

# *Redfish Pass Inlet Management Plan*

**Office of Resilience and Coastal Protection**

**Florida Department of Environmental Protection**

**September 2022**



## **Final Order Adopting Redfish Pass 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 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 2017-19, the Department and the Captiva Erosion Prevention District (CEPD) sponsored an inlet management study of Redfish Pass performed by Aptim Coastal Planning & Engineering, Inc. (APTIM, 2019), which compiled new and historical data and information regarding its coastal processes and inlet and shoreline dynamics, updated its sediment budget, and developed feasible alternatives for the mechanical transfer of sand from the inlet to the beaches south of the inlet. Redfish Pass has been altered by ebb shoal dredging and the construction of shore-protection structures both north and south of the pass; and

WHEREAS in 2021, due to a petition to the proposed inlet management plan, Humiston & Moore, Associates, Inc., provided additional research and analysis to assist in the development of the inlet management plan for Redfish Pass; and

WHEREAS, in September 2022, the Department further developed the inlet management plan that contains corrective measures to mitigate the identified inlet erosion impacts to adjacent beaches; and

WHEREAS, the Captiva Erosion Prevention District are the entities responsible for dredging at Redfish Pass, 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,

**NOW, THEREFORE:**

The Department does hereby adopt the following implementation strategies, as set forth in the attached **Redfish Pass Inlet Management Plan**. Future inlet management activities conducted by the Captiva Erosion Prevention District shall be consistent with the following four strategies:

- 1) **A comprehensive beach and inlet hydrographic monitoring program** shall be conducted to promote bypassing and recovery of ebb shoal features, evaluate the performance and impact of any sand bypassing and nourishment projects and to periodically update the inlet sediment budget. Beach and nearshore surveys between at least R77 on North Captiva Island to R100 on Captiva Island shall be conducted. Periodic inlet hydrographic surveys to include the inlet channel and the ebb and flood shoals should also be conducted between at least R81 to R85. The monitoring program should also consider the integrity and stability of the inlet features including the inlet channel and ebb shoal features. Along with topographic and hydrographic surveys of the inlet system and adjoining beaches, hydraulic monitoring may be conducted to enhance future modeling input data for investigations of inlet management alternatives.
- 2) **Sand bypassing shall be performed from the Redfish Pass ebb shoal to the adjacent gulf-fronting beaches.** An initial bypassing event from the ebb shoal is limited to approximately 240,000 cubic yards to be placed south onto Captiva Island and any subsequent ebb shoal dredging may only be considered acceptable following substantial recovery of ebb shoal and further analysis quantifying any direct adverse impact on adjacent beaches. The quantity of

material to be bypassed shall be based on available ebb shoal deposition quantities documented through the monitoring protocol of Strategy #1 above. Impacts from the dredging of the ebb shoal on the adjacent beaches north of the inlet shall be restored prior to, or as part of, the following dredging event.

- 3) **On an average annual basis, the initial target inlet sand bypassing quantity shall be 30,000 cubic yards per year to the south.** This target quantity may be modified or updated based on a minimum of four years of additional monitoring data indicating a change in the sediment budget. Based on monitoring data and analysis sand may also be placed on adjacent beaches north or south of the inlet as determined by the need to address ongoing erosion within the inlet area of influence as shown in the monitoring data.
- 4) **The source of sediment for meeting the target sand bypassing quantities in Strategy #3 shall be the Redfish Pass ebb shoal borrow areas as authorized by permit.** Alternative 10b identified in APTIM (2019) shall be prioritized since it is expected to refill in the shortest time, but other alternatives may also be considered for further geotechnical and engineering design and permitting to develop an environmentally acceptable project with minimal impacts to inlet features and adjacent beaches. Acceptable beach quality sand may also be obtained from inland sand mines or offshore sources to achieve the target sand bypassing quantities.

Inlet management actions conducted by the Captiva Erosion Prevention District 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 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. Activities ineligible for cost sharing include, but are not limited to navigational construction, operation, and maintenance activities, except those elements whose purpose is to place or keep sand on adjacent beaches. Nothing in this plan precludes the evaluation and potential adoption of other strategies for the effective management of Redfish Pass and the adjacent beaches.

## Approval of Adoption

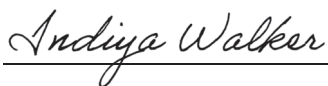


Alex Reed

Director of the Office of Resilience and Coastal Protection  
Florida Department of Environmental Protection

## Filing and Acknowledgement

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



Deputy Clerk

09/06/2022

Date

## 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 Redfish Pass in Lee County, Florida.

*Redfish Pass Inlet Management Plan* updates strategies for Redfish Pass that were adopted in the *Strategic Beach Management Plan* (FDEP, 2018) to be consistent with current statutes and observed erosion<sup>1</sup> conditions. The *Strategic Beach Management Plan* (FDEP, 2018) called for an updated inlet sediment budget and adoption of an inlet management plan. The Department and the Captiva Erosion Prevention District (CEPD) sponsored an updated inlet management study of Redfish Pass in 2017-18 that was performed by Aptim Coastal Planning & Engineering, Inc. (APTIM, 2019).

## ***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 extend the life of proximate beach restoration projects so that periodic nourishment is needed less frequently.”

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<sup>1</sup> 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.

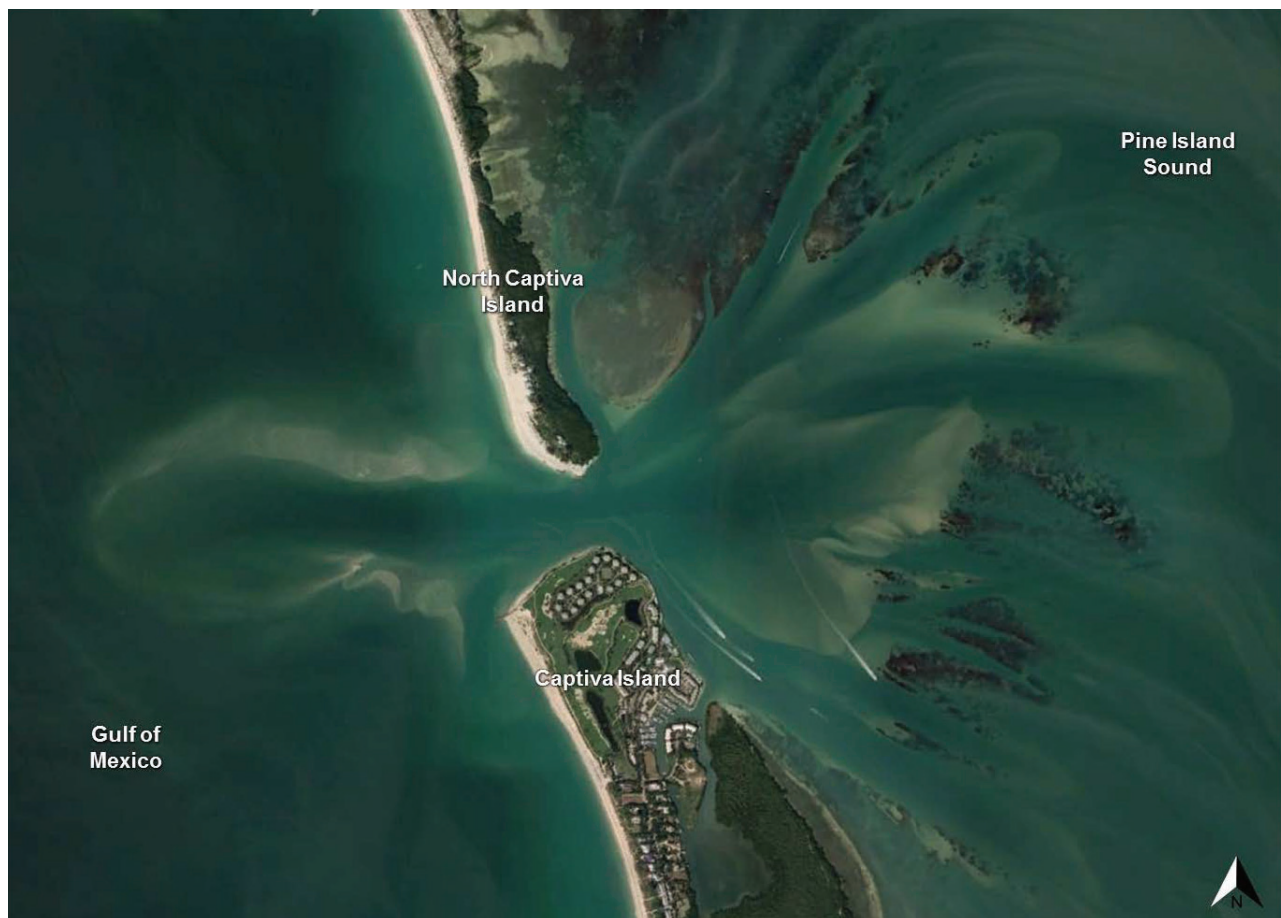
Pursuant to Section 161.143, Florida Statutes,

“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.”

The Captiva Erosion Prevention District has been the entity responsible for dredging Redfish Pass and consequently, mitigating the extent of beach erosion caused by the inlet, as specified in Subsection 161.142 (6), Florida Statutes.

### ***History of Redfish Pass***

Redfish Pass is located in Lee County on the southwest coast of Florida connecting the Gulf of Mexico with Pine Island Sound (**Figure 1**). The inlet separates North Captiva Island to the north and Captiva Island to the south.



**Figure 1.** Redfish Pass between North Captiva Island and Captiva Island, 2017 (Aerial photo: Google Earth images).

It is important to understand the history of Redfish Pass, 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 hurricane of 1921, which made landfall on the southwest coast of Florida, breached Captiva Island forming Redfish Pass and separating North Captiva Island from Captiva Island. Prior to the formation of Redfish Pass, Blind Pass, located five miles to the south, was a larger inlet conveying a greater tidal prism. After opening, Redfish Pass captured a significant portion of the Pine Island Sound tidal prism, and Blind Pass, which then conveyed a substantially smaller tidal prism, became smaller and less hydraulically stable. In addition to affecting the hydraulics of Blind Pass, the opening of Redfish Pass caused significant erosion along the beaches of Captiva Island.

Redfish Pass has remained hydraulically stable through the years with little change in its location. In 1977, construction of a terminal groin was initiated on the north end of Captiva Island and completed in 1981. In October 1981, a beach restoration project known as the South Seas Plantation Improvement Project was constructed along northern Captiva Island (R85-R93.4) using 655,000 cubic yards of sand dredged from the Redfish Pass ebb shoal. An island-wide beach restoration was constructed between August 1988 and April 1989, which involved the excavation of 1,595,000 cubic yards of sand from the Redfish Pass ebb shoal and placement between R85 and R109 at Blind Pass. Between February and April 1996, a nourishment project was conducted along Captiva and Sanibel Islands (R84-R114), but the sand was obtained from an offshore source.

In 1995, an inlet management study of Redfish Pass was sponsored by the Department and the Captiva Erosion Prevention District (CEPD) addressing the extent to which the inlet causes beach erosion and providing recommendations to mitigate erosion. The inlet management plan recommended in this study was not formally adopted by the Department; however, the Department adopted inlet management strategies in the *Strategic Beach Management Plan* (FDEP, 2000).

In 1999, in response to erosion stress north of Redfish Pass, the property owner constructed three T-groins at the south end of North Captiva Island. The south end of North Captiva Island suffered major erosion on August 13, 2004, when Category 4 Hurricane Charley made landfall (Clark and LaGrone, 2004). A 0.3-mile segment of North Captiva Island was breached in the vicinity of R78-R79 forming a shallow pass called Charley's Cut. This pass severed the southern 0.8 mile of North Captiva Island cutting off any significant longshore sediment transport to this beach segment from the north. Over the next four to five years, Charley's Cut eventually closed and southward longshore sediment transport

resumed to nourish the beaches of southern North Captiva Island. Several hurricanes affecting or making landfall elsewhere in Florida during the active 2004-2005 tropical storm seasons continued to cause significant erosion along the beaches adjacent to Redfish Pass.

Between September 2005 and January 2006, a second major nourishment project was constructed along Captiva and Sanibel Islands (R84-R118) with the sand being obtained from an offshore source. In March 2006, the terminal groin on the north end of Captiva Island was reconstructed and extended from a length of 260 feet to a length of 380 feet, and a rock revetment was reconstructed along the inlet's south shoreline. A federally funded hurricane recovery project was constructed by the U.S. Army Corps of Engineers with nourishment along Captiva Island (R85-R86 and R94-R96) between April and May 2008. The sand was obtained from an offshore borrow area. A third major nourishment project obtaining sand from offshore was also constructed along Captiva and Sanibel Islands (R84-R116) between October and December 2013.

### ***Prior Inlet Management Study of 1995***

In 1995, the Department and the Captiva Erosion Prevention District sponsored an inlet management study conducted by Coastal Planning & Engineering, Inc. (CP&E, 1995). The study evaluated historical surveys and aerial photography, shoreline and nearshore profile changes, bathymetric data and changes, and the littoral sediment budget for different time periods. The sediment budgets for different time periods showed that Redfish Pass had been a significant cause of beach erosion on Captiva Island. Environmental resources were also surveyed, and the inlet's hydraulics and stability were evaluated.

The study evaluated 15 inlet management alternatives for addressing the critical erosion conditions to the adjoining beaches that were caused in part by Redfish Pass. One inlet closure option was considered, which involved removing the terminal groin on Captiva Island and filling the inlet with sand. Fourteen other alternatives were considered, which included beach fill proposals for Captiva Island using sand dredged from the inlet ebb shoal, reconstruction or modifications of the terminal groin on Captiva Island, terminal groin construction on North Captiva Island, nourishment and/or revetment construction on the inlet's south shoreline on Captiva Island, as well as a no-action alternative. In addition, an experimental system with jet pumps and fluidizers was considered. The analysis compared costs and effectiveness of each alternative, along with the technical feasibility and any expected environmental impacts.

The study's recommended plan called for a feeder beach on northern Captiva Island intended to facilitate mechanical sand bypassing. The feeder beach would receive 256,000 cubic yards every eight years in conjunction with the Captiva Island nourishment program. The study also recommended upgrading the terminal groin on Captiva Island, which would be intended to provide erosion control on the gulf beach, anchor the inlet channel and provide storm protection. A 1050-foot rock revetment was recommended to be constructed on the south inlet shoreline (R83 to R84) intended to provide storm protection, erosion control and further stabilize the inlet from southward migration. In addition, a terminal groin was recommended to be constructed north of the inlet on North Captiva Island for erosion control.

The Department adopted inlet management strategies for Redfish Pass in the *Strategic Beach Management Plan* (2000), which were: Implement a comprehensive beach, inlet and offshore monitoring program to validate or redefine the sediment budget developed in the inlet management study. The Department adopted updated inlet management strategies for Redfish Pass in the *Strategic Beach Management Plan* (2015), which were: Update the 1995 study with a new sediment budget and adopt an inlet management plan.

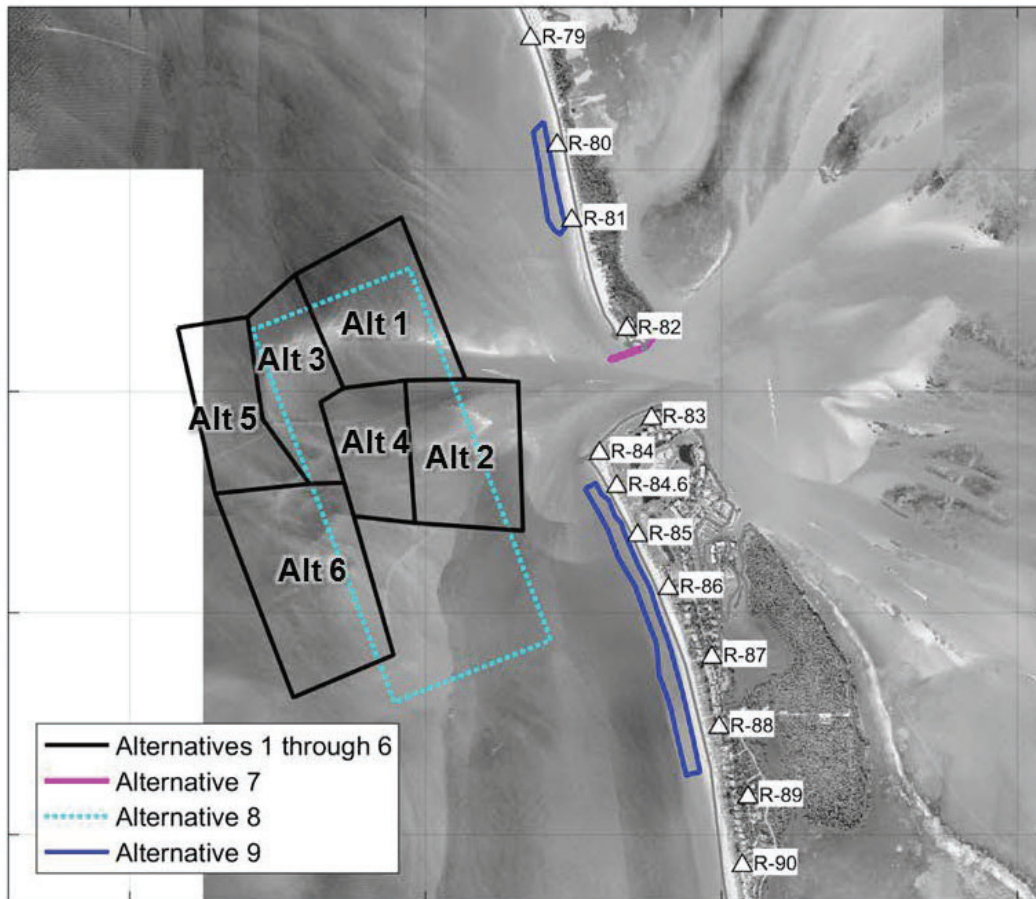
### ***Updated Inlet Management Study of 2019***

The Department and the Captiva Erosion Prevention District (CEPD) sponsored an updated inlet management study in 2018-2019, to update the inlet's sediment budget and develop bypassing strategies for mitigating the critical erosion conditions of Captiva Island and North Captiva Island (APTIM, 2019). This study updated the inlet's recent history since the 1995 study and updated the sediment budget with collection of new data, conducted an inlet management alternatives analysis with advanced numerical modeling, and provided recommendations for an updated inlet management plan. Conceptual designs were evaluated individually and in combination employing the numerical model Delft3D. Study guidance was provided by a Technical Advisory Committee made up of representatives of Lee County, CEPD, North Captiva Island and the Department.

A comprehensive inlet management analysis was conducted of nine preliminary alternatives, which included various options of dredging within the inlet's ebb shoal with a preponderance of material bypassing to the adjacent eroded beaches of Captiva Island and some bypassing to the eroded beaches of North Captiva Island. One alternative considered the construction of a terminal groin at the south end of



North Captiva Island, and another alternative considered nearshore placement of material in lieu of fill placement directly on the beach. Alternatives 1 through 9 are shown in **Figure 2**.

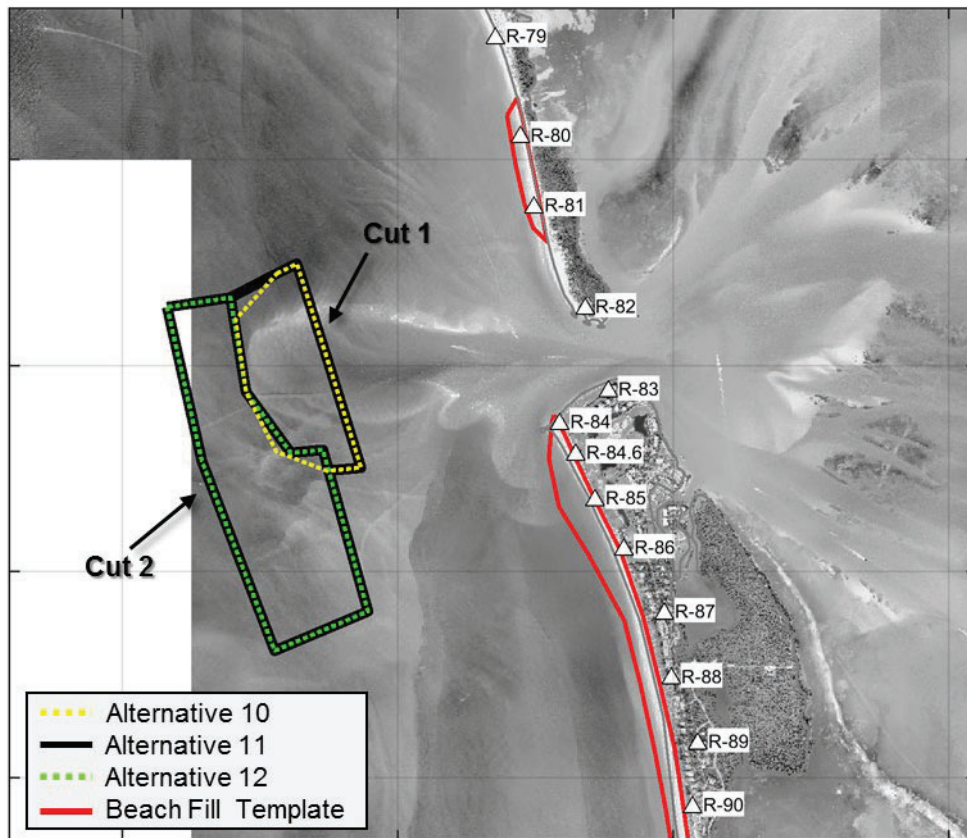


**Figure 2.** Preliminary Alternatives 1 through 9 from Redfish Pass Study (APTIM, 2019).

The preliminary alternatives were assessed for their impact to adjacent beaches over a five-year period of average wave conditions. The results of the morphological analysis as well as the wave analysis determined that Alternatives 1, 2, and 8, which are located on the interior portion of the ebb shoal, had impacts that extended to the adjacent beaches. Alternatives 3 through 6, which are located on the mid to exterior portion of the ebb shoal, were not shown to affect the morphology of the adjacent beaches and had minimal effect on waves. Alternative 7, which was the construction of a terminal groin at the south end of North Captiva Island, was shown to stabilize the south end of the island, but would have impacts within the inlet and ebb shoal, and potentially impact the inlet shoreline on Captiva Island. Alternative 9, which was nearshore placement, was shown to slow accretion at the south end of North Captiva Island, although it could be considered a technically viable placement option. It is noted however, that Section 161.142, Florida Statutes, requires direct beach placement except for the maintenance of federal channels.

For borrow site Alternatives 1 through 6 and 8, infilling rates were estimated for the feasibility of multiple uses and beach nourishment intervals and volumes. The borrow site alternatives nearest the shorelines and having the shallowest cuts were shown to have the shortest time intervals for infilling. Slower infilling rates were observed in the borrow sites further from shore and at greater depths.

In summary, Alternatives 1, 2, 7, and 8 were determined to have potential for adverse impacts to adjacent shorelines and were removed from further consideration. Alternatives 3 through 6 were not shown to have potential significant impacts, and were combined to develop five final alternatives for further analysis, as shown in **Figure 3**.



**Figure 3.** Final Alternatives 10 – 12 from Redfish Pass Study (APTIM, 2019).

Alternative 10 was developed out of substantially combining the boundaries of Alternatives 3 and 4, creating a borrow area with a half-moon shape around the outer portion of the ebb shoal. Alternative 12 combined Alternatives 5 and 6 to develop a borrow area in the most passive areas furthest offshore. Alternative 11 combines Alternatives 10 and 12 in order to maximize the borrow area volume. Alternatives 10 and 11 were evaluated at different cut depths in order to compare the effects of dredging deeper. **Table 1** provides the cut depths and dredge volumes for the final alternatives.

**Table 1.** Summary of the Final Alternatives.

<b>Borrow Area Designs</b>	<b>Cut Depth (Ft. NAVD)</b>	<b>Volume (CY)</b>
Alternative 10a	-16.2	563,000
Alternative 10b	-14.2	263,000
Alternative 11a	-16.2 (Cut 1) and -19.0 (Cut 2)	1,309,000
Alternative 11b	-14.2 (Cut 1) and -19.0 (Cut 2)	984,000
Alternative 12	-19.0	680,000

The final alternatives were evaluated for morphological change at the end of a five-year simulation. Model results demonstrated that all effects for each alternative were retained within the ebb shoal area with no effects on the adjacent shorelines. The final alternatives were also evaluated for their effects on waves, and two high energy wave conditions were selected from the five-year simulation period for analysis. Model results showed that the alternatives affect wave heights within the borrow areas and the ebb shoal but did not affect wave heights on adjacent beaches. The effects were reduced the further offshore the dredge area was located.

As was conducted for the preliminary alternatives, infilling rates were estimated for the final alternatives. Infilling rates at the end of the five-year simulation were calculated and estimates were made to determine how long it would take for the borrow areas to completely refill. Alternative 10b, the nearest to shore and the shallowest alternative, was estimated to refill its 263,000 cubic yards of sand in 10 to 11 years. Alternative 10a, with over twice the volume as Alternative 10b, was estimated to refill in 17 to 22 years. Alternative 12, which was completely offshore from Alternatives 10a and 10b, was estimated to take over 50 years to completely refill. Alternatives 11a and 11b combined the boundaries of Alternatives 10a, 10b and 12, and differed by using the cut depths of 10a and 10b. Infilling of Alternatives 11a and 11b ranged from 34 to 47 years. Clearly, the highest infilling rates were closest to shore and with shallower dredge depths; whereas, slower infilling rates were further offshore and with greater dredge depths.



The final alternatives were also evaluated for the effects of two storm conditions. The January 2016 cold front was selected to represent a typical winter storm, and Hurricane Charley (August 2004) was selected as an extreme event. For both storm conditions, model results show morphological change and increased wave heights being generally limited to the ebb shoal area with effects not reaching the shoreline when compared to the without dredging conditions. The January 2016 cold front affected infilling by less than 1 percent; however, Hurricane Charley caused substantially greater infilling of the borrow areas ranging from 7 to 27 percent.

Based upon the modeling, all the final alternatives show the potential to provide nourishment material without having significant effects to adjacent beaches. The dredge volumes available with the different final alternatives could support nourishment projects of different sizes; however, the infilling rates could limit re-use of the same borrow sites on the nourishment cycle required for the island-wide Captiva Island Beach Restoration Project. Alternative 10b showed the best potential for future re-use due to its shortest time to refill. The estimated 263,000 cubic yards of sand available in Alternative 10b could provide approximately six and a half years volume of sand to mitigate inlet impacts to Captiva Island, which is estimated to be 40,000 cubic yards per year.

### ***Updated Sediment Budget of 2009-2015***

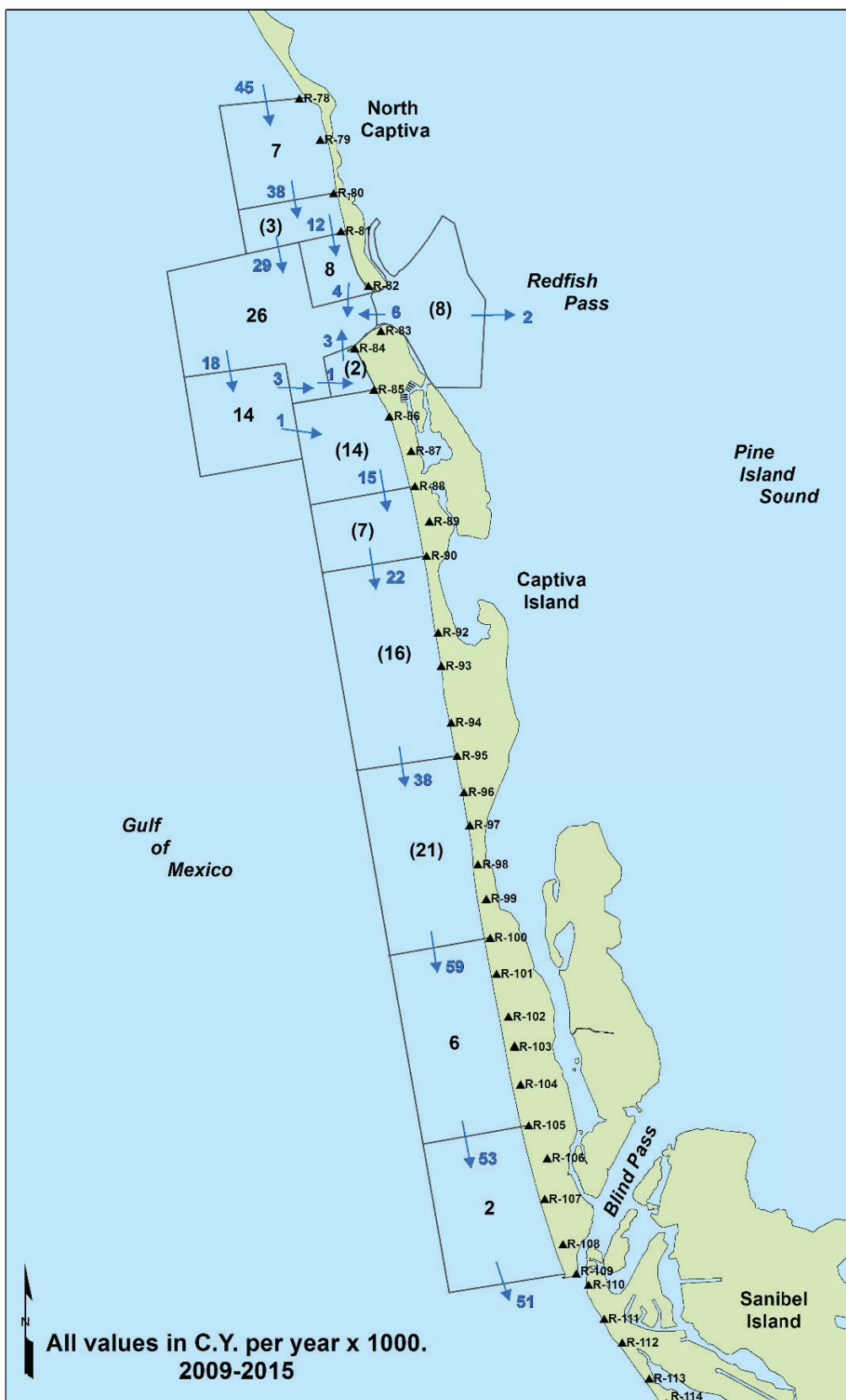
Pursuant to Section 161.142, Florida Statutes, dredging within an inlet system, including its shoals, should result in the placement of all beach quality sand on adjacent eroding beaches to balance the sediment budget between the inlet and adjacent beaches. A sediment budget is a balance of the volumes (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 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.

The 1995 inlet management study for Blind Pass developed a general sediment budget for the time periods 1941-1955, 1955-1974, 1974-1988/89, and 1988/89-1991 (CP&E, 1995). These sediment budgets covered North Captiva Island, Redfish Pass and Captiva Island. Another study in 2010 developed a sediment budget for the period 1996-2009 (CP&E, 2010).

The 2019 inlet management study for Redfish Pass (APTIM, 2019) developed an updated sediment budget covering the time period from 2009 to 2015 (**Figure 4**). Along the study area, the predominant direction of longshore sediment transport is from north to south with the exception that between the inlet (R84) and a nodal point near R85, there is a transport reversal to the north. During the time period from 2009 to 2015, approximately 33,000 cubic yards per year of sand were transported from North Captiva Island southward to Redfish Pass.

The south end of North Captiva Island (R78 and R82) gained 12,000 cubic yards per year between 2009 and 2015. Accretion of 7,000 cubic yards per year was measured between R78 and R80, erosion of 3,000 cubic yards per year was measured between R80 and R81, and accretion of 8,000 cubic yards per year was measured between R81 and R82. This overall gain in beach volume is likely due to the natural closure of Charley's Cut to the north and restoration of the southerly flow of sand along North Captiva Island as well as due to the shoreline stabilization at the island's south end with terminal T-groins.

Because the sediment budget indicates that 33,000 cubic yards of sand is annually being transported from North Captiva Island into the inlet and only 2,000 cubic yards per year gets naturally bypassed to Captiva Island, there is a need to bypass at least 30,000 cubic yards per year from the Redfish Pass ebb shoal complex. The sediment budget shows that Captiva Island is erosional between R84 and R100, losing 60,000 cubic yards per year between 2009 and 2015. This is comparable to the 2010 study, which showed a loss of 64,000 cubic yards per year between 1996 and 2009. A bypassing quantity of 30,000 cubic yards per year addresses only the inlet effects toward erosion. Other causes for the erosion in the Captiva Island area of inlet impact include storm erosion, sea level rise, and inherent instability of the beach fill project through fill spreading and profile adjustments. The south end of Captiva Island between R100 and R109 is stable to accretional.



**Figure 4.** Updated sediment budget for Redfish Pass (2009-2015). Blue numbers represent net sediment transport into and out of littoral cells. The black numbers represent the net gain or loss within a littoral cell. Reference: APTIM (2019).

### ***Additional Inlet Management Analysis, 2021***

Following the update inlet management study by APTIM (2019), an additional analysis was conducted by Humiston & Moore Engineers (2021) representing different North Captiva Island property owners than had participated in the prior study's technical advisory committee. Humiston & Moore (2021) presented background history covered in earlier inlet management studies but was not repeated in APTIM (2019). The additional detailed historical morphodynamics of North Captiva Island and Redfish Pass are important to understand so that the recent accretional trend shown in the latest sediment budget is not taken out of context. The impact to North Captiva Island from the prior ebb shoal dredging triggers abundant caution in the evaluation of any future ebb shoal dredging. Humiston & Moore (2021) shared the department staff's concern for ebb shoal recovery following any dredging project. The sustainability of obtaining bypass material from the ebb shoal is directly dependent upon recovery of the borrow area as determined through an appropriate monitoring program. Should the ebb shoal not substantially recover from an initial or future dredge event, then a non-inlet alternative source of sand should be developed. The additional analysis provided by Humiston & Moore (2021) weighed heavily in the final development of the updated inlet management strategies for Redfish Pass.

### ***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 promote bypassing and recovery of ebb shoal features, evaluate the performance and impact of any sand bypassing and nourishment projects, and to periodically update the inlet sediment budget. Beach and nearshore surveys between at least R77 on North Captiva Island to R100 on Captiva Island shall be conducted. Periodic inlet hydrographic surveys to include the inlet channel and the ebb and flood shoals should also be conducted between at least R81 to R85. The monitoring program should also consider the integrity and stability of the inlet features including the inlet channel and ebb shoal features. Along with topographic and hydrographic surveys of the inlet system and adjoining beaches, hydraulic monitoring may be conducted to enhance future modeling input data for investigations of inlet management alternatives.

**Discussion** – A comprehensive beach and inlet hydrographic monitoring program is the most important element to manage the sediment at Redfish Pass. 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 161.161, Florida Statutes. The hydrographic monitoring program will evaluate beach erosion along inlet adjacent beaches within the inlet area of influence, stability of the inlet channel and recovery of ebb shoal sediments and guide any future bypassing projects. The program will also include a plan with review and input from the stakeholders along both sides of Redfish Pass.

- 2) Sand bypassing shall be performed from the Redfish Pass ebb shoal to the adjacent gulf-fronting beaches.** Consistent with the inlet management study by APTIM (2019), an initial bypassing event from the ebb shoal is limited to approximately 240,000 cubic yards to be placed south onto Captiva Island and any subsequent ebb shoal dredging may only be considered acceptable following substantial recovery of the ebb shoal and further analysis quantifying any direct adverse impact on adjacent beaches. The quantity of material to be bypassed shall be based on available ebb shoal deposition quantities documented through the monitoring protocol of Strategy #1 above. Impacts from the dredging of the ebb shoal on the adjacent beaches north of the inlet shall be restored prior to, or as part of, the following dredging event.

**Discussion** – Pursuant to Section 161.142, Florida Statutes, Captiva Island south of Redfish Pass and the south end of North Captiva Island are the adjacent beaches directly influenced by Redfish Pass. The beaches 3.2 miles to the south of Redfish Pass (R84-R100) and 0.75 miles north of Redfish Pass (R79-R82.3) are currently designated critically eroded by the Department (FDEP, 2022). Monitoring data and analysis shall be used to assess erosion or inlet impacts on adjacent beaches within the inlet area of influence. Future dredging of the ebb shoal is considered feasible once monitoring determines ebb shoal recovery.

- 3) **On an average annual basis, the initial target inlet sand bypassing quantity shall be 30,000 cubic yards per year to the south.** This target quantity may be modified or updated based on a minimum of four years of additional monitoring data indicating a change in the sediment budget. Based on monitoring data and analysis sand may also be placed on adjacent beaches north or south of the inlet as determined by the need to address ongoing erosion within the inlet area of influence as shown in the monitoring data.

**Discussion** – The recent sediment budget indicates a need to place an annual quantity of 30,000 cubic yards of sand per year on the beaches south of the inlet to account for the inlet’s impact on northern Captiva Island. To mitigate sand losses on Captiva Island that are not attributed to Redfish Pass, additional sand may be placed that is obtained from acceptable offshore sources or inland sand mines.

- 4) **The source of sediment for meeting the target sand bypassing quantities in Strategy #3 shall be the Redfish Pass ebb shoal borrow areas as authorized by permit.** Alternative 10b identified in APTIM (2019) shall be prioritized since it is expected to refill in the shortest time, but the other alternatives may be considered for further geotechnical and engineering design and permitting to develop an environmentally acceptable project with minimal impacts to inlet features and adjacent beaches. Acceptable beach quality sand may also be obtained from inland sand mines or offshore sources to achieve the target sand bypassing quantities.

**Discussion** – The area dredged for sand bypassing is the Redfish Pass ebb shoal; however, additional geotechnical and engineering design is necessary to develop an acceptable borrow site plan. Based upon the modeling, all the final alternatives show the potential to provide nourishment material without having significant effects to adjacent beaches. However, the refilling rates of the alternatives should be considered and may limit future re-use. Alternative 10b showed the best potential among the proposed alternatives for future re-use due to its shortest time to refill. Should substantial recovery of the ebb shoal not occur following an initial or future dredge event, other non-inlet alternatives will be considered based on actual conditions and sediment needs in the future and the results of Strategies #1-3 of this Plan.

## **References**

- Aptim Coastal Planning & Engineering, Inc., 2019. *[Inlet Management Study of Redfish Pass and Adjacent Beaches](#)*, 40 p. plus appendices.
- Clark, R.R. and LaGrone, J.W., 2004. *Hurricane Charley: 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, 34 pp.
- Coastal Planning & Engineering, Inc., 1995. *Redfish Pass Inlet Management Plan*, 135 p. plus appendices.
- Coastal Planning & Engineering, Inc., 2010. *Captiva Island Beach Renourishment Project Engineering and Design Report*, 43 p. plus appendices.
- Florida Department of Environmental Protection, 2022. *Critically Eroded Beaches in Florida*, Office of Resilience and Coastal Protection, 89 p.
- Florida Department of Environmental Protection, 2000. *Strategic Beach Management Plan*, Bureau of Beaches and Coastal Systems.
- Florida Department of Environmental Protection, 2015. *Strategic Beach Management Plan*, Division of Water Resource Management, 365 p.
- Florida Department of Environmental Protection, 2018. *Strategic Beach Management Plan*, Division of Water Resource Management, 380 p.
- Humiston & Moore Engineers, 2021. *Redfish Pass, Review of Inlet Management Plan*, 34 p.