Ponce de Leon Inlet Management Plan

Office of Resilience and Coastal Protection

Florida Department of Environmental Protection

September 2020

Final Order Adopting
Ponce de Leon Inlet Management Plan

WHEREAS, pursuant to Section 161.161, Florida Statutes, the Department of Environmental Protection (Department) shall "evaluate each improved, modified, or altered inlet and determine whether the inlet is a significant cause of beach erosion. With respect to each inlet determined to be a significant cause of beach erosion, the plan shall include the extent to which such inlet causes beach erosion and recommendations to mitigate the erosive impact of the inlet, including, but not limited to inlet sediment bypassing; improvement of infrastructure to facilitate sand bypassing; modifications to channel dredging, jetty design, and disposal of spoil material; establishment of feeder beaches; and beach restoration and beach nourishment."

WHEREAS on March 10, 1997 the Department adopted the Ponce de Leon Inlet Management Implementation Plan, which contained corrective measures to mitigate the identified impacts of the inlet; and

WHEREAS in 2008, the Florida Legislature amended Section 161.142, Florida Statutes, finding, "The Legislature recognizes the need for maintaining navigation inlets to promote commercial and recreational uses of our coastal waters and their resources. The Legislature further recognizes that inlets interrupt or alter the natural drift of beach-quality sand resources, which often results in these sand resources being deposited in nearshore areas or in the inlet channel, or in the inland waterway adjacent to the inlet, instead of providing natural nourishment to the adjacent eroding beaches. Accordingly, the Legislature finds 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 in 2018-19, the Department and Volusia County sponsored an inlet management study of Ponce de Leon Inlet performed by Taylor Engineering, Inc., which compiled new survey data and information regarding its coastal processes and inlet and shoreline dynamics, and updated its sediment budget; and

WHEREAS, in September 2020, the Department finalized the development of an updated inlet management plan that contains corrective measures to mitigate the identified inlet erosion impacts to adjacent beaches; and

WHEREAS, Volusia County and the U.S. Army Corps of Engineers (USACE) are the entities responsible for dredging at Ponce de Leon Inlet, and therefore, responsible for implementation of the inlet management plan; and

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

THEREFORE:

The Department does hereby adopt the following updated implementation strategies, as set forth in the attached **Ponce de Leon Inlet Management Plan**. Future inlet management activities conducted by Volusia County or the U.S. Army Corps of Engineers shall be consistent with the following six strategies:

1) **A comprehensive beach and inlet hydrographic monitoring program shall be conducted** to evaluate the performance and impact of existing sand bypassing and nourishment projects and to periodically update the inlet sediment budget. This monitoring program shall include topographic and hydrographic surveys of the inlet system, its ebb and flood shoals, and adjoining beaches between FDEP reference monuments R125 and R170.

2) **Sand bypassing shall be performed from the Ponce de Leon Inlet federal navigation project channel to the adjacent Atlantic beaches or active nearshore to the north and south of the inlet between FDEP Reference Monuments R125 and R170.** The quantity of material to be bypassed shall be based on available navigation channel deposition quantities documented through the monitoring protocol of Strategy #1 above. Sand may also be dredged from adjacent inlet shoal areas where the Corps of Engineers determines is necessary for the integrity of the federal navigation project; however, additional geotechnical and engineering design is necessary to develop an acceptable borrow site plan for dredge areas not currently authorized.

3) **On an average annual basis, the initial target inlet sand bypassing quantity shall be 40,000 cubic yards per year to the north and 20,000 cubic yards to the south.** This target quantity

may be modified or updated based on a minimum of four years or more of monitoring data or additional inlet model studies indicating a change in the sediment budget. In the interim, should the volume of sand accumulating in the Ponce de Leon Inlet navigation channel and connecting waterways exceed 60,000 cubic yards per year, the additional sand may be dredged and placed on the adjacent beaches or nearshore either north or south of the inlet. However, given the south beaches and nearshore have received substantial advanced placement of bypassed material since 2017, the north beaches and nearshore shall be prioritized for placement.

4) **Acceptable beach quality sand may also be obtained from Intracoastal Waterway maintenance dredging or Dredge Material Management Areas** as well as inland sand mines or offshore sources to meet the target sand bypassing quantities**.**

5) **The federal navigation project north jetty structure that was damaged by Hurricanes Matthew, Irma and Dorian, resulting in the loss of beach and dune material north of the inlet, shall be repaired.**

6) **The Congressionally authorized federal navigation project south jetty extension may be constructed as previously permitted, pending reauthorization.**

Inlet management actions conducted by Volusia County and the U.S. Army Corps of Engineers that implement the strategies contained in this plan are subject to further evaluation, and subsequent authorization or denial, as part of the Department's permitting process. Activities other than the federal navigation project that implement these adopted strategies shall be eligible for state financial participation pursuant to Section 161.143, Florida Statutes, subject to Department approval of a funding request and an appropriation from the Florida Legislature. The level of State funding shall be determined based on the activity being conducted and the Department's 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 this final order. Nothing in this plan precludes the evaluation and potential adoption of other strategies for the effective management of Ponce de Leon Inlet and the adjacent beaches.

Approval of Adoption

Alex Reed

Director of the Office of Resilience and Coastal Protection

Florida Department of Environmental Protection

Filing and Acknowledgement

FILED, on this date with the designated Deputy Clerk, pursuant to

Section 120.52, F.S., receipt of which is hereby acknowledged.

Sandra K Rogers

Deputy Clerk

10/02/2020

Date

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Notice of Rights

This action is final and effective on the date filed with the Clerk of the Department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a petition. On the filing of a timely and sufficient petition, this action will not be final and effective until further order of the Department. Because the administrative hearing process is designed to formulate final agency action, the hearing process may result in a modification of the agency action or even denial of the request for a variance or waiver.

Petition for Administrative Hearing

A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rule 28-106.201, F.A.C., a petition for an administrative hearing 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, telephone number, and any e-mail address of the petitioner; the name, address, telephone number, and any e-mail address 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 are or will be affected by the agency 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.

The petition 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. Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

Time Period for Filing a Petition

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing must be filed within 21 days of receipt of this written notice. The failure to file a petition 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, F.S., 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, F.A.C.

Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time. Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, before the applicable deadline for filing a petition for an administrative hearing. 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.

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Introduction

Pursuant to Subsection 161.101(2), Florida Statutes, the Florida Department of Environmental Protection (Department or FDEP) is the beach and shore preservation authority for the State of Florida. As part of the Department's statewide beach management plan adopted pursuant to Section 161.161, Florida Statutes, the Department is adopting this inlet management plan for Ponce de Leon Inlet in Volusia County, Florida.

Ponce de Leon Inlet Management Plan updates strategies for Ponce de Leon Inlet that were adopted in the *Ponce de Leon Inlet Management Implementation Plan* (FDEP, 1997) to be consistent with current statutes and observed erosion[1] conditions. The *Strategic Beach Management Plan* (FDEP, 2020) called for a continuation to bypass material from the inlet to the adjacent eroding beaches, to obtain updated beach and offshore profiles with-in the area of inlet influence, to update the sediment budget and to adopt an updated inlet management plan. The Department and Volusia County sponsored an updated inlet management study of Ponce de Leon Inlet in 2018-19 that was performed by Taylor Engineering, Inc.

Program Objectives and Statutory Responsibilities for Inlet Management

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

> "The Legislature recognizes the need for maintaining navigation inlets to promote commercial and recreational uses of our coastal waters and their resources. The Legislature further recognizes that inlets interrupt or alter the natural drift of beach-quality sand resources, which often results in these sand resources being deposited in nearshore areas or in the inlet channel, or in the inland waterway adjacent to the inlet, instead of providing natural nourishment to the adjacent eroding beaches. Accordingly, the Legislature finds 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

[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 descriptions of coastal processes in this document are not intended to affect title to real property or real property boundaries.

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."

Volusia County and the U.S. Army Corps of Engineers have been the entities responsible for dredging Ponce de Leon Inlet and consequently, mitigating the extent of beach erosion caused by the inlet, as specified in Subsection 161.142 (6), Florida Statutes.

History of Ponce de Leon Inlet

Ponce de Leon Inlet is in Volusia County on the northeast coast of Florida connecting the Atlantic Ocean with the Halifax River lagoon to the north and the Indian River North lagoon to the south, which are mangrove-fringed estuaries (**Figure 1**). The Atlantic Intracoastal Waterway extends for 24 miles north of the inlet along the Halifax River past the Town of Ponce Inlet, Wilber-by-the-Sea, Port Orange, Daytona Beach Shores, Daytona Beach, Ormond Beach and Ormond by the Sea. North of Ormond Beach, the Tomoka River connects to the Halifax River and contributes to the Ponce de Leon Inlet tidal prism. The Atlantic Intracoastal Waterway extends south from the inlet along the Indian River North lagoon and into the Mosquito Lagoon. The inlet separates the north peninsula of Volusia County with the Town of Ponce Inlet to the north from the south peninsula of Volusia County with the City of New Smyrna Beach to the south.

It is important to understand the history of Ponce de Leon Inlet, its evolution and prior inlet management activities, and beach erosion control activities along the adjacent beaches, to gain a perspective on the inlet's dynamics and the need to change inlet management strategies over time. The creation of Ponce de Leon Inlet pre-dates historical records. There is geological evidence of several other relic inlets extending south of Ponce de Leon Inlet to Cape Canaveral, which have been open and connecting the Atlantic Ocean to the Mosquito Lagoon as recent as approximately 1,500 years ago. These now closed inlets date progressively more recent to the north, with Ponce de Leon Inlet being the most recent and currently open. The most recent of these relic inlets closed around 500 A.D. and was located near Turtle Mound about 11 miles south of Ponce de Leon Inlet (Mehta and Brooks, 1973).

Figure 1. Ponce de Leon Inlet, Google Earth imagery, 2019**.**

Ponce de Leon Inlet has provided historical navigation to early native Americans, and European colonists from Spain, France, and Great Britain. The first historical account appears to be that of the Spanish explorer, Ponce de Leon, who made his first landing somewhere between the mouth of the St. Johns River and St. Augustine in 1513, and then sailed south along the coast and landed again near Turtle Mound. Upon meeting resistance from the natives, he found refuge in a nearby river, which he called Rio de la Cruz (river of the cross). Historians believe this was the junction of Ponce de Leon Inlet with the Halifax and Indian Rivers (Davies, 1975). In 1573, Pedro Menendez Marques, Spanish Governor of Florida, sailed the east coast of Florida and observed depths over the inlet's ebb shoal of 4.2 feet at low tide and 7.0 feet at high tide (Gould, 1927).

Prior to 1926, the inlet was called Mosquito Inlet. After Great Britain obtained possession of Florida from Spain in 1763, a British surveyor, Colonel James Moncrief, prepared a map entitled, "Plan of the Harbour of Musquitos – Distant from St. Augustine 72 miles." This map, dated 1765, showed soundings over the ebb shoal of 6 to 8 feet at low tide. After possession of Florida returned to Spain in 1783, Antonio Pons and his wife received land grants from the Spanish government for 320 acres of land on the north side of Mosquito Inlet. This land ownership was recognized by the United States when Florida was acquired by treaty with Spain in 1821 (Davies, 1976). The current county park known as Lighthouse Point Park, includes this land.

Shipping through the inlet, particularly of timber from native live oaks that was used in ship construction, was particularly hazardous with no navigation aids during the mid-18th to mid-19th centuries. A lighthouse was initially constructed in 1834 on the south side of the inlet; however, the lighthouse was damaged by a storm and destroyed by native Americans in 1835 (Davies, 1976), prior to the outset of the Second Seminole War. The U.S. Coast Survey conducted hydrographic surveys of Mosquito Inlet, providing bathymetric maps in 1851 and 1874. These maps show the inlet remained geometrically stable, but the inlet channel and shoal locations varied over time. In 1883, the U.S. government purchased 10 acres of the original Pons grant and initiated construction of a lighthouse, which went into commission in 1887.

By 1912, the Florida East Coast Canal was completed through the area, which had effects on the hydraulics of the inlet; however, the controlling depths were less than the authorized 5 feet. In 1925, the U.S. Coast and Geodetic Survey charted the inlet, and in 1926, the name Mosquito Inlet was changed to Ponce de Leon Inlet (Jones and Mehta, 1978). Also, in 1926, a hurricane passed the inlet vicinity causing extensive damage, which included the Inlet Terrace Hotel that was under construction in Ponce Park. Some of the foundation ruins of this brick construction remain adjacent the inlet today.

The Florida Inland Navigation District was formed by the Florida Legislature in 1927, and the 1927 River and Harbor Act by the U.S. Congress authorized increasing the project dimensions of the Intracoastal Waterway (IWW) to an 8-foot depth and 75-foot width. The 1930 River and Harbor Act increased the project width to 100 feet. Between August 1, 1932 and January 18, 1933, a bypass channel was cut through wetlands west of Ponce de Leon Inlet, rerouting the IWW from the Halifax River and Indian River North in the inlet vicinity with the excavation of approximately 934,000 cubic yards of material. The Corps of Engineers surveyed the inlet in 1934, and the IWW enlargement was completed in 1935. In 1938, the Ponce de Leon Coast Guard Station was opened just south of the inlet,

and in 1939, the Corps of Engineers surveyed the inlet in preparation for dredging an ocean entrance channel.

In 1941, the Ponce de Leon Inlet and Port District was formed. Following another inlet survey in 1942, the Corps of Engineers dredged the inlet and interior connecting channels in 1943, as a war measure to aid passage of Navy and Coast Guard craft. About 860,000 cubic yards of sand was dredged resulting in a channel 14 feet deep across the ebb shoal. Rapid shoaling prompted the Navy to dredge another 317,000 cubic yards of sand in 1944, resulting in a channel 16 feet deep. Following the passage of a hurricane in October 1944, surveys obtained in 1945 showed continued shoaling. By 1952, a Corps of Engineers survey of the entrance channel showed depths across the ebb shoal between 4 and 6 feet. In 1952, the IWW was enlarged to a depth of 12 feet and width of 125 feet for approximately 13 miles both north and south of Ponce de Leon Inlet, involving the removal of nearly 2.4 million cubic yards of material.

Federal Navigation Project

Following a 1963 Corps of Engineers survey of the inlet, the 1965 Rivers and Harbors Act authorized navigation improvements at the inlet (USACE, 1963). The project consisted of an entrance channel across the ebb shoal with a depth of 15 feet and a width of 200 feet, an inlet channel with a depth of 12 feet and a width of 200 feet, a channel extending south from the inlet through the Indian River North lagoon to a connection with the Intracoastal Waterway with a depth of 12 feet and a width of 100 feet, and a channel extending north from the inlet through the Halifax River lagoon to a connection with the Intracoastal Waterway with a depth of 7 feet and a width of 100 feet (**Figure 2**). The project also consisted of two jetties, including a south jetty 4,078 feet long, and a north jetty 4,050 feet long, which included 1,800 feet of concrete weir section to facilitate bypassing of the southward littoral drift into a dredged impoundment basin (USACE, 1967).

In 1968, the Ponce de Leon Inlet and Port District became the Ponce de Leon Port Authority, and construction commenced on the federal navigation project. South jetty construction began in July and driving the king piles for the north jetty weir section began in October. Both activities were completed by October 1969. Construction on the 1,750 feet of boulder mound north jetty commenced January 1970 and was completed by July 1971. The horizontal beams in the weir section were placed between March and July 1971. Dredging of the entrance channel began in July and dredging the impoundment basin began in August, followed by dredging the interior channel in the Indian River North in

September. Through 1972, approximately 178,000 cubic yards of sand were excavated from the entrance channel and 400,000 cubic yards of sand were removed for the impoundment basin and discharged south of the south jetty. Small riprap was placed along the concrete weir section to minimize scour. **Table 1**, from Trudnak et al (2020), lists the maintenance dredging history at Ponce de Leon Inlet since 1973 with a total volume of 5,049,378 cubic yards of sand dredged from the federal inlet channel and IWW from 1973 to 2019. IWW dredge material was used for 1994, 1999, 2006, 2008 and 2019 beach placement events. Another 255,429 cubic yards of material was obtained from the Dredged Material Management Area (MSA-434) introducing sand to the inlet's area of influence from outside the inlet's hydraulic system.

Figure 2. Ponce de Leon Inlet Federal Navigation Project, Google Earth aerial image, 2019.

Table 1. Inlet dredge and fill projects since completion of the federal navigation project, 1973 to 2019 (Trudnak et al, 2020). The total combined volume is 5,304,807 cubic yards (cy).

Date	Volume (cy)	Dredging Location	Disposal Location
1973	120,204	Inlet	North Offshore
1974	433,751	Inlet/South Shoal	North Spit Breach Closure
1974	89,167	Inlet/South Shoal	North Beach
1975	138,009	Inlet	North Offshore
1976	12,515	Inlet	North Offshore
1976	137,936	Inlet	North Offshore
1978	40,821	Inlet	North Offshore
1978	434,558	Inlet	North Beach
1984	82,212	Inlet	North Beach
1985	899,996	Inlet	North Beach
1989	868,967	Inlet	North Beach
1994	214,700	IWW	North Bank
1999	32,000	North channel near IWW	South Beach Nearshore
2005	115,339	Inlet	North Beach
2006	255,429*	DMMA	South Beach
2008	432,073	IWW	South Beach Nearshore
2009	137,008	Inlet	North Beach
2011	30,000	Inlet	South Beach Nearshore
2012	51,160	Inlet	North Beach Nearshore
2013	141,600	Inlet	North Beach Nearshore
2014	46,170	Inlet	South Beach Nearshore
2015	130,215	Inlet	South Beach Nearshore
2017	34,850	Inlet	South Beach Nearshore
2018	16,080	Inlet	South Beach Nearshore
2019	410,047	Inlet and IWW	South Beach Nearshore

* The 2006 event placed 745,000 cy between R-161 and R-187.25. Assuming equal distribution of fill across all monuments, the 255,429-cy value represents the volume placed between R-161 and R-170 (i.e., within the study area). The material was offloaded from an Intracoastal Waterway dredged material management area (DMMA) near the inlet.

After completion of the federal navigation project, several investigators monitored conditions at Ponce de Leon Inlet. These studies documented physiographic characteristics at the inlet and supported post-

construction activities (Partheniades and Purpura, 1972; Clark, 1973; Purpura et al, 1974; Purpura and Chiu, 1977; USACE, 1983). Various aspects of the federal project design were problematic as the jetty-weir system was considered experimental at the time of construction. The weir was designed to be adjustable with changes in the level of the foreshore slope of the beach; however, problems with king-pile displacement and biofouling prevented the panels from being removable. So, the weir had the effect of creating a permanent elevation. Although sand continued to pass over the weir at a more landward location due to the fixed elevation on the upper beach profile, much of the bypass material passed into the inlet landward of the impoundment basin.

Another problem was the channel alignment with respect to the north jetty. The pre-project natural channel tended to migrate from a more easterly alignment when affected by major northeasters, to a more northeasterly alignment during less stormy periods of southeast wave conditions. Due to wave sheltering by the north jetty and the location of the sand impoundment basin located immediately south of the weir, the most hydraulically efficient flow path for the channel was back to its historic northeasterly alignment. Due to greater depths in the impoundment basin, the channel migrated northward to pass through it. This northward channel migration became a major problem by scouring the interior foundation of the north jetty. In 1978, approximately 35,000 tons of granite boulders were placed along the south side of the outer section of the north jetty to prevent it from collapsing. Also, in 1979, the length of the weir was reduced from 1,800 feet to 1,500 feet by extending the landward boulder tie-back section of the jetty seaward through the addition of granite boulders. This was intended to push the beach and its weir bypassing further seaward. Given the continued functionality problems with the weir system and sand trap design, and due to the severe erosion to the beaches north of the inlet, the weir was substantially closed in 1984 through the addition of granite boulders. The effect of closing the weir has been to stabilize the beaches north of the inlet. These beaches continued to accrete until recently when Hurricanes Matthew (2016), Irma (2017) and Dorian (2019) caused major damage to a 225-foot section of the north jetty at its landward end. Each major storm since the jetty was breached has caused additional major beach and dune erosion north of the inlet as significant quantities of sediment have been transported through the jetty breach into the inlet. This problem will be resolved when the north jetty is repaired to its original specifications.

Another major issue impacting the inlet sediment management was the observed large-scale accretion south of the south jetty. Within the first two years of constructing the south jetty, approximately 1.4 million cubic yards of sand accreted in this area while erosion prevailed on the beaches north of the inlet (Partheniades and Purpura, 1972). Although the net longshore transport at the inlet was considered to be

southward, overlooked was the greater gross longshore transport of sediment, which included a large volume of longshore transport in the direction opposite that of the predominant direction observed in the region. The result of this effect was to completely inundate the south jetty with sand that formed a large shoal projecting into the inlet on the south side. This south side shoaling within the inlet added pressure to the northward channel migration. Based upon subsequent federal feasibility studies and engineering and design, the authorized solution to this issue is to extend the length of the south jetty 1,000 feet to match the seaward terminus of the north jetty.

Adopted Inlet Management Plan of 1997

In 1991, an inlet management study of Ponce de Leon Inlet was sponsored by the Department and Volusia County, acting as the Ponce de Leon Port Authority addressing the extent to which the inlet causes beach erosion and providing recommendations to mitigate erosion (Taylor and Yañez, 1994). The study, which was completed in 1994, provided an evaluation of alternative inlet management strategies. Seven alternatives were evaluated, including –

- Closing the inlet.
- Bypassing via contractor dredging of inlet interior with feeder beach disposal.
- Extending the south jetty 1,000 feet seaward and bypassing via contractor dredging of inlet interior with feeder beach disposal.
- Bypassing via an offshore jet pump/fluidization system and contractor dredging of inlet interior with feeder beach disposal.
- Bypassing via an offshore jet pump/fluidization system, extending the south jetty 1,000 feet seaward, and contractor dredging of inlet interior with feeder beach disposal.
- Bypassing via contractor dredging of inlet interior with feeder beach disposal and opening the weir section in the north jetty.
- Bypassing via locally owned and operated dredge working inlet interior with feeder beach disposal.

Closing the inlet would have extensive negative impacts to the entire estuarine system and was not considered further. The six engineering alternatives with bypassing were considered for construction, operation, and maintenance as well as their known successes or failures.

A sediment budget was developed for three historic stages of the inlet. The latest stage at the time of the study, 1985-1992, covered the period following closure of the north jetty weir. It was determined that

the inlet and its ebb shoal were trapping sand at a rate of 43,000 cubic yards per year. Because of the weir closure, the north beach was expected to accrete, but the south beach was expected to erode at a rate of -12,000 cubic yards per year. It was believed that bypassing 43,000 cubic yards per year to the south beach would change the south beach from erosion to accretion.

In evaluating bypassing effectiveness, it was conceded that dredging was a reliable alternative that would ensure removal of an adequate quantity of sand from the inlet interior. However, it would not stop or diminish the inlet sand trapping. Extending the south jetty was expected to reduce the trapping rate and improve navigation and public safety. A jetty extension would reduce the quantity of sand transported from the south beach around the seaward end of the south jetty into the inlet. An extension would produce a more even distribution of the flow across the entrance channel, thus providing a more centrally located channel while reducing the erosive impact along the north jetty.

Following closure of the north jetty weir section, the north spit inside the inlet experienced accelerated erosion. Between 1986 and 1990, Taylor et al (1992) calculated shoreline recession for this spit in excess of -70 feet per year, which had exposed the north jetty's landward tieback on its south side. To stabilize the north spit, the construction of four groins was recommended with a preliminary design.

On March 10, 1997, the Department adopted the Ponce de Leon Inlet Management Implementation Plan, which included the following five strategies:

1) Bypass all beach compatible dredged material including channel maintenance material to downdrift beaches in eroded areas as identified in the inlet, beach, and offshore monitoring plan. Material shall be placed on beaches located downdrift of the inlet in areas of greatest need, within the area of influence, based on a plan approved by the Department. A minimum of 43,000 cubic yards of material shall be bypassed on an average annual basis. The sediment budget contained in the study report is adopted as an interim measure and shall be formally validated or redefined in subsequent revisions of the plan based on a comprehensive monitoring plan by December 31, 2001.

2) Extend the south jetty and stabilize the shoreline of the northern spit based on the final results of the USACE feasibility study.

3) Conduct additional sediment analysis of the interior shoals to determine the suitability for beach disposal.

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

5) Conduct a feasibility study of restoration of the downdrift beaches as mitigation for the effects of the inlet.

Since adoption of the plan in 1997, an excess of 43,000 cubic yards of sand has been mechanically bypassed to the beaches south of the inlet through maintenance dredging of the federal navigation project and through the transfer of IWW sand that was stockpiled on the dredge material management area – MSA-434 inside Ponce de Leon Inlet. The south jetty extension was authorized in 2001 (Joint Coastal Permit #0168748-001-JC), but was not constructed due to lack of federal funding, and the permit expired July 27, 2015. Additional sediment analyses were conducted of the interior shoals and channel by the USACE in 2010 (USACE, 2013), but a feasibility study of the restoration of the south beaches was not conducted. However, following the 2004-2005 hurricanes, an emergency beach and dune restoration project was conducted in 2006 along a segment of New Smyrna Beach between R161 and R187 with 745,000 cubic yards of sand obtained from MSA-434. Monitoring was conducted of the beach project and occasional surveys have been obtained north and south of the inlet; however, hydrographic surveys of the inlet and shoals were nonexistent after a 2001 survey until 2017.

Updated Inlet Sediment Budget Study of 2019

Pursuant to Section 161.142, Florida Statutes, dredging within an inlet system, including its shoals, should result in the placement of all beach quality sand on adjacent eroding beaches to balance the sediment budget between the inlet and adjacent beaches. A sediment budget is a balance of the volumes (or volume rate of change) for sediments entering and leaving a tidal inlet system and its adjacent beaches. A sediment budget quantifies the natural longshore sediment transport by waves and tides to and from the inlet, the entrapment of longshore sediment by the inlet channel and the ebb and flood shoals, and the mechanical "bypassing" of sediment, typically by a hydraulic dredge, from the inlet to the adjacent eroded beaches or nearshore. Sediment transport volumes and pathways are unique to each inlet as influenced by regional geology, morphological characteristics, wave and tide conditions, and sediment characteristics and supply. A sediment budget is determined by comparing two or more surveys of an inlet system, including its channel, ebb and flood shoals, and the adjacent beaches.

Following an updated hydrographic survey of Ponce de Leon Inlet and its shoals in 2017, the Department and Volusia County sponsored a study to update the inlet's sediment budget. This study was conducted by Taylor Engineering, Inc., and was completed in October 2019 (Trudnak et al, 2020). The scope of the study did not include sediment transport modeling, and therefore used the sediment

transport estimates reported in Trudnak and Srinivas (2003) for cells north of the inlet and the transport estimates reported in Taylor Engineering (2003) for cells south of the inlet. An updated nearshore wind climate analysis was used to update the aeolian transport analysis.

The 1994 inlet management study adopted a very conservative area of inlet influence extending 17,000 feet (3.2 miles) to the north and 14,500 feet (2.7 miles) to the south, between FDEP reference monuments R130 to R165. The study area for the updated sediment budget included that area of inlet influence and added another 5,000 feet to the north and south to extend from R125 to R170. Trudnak et al (2020) developed 20 sediment compartments subdividing the area of inlet influence based on morphological features and data availability, as shown in **Figure 3**. Ponce de Leon Inlet is subdivided into six cells describing the inlet entrance, the north bank, the inlet throat, the south bank, the center interior, and the south interior. There is an additional cell describing the inlet nearshore, which includes the inlet's ebb shoal and extends southward to FDEP reference monument R156. Another 13 cells describe the north and south beaches and nearshore areas. The line of Mean High Water (MHW) separates the beach cells from the nearshore cells, and the landward and seaward extent of reliable survey data provides the cross-shore boundary of the cells. The longshore boundaries of the beach and nearshore cells are the north jetty and FDEP reference monuments R125, R130, R140, R156, R165, and R170.

Mean high water shoreline changes and beach profile volumetric changes were calculated using surveys for 1986/87, 2001, and 2017. Volumetric changes were calculated for the time periods 1986/87-2001, 2001-2017, and 1986/87-2017, and shown in **Table 2**.

Table 2. Beach and nearshore volume changes (Trudnak et al 2020).

Cell	1986/1987–2001 Volume Change Rate (cy/yr)		2001–2017 Volume Change Rate (cy/yr)		1986/1987–2017 Volume Change Rate (cy/yr)	
	Beach	Nearshore	Beach	Nearshore	Beach	Nearshore
North 3	601*	-1,167*	969*	-2,272*	3,370	-23,641
North 2	9,104	-3,451	6,990	-53,109	8,136	-31,580
North 1	16,542	-3,150	4,491	-66,979	9,961	-51,507
South 1	12,818	40,092	9,189	51,975	10,756	43,950
South 2	621	-27,544	12,346	31,217	6,727	4,053
South 3	-2,198	-36,929	7,334	28,216	2,804	-5,422
South 4	-637*	-9,253*	1,189*	3,777*	1,109	-13,047

*Note: The 2001 data does not cover R-125 to R-129 and R-166 to R-170.

Generally, during each of the time periods, the beaches both to the north and to the south accreted. This accretion of the beaches within the vicinity of the inlet is a direct reflection of the success of the inlet management efforts to bypass sand both to the north and to the south of the inlet. However, the nearshore areas from mean high water out to the -20-foot contour sustained volumetric losses north of the inlet and mixed volumetric gains and losses south of the inlet.

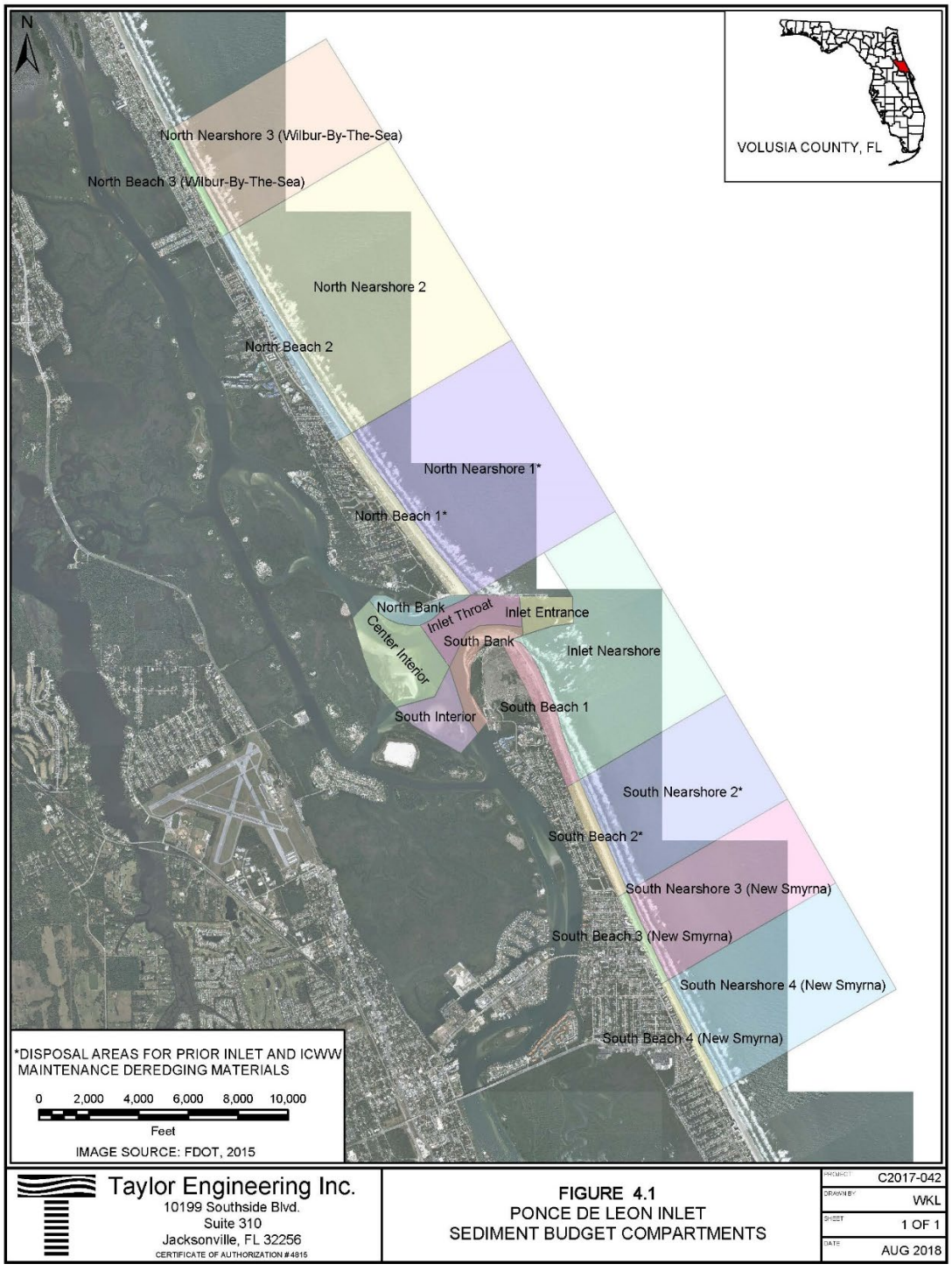

Figure 3. Sediment budget compartments (Trudnak et al, 2020).

Figure 4 provides the most recent and updated sediment budget for the period between 2001 and 2017. During this period, the measured beach cell gains equaled 12,450 cubic yards per year to the north and 30,058 cubic yards per year to the south. The inlet entrance and interior cells experienced a total loss of approximately -46,226 cubic yards per year. Most of this loss was due to the 43,000 cubic yards per year obtained from the inlet dredging. Also, during this period, the inlet nearshore cell, which includes the inlet ebb shoal, experienced a gain of 51,975 cubic yards per year. Entering the inlet nearshore cell from the south was 125,000 cubic yards per year and entering the inlet nearshore cell from the north was 28,000 cubic yards per year. For the recent time period between 2001 and 2017, dredged material from the federal channel and IWW was distributed as follows: 445,107 cubic yards to the north and 673,308 cubic yards to the south. Of note, the 2001 data set does not have complete coverage within the North 3 and South 4 cells. Profile data for R125-R129 and for R166-R170 do not exist for the 2001 survey, which directly affects the volumes reported for the North 3 and South 4 cells.

Figure 5 provides the longer-term sediment budget between 1986/87 and 2017. The aforementioned lack of profile data for the 2001 survey did not impact this longer-term sediment budget. During this period, the measured beach cell gains equaled 21,467 cubic yards per year to the north and 20,287 cubic yards per year to the south. To achieve this relative balance, dredged material was distributed roughly two thirds to the north (1,314,074 cubic yards) and one third to the south (705,308 cubic yards), or by placing 42,389 cubic yards per year to the north beaches and 22,752 cubic yards per year to the south beaches. As was seen in **Table 1**, most of the north beach placement occurred from 2005 and earlier, whereas, most of the south beach placement took place from 2006 to the present. The beach stability to the north was also improved by the closure of the north jetty weir in 1984.

Since the development of the updated sediment budget, the beach immediately north of the inlet has experienced significant erosion. This erosion appears to have been directly related to the damage to the north jetty during Hurricanes Matthew, Irma, and Dorian. Although repairing the north jetty is paramount to solving this problem, initial sand bypassing should be prioritized to the beaches north of the inlet.

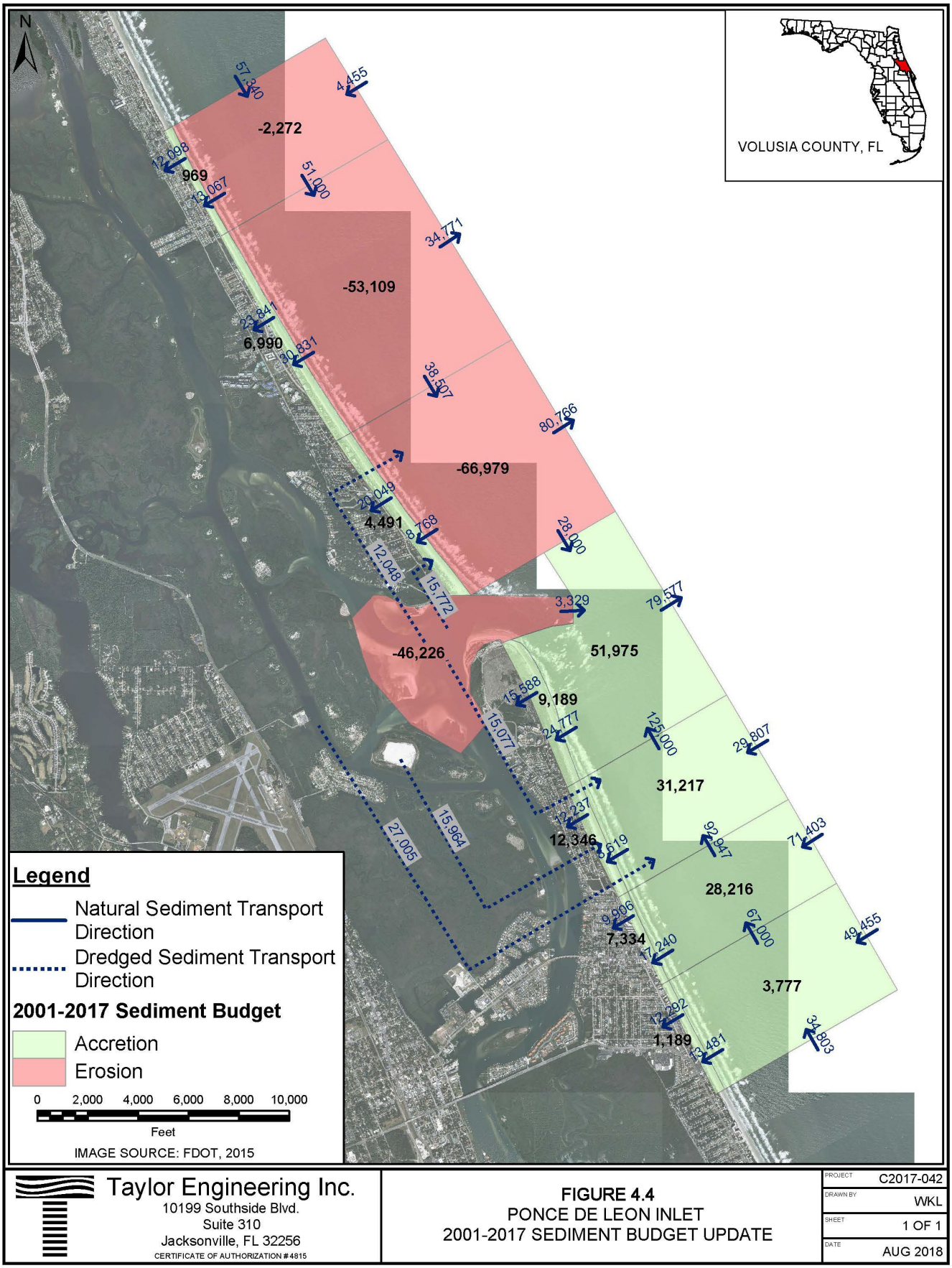

Figure 4. *Updated sediment budget, 2001 – 2017 (Trudnak et al, 2020).*

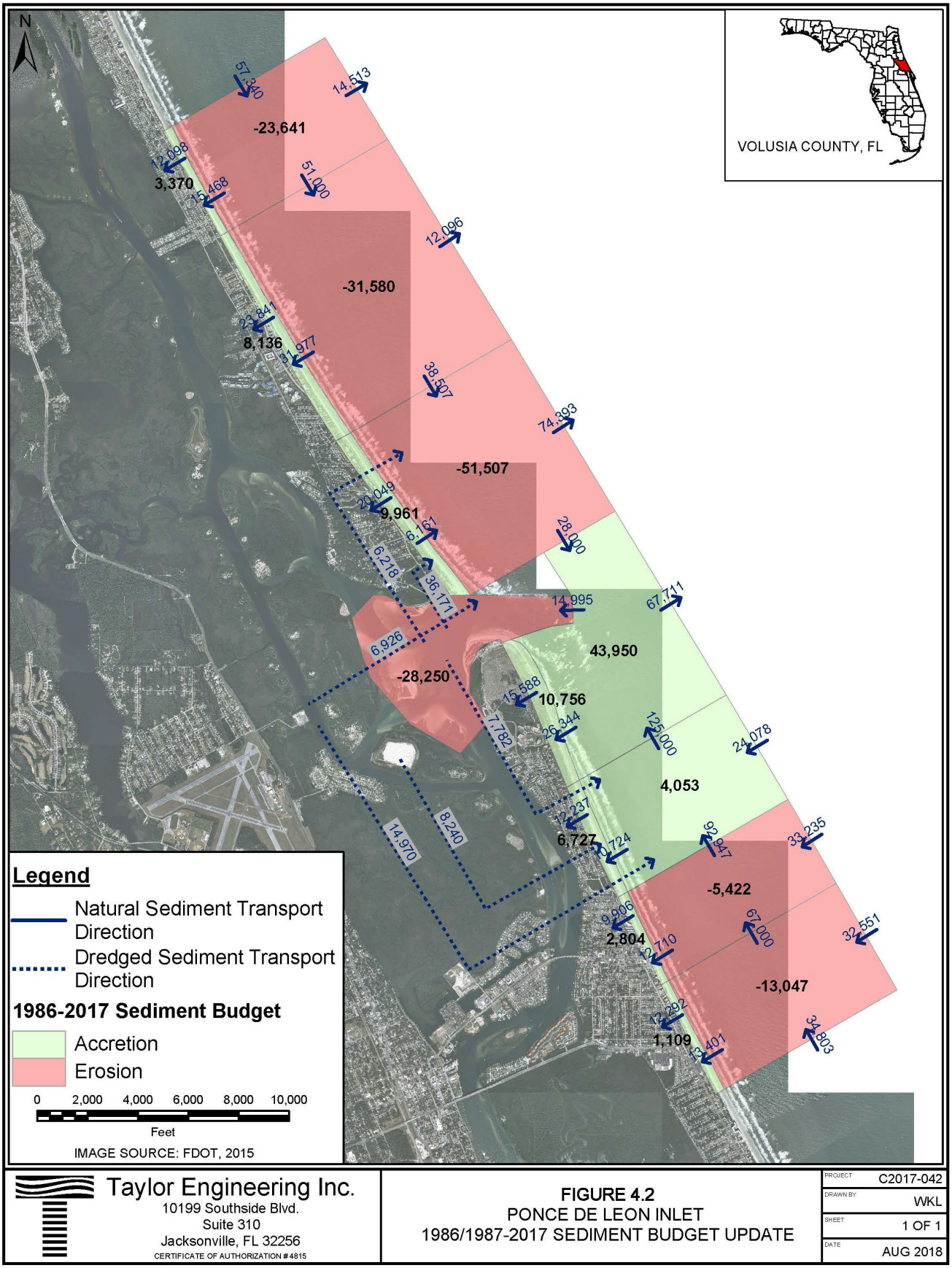

Figure 5. *Long-term sediment budget, 1986/87 – 2017 (Trudnak et al, 2020).*

Development of Recommended Inlet Management Strategies

The inlet management plan adopted in 1997 established a sand bypassing protocol that called for the transfer of 43,000 cubic yards of sand per year to the downdrift beaches south of the inlet. Since adoption of the plan, annual bypassing in excess of 43,000 cubic yards has been placed on the south beaches. The amendment to Section 161.142, Florida Statutes, in 2008 brought attention to the need to balance the sediment budget of an inlet. This effectively changed inlet management from the practice of only considering the net longshore transport of sediment in one direction to considering the gross transport of longshore transport in all directions.

For Ponce de Leon Inlet, all studies since the construction of the federal navigation project, have shown significant transport to the north as well as in the direction of predominant regional net transport, which is to the south. Taylor Engineering (2003) modeled the region south of the inlet to Canaveral National Seashore and calculated a significant longshore transport reversal. Likely reasons for the transport reversal are circulation patterns induced by tidal flows and interactions between tidal flows and waves which can modify the patterns and magnitudes of longshore transport. The ebb shoal that developed after construction of the federal navigation project extends substantially south of the south jetty and waves from the northeast crossing the ebb shoal are refracted in a manner that alters their direction in the nearshore to approach the shoreline from the southeast. Although the greatest wave energy occurs from the northeast during winter months, the long summer season of southeast swell coupled with the inlet tidal currents causes a substantial transport of sediment northward into the inlet.

The update sediment budget of 2001 to 2017 (**Figure 4**), despite its problems with data deficiencies, clearly shows longshore transport both from the south and from the north. But the longshore transport between cells was based upon an earlier time period and may not be completely representative of the recent period of wave climate. Hydrographic data was missing adjacent the north jetty and longshore transport was unknown at the south jetty. Reasonable target bypassing quantities are not obtainable from this updated sediment budget; however, the information is sufficient to modify the 1997 sand bypassing requirement to establish sand bypassing to the north as well as to the south.

The longer-term sediment budget of 1986/87 to 2017 (**Figure 5**) did not have the data problems of the 2001 survey and covered both the earlier time period of mostly northward bypassing as well as the later period of mostly southward bypassing. The longer-term sediment budget demonstrated a relative balance in the beach accretion rate both north and south of the inlet. The inlet sand bypassing during this period was approximately two-thirds to the north and one-third to the south.

Future inlet bypassing strategies should be based on greater refinement in the development of the sediment budget. The hydrographic survey data should be complete around and within the inlet, and the wave climate data should be updated to the same period of record. A comprehensive beach and inlet hydrographic monitoring program is needed for the basis of all future inlet management activities.

Maintenance dredging of the federal navigation channels should continue to place material on the beaches adjacent to the inlet. However, in lieu of the placement option set forth in the 1997 inlet management plan, sand placement should be conducted both to the north and to the south of the inlet. The longer-term sediment budget showed the quantity of sand bypassed between 1986/87 and 2017 resulted in the equitable accretion rate of the beaches north and south of the inlet. Such a distribution based upon three decades of data, including several major storms, would be an appropriate initial planning target for inlet sand bypassing to the adjacent beaches. A comparable rate of inlet sand bypassing could be an initial strategy that could be adjusted based upon the monitoring data obtained in future surveys. Such a strategy would increase the total bypassing requirement to 60,000 cubic yards per year with two-thirds (40,000 cubic yards per year) being placed to the north and one-third (20,000 cubic yards per year) being placed to the south.

Subsection 161.142(5), Florida Statutes, allows nearshore placement of sand dredged from federal projects. The intent of the legislation is to allow federal projects to place sand seaward of the beach on the submerged profile within the zone of active sand transport. Such a nearshore placement of sand could feed the littoral system of longshore transport as well as potentially be transported shoreward. Physical monitoring of the 2006 post-hurricane beach and dune nourishment project south of Ponce de Leon Inlet showed the offshore bar resulting from the erosion of the 2004 hurricanes migrated shoreward and attached to the beach. Instead of erosion to the nourishment project, monitoring showed accretion of the beach profile within the project area as this volume of nearshore sand was transported shoreward. A subsequent project in the same area south of the inlet, but with nearshore placement of sand obtained from the IWW in 2008, continued to show landward migration of the placed material from the nearshore. High frequency monitoring has been conducted for the 2019 project south of the inlet using coastal imaging to supplement traditional survey data (Bruder et al, 2019). Nearshore placement of dredged sand has been shown to be an effective strategy in the vicinity of Ponce de Leon Inlet.

Recommended Inlet Management Plan Strategies

The Department staff recommends the following inlet management strategies be adopted to meet the requirements of Chapter 161, Florida Statutes.

1) **A comprehensive beach and inlet hydrographic monitoring program shall be conducted** to evaluate the performance and impact of existing sand bypassing and nourishment projects and to periodically update the inlet sediment budget. This monitoring program shall include topographic and hydrographic surveys of the inlet system, its ebb and flood shoals, and adjoining beaches between FDEP reference monuments R125 and R170.

Discussion – A comprehensive beach and inlet hydrographic monitoring program is the most important element to manage the sediment at Ponce de Leon Inlet. Topographic and bathymetric surveys provide reliable data to estimate the volumetric impact of the inlet on adjacent beaches and to establish a sand placement protocol that complies with Section 161.142, Florida Statutes.

2) **Sand bypassing shall be performed from the Ponce de Leon Inlet federal navigation project channel to the adjacent Atlantic beaches or active nearshore to the north and south of the inlet between FDEP Reference Monuments R125 and R170.** The quantity of material to be bypassed shall be based on available navigation channel deposition quantities documented through the monitoring protocol of Strategy #1 above. Sand may also be dredged from adjacent inlet shoal areas where the Corps of Engineers determines is necessary for the integrity of the federal navigation project; however, additional geotechnical and engineering design is necessary to develop an acceptable borrow site plan for dredge areas not currently authorized.

Discussion – The beaches approximately 4.2 miles north and 3.7 miles south of the inlet are considered within the influence of the inlet. During the period between 2001-2017 described in the updated sediment budget, as well as during the longer period between 1986/87 and 2017, the beaches north and south of the inlet accreted and were not considered eroded. The accretion and stability of these beaches is a direct result of the bypassing efforts conducted during the period. Since 2017, the beach to the immediate north of the inlet has been erosional and is in need of nourishment.

3) **On an average annual basis, the initial target inlet sand bypassing quantity shall be 40,000 cubic yards per year to the north and 20,000 cubic yards to the south.** This target quantity may be modified or updated based on a minimum of four years or more of monitoring data or

additional inlet model studies indicating a change in the sediment budget. In the interim, should the volume of sand accumulating in the Ponce de Leon Inlet navigation channel and connecting waterways exceed 60,000 cubic yards per year, the additional sand may be dredged and placed on the adjacent beaches or nearshore either north or south of the inlet. However, given the south beaches and nearshore have received substantial advanced placement of bypassed material since 2017, the north beaches and nearshore shall be prioritized for placement.

Discussion – The 1986/87-2017 sediment budget indicates adequate sand bypassing that has maintained the beaches north and south of the inlet. Between 1986/87 and 2017 roughly two thirds of the inlet dredge material (42,389 cubic yards per year) was placed to the north of the inlet and one third (22,752 cubic yards per year) was placed to the south. Monitoring may determine the need to adjust these initial target sand bypassing quantities and the timing for fill placements. Since the 2017 sediment budget computations, over 426,000 cubic yards of sand has been bypassed to the nearshore south of the inlet. Given the recent eroded beach conditions north of the inlet since 2017 and lack of bypassing north of the inlet since 2013, sand placements shall be prioritized to the north of the inlet until monitoring data indicates conditions have stabilized.

4) **Acceptable beach quality sand may also be obtained from Intracoastal Waterway maintenance dredging or Dredge Material Management Areas** as well as inland sand mines or offshore sources to meet the target sand bypassing quantities**.**

Discussion – Roughly three-fourths of all the sand placements south of Ponce de Leon Inlet to R170 prior to 2017 have come from the Intracoastal Waterway or Dredge Material Management Areas. These fill placements have effectively mitigated beach and nearshore erosion losses south of the inlet. Sand placements from these sources to the north would also help mitigate sand deficits north of the inlet.

5) **The federal navigation project north jetty structure that was damaged by Hurricanes Matthew, Irma and Dorian, resulting in the loss of beach and dune material north of the inlet, shall be repaired.**

Discussion – Since Hurricane Matthew in 2016, each major storm, including Hurricanes Irma in 2017 and Dorian in 2019, and several northeasters, have caused continued beach and dune erosion for at least a half mile north of the inlet. Storm tides and waves transport sand from the beach and dunes southward through the jetty breach into the inlet. Repair of the jetty to its pre-damage dimensions may be expected to prevent the further loss of material from this erosion area.

6) **The Congressionally authorized federal navigation project south jetty extension may be constructed as previously permitted, pending reauthorization.**

Discussion – Joint Coastal Permit #0168748-001-JC was issued to the U.S. Army Corps of Engineers, Jacksonville District, on July 27, 2001, for the 1,000-foot seaward extension of the south jetty at Ponce de Leon Inlet. The permit expired on July 27, 2015. The south jetty extension is designed to reduce the entrainment of sediment into the inlet from the beach and nearshore south of the inlet and reduce sediment losses from New Smyrna Beach.

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