p.

Ramsey, J. et al, 2014. *2014 Updated St. Lucie Inlet Sediment Budget*, Applied Coastal Research and Engineering, Inc., 21 p.

Ramsey, J., and Quan, R., 2014. *Review of “2014 Draft St. Lucie Inlet Management Plan”*, 10 p.

Rodriguez, E., and Dean, R.G, 2009. *A Sediment Budget Analysis and Management Strategy for Fort Pierce Inlet, Florida*, Journal of Coastal Research, Volume 25, Issue 4, pp. 870-883.

Stubbs, D.C., 2012. *Bathtub Beach and Sailfish Point Shoreline Analysis*, Isiminger & Stubbs Engineering, Inc., 39 p.

Tabar, J.R., and Roberts, S.B., 2012. *2012 St. Lucie Inlet Maintenance Dredging: Final Construction Report*, Atkins, Inc., 1033 p.

U.S. Army Corps of Engineers, 2000. *St. Lucie Inlet Design Memorandum and Final Environmental Assessment*, Jacksonville District.

Walton, T.L., 1974. *St. Lucie Inlet: Glossary of Inlets Report No.1*, Florida Sea Grant Report No. 2, 64 p.