COQUINA BEACH SHORELINE STABILIZATION & LONGBOAT PASS JETTY RECONSTRUCTION FEASIBILITY STUDY

Project Synopsis and Status Update – September 2021

This document has been prepared based on the engineering and modeling work completed to date to summarize the progress and preliminary findings of the subject study for review and consideration in the context of the overall Manatee County program related to Coquina Beach. The information presented herein shall be considered draft for review and awareness, and is subject to change based on further coordination, ongoing modeling, and report development. The feasibility study is being prepared to support ongoing agency coordination, funding requests, future permitting efforts, and final engineering design.

Background

The Longboat Pass jetty (also referred to as the Anna Maria Island terminal groin) is located on the west coast of Florida in Manatee County at the south end of Anna Maria Island at Coquina Beach near FDEP monument R-41. The south end of Anna Maria Island is stabilized by an existing terminal groin known locally as the Longboat Pass Jetty (herein referred to as the jetty). Extending approximately 1 mile north from the jetty along the Gulf shoreline of Anna Maria Island is Coquina Beach, a public beach and recreation facility with aging shore-perpendicular groins throughout of the project area.

The jetty was initially installed in 1957 to stabilize the southern portion of the island when Coquina Beach was created to shorten the bridge span to Longboat Key. The existing jetty is approximately 500 feet long and is composed of wooden crib and concrete pilings filled with limestone boulders. Around the same time the jetty was built, a groin field consisting of about twenty structures was installed in 1959 to control erosion along the beach. The existing groins are approximately 90 feet in length and are spaced about 250 feet apart. These structures have deteriorated since installation and as a result, sand from Coquina Beach migrates around, over the top of, and/or through the structures, which contributes erosion of Coquina Beach and shoaling in Longboat Pass. Periodic maintenance of the beach has occurred to offset the erosion; however, the structures have deteriorated such that they no longer function as originally intended and present a safety concern.

The beach provides protection to upland infrastructure, public recreational beach facilities, and State Road 789, which is the main coastal road on the island and serves as an evacuation route in the event of a major storm or hurricane. The primary objective of this feasibility study is to evaluate shoreline stabilization options along Coquina Beach along with reconstruction of the jetty at Longboat Pass to stabilize the shoreline and moderate erosion within the study area. The scope of work presently underway includes a review of the coastal management history, analysis of coastal processes and recent conditions, site visits of the beach and the existing structures, numerical modeling to evaluate conceptual project alternatives, cost considerations, permitting objectives, and identification of the feasible alternatives for further engineering and implementation.

As part of the Longboat Pass Inlet Management Study (CP&E, 2011), sand-tightening and extension of the jetty were considered in order to address high erosion rates on Coquina Beach. This Coquina Beach Shoreline Stabilization & Longboat Pass Jetty Reconstruction Feasibility Study is intended to expand upon this previous effort and provide further engineering analysis in support of state and federal permit applications. The work is being completed by Aptim Environmental and Infrastructure, LLC (APTIM) and Coastal Protection Engineering LLC (CPE).

Feasibility Study Status

APTIM and CPE have completed the conceptual level engineering and numerical modeling study of Coquina Beach, encompassing the groins in Cortez and Coquina Beach, and the Longboat Pass jetty, to support the development of the Coquina Beach Shoreline Stabilization & Longboat Pass Jetty Reconstruction Feasibility Study. The primary objectives of the study include:

1) Evaluate alternatives to rehabilitate, remove, and/or replace the Coquina Beach groins and develop structural stabilization options to balance the erosion along Coquina Beach.
2) Expand upon previous efforts for the Longboat Pass jetty (CPE, 2011) and provide further analysis to evaluate feasible options to rehabilitate the jetty.
3) Evaluate the combined effects of objectives 1 and 2 in the context of the coastal system.

The primary tool in this investigation is the Delft3D morphological model (Deltares, 2016a). This model simulates changes in a topographic and bathymetric surface based on the effects of waves, water levels, winds, and currents. Wave transformation from the offshore to the nearshore area is simulated using the SWAN wave transformation model (Booij, et al, 2004, Deltares, 2016b). The numerical modeling study includes a regional wave and a flow model covering the area of influence and a smaller detailed domain refined for the study area. The regional models cover a large area with resolution defined to compute boundary conditions for the detailed local domains.

The data used as input in the model included topo-bathymetric data collected by multiples sources (APTIM, USACE, NOAA, Sea Diversified, USGS/LABINS), mapping of existing structures, bottom sediments and hardbottom, waves and winds from WIS and WW3, water levels from NOAA, and current, water levels, and waves measurements used for calibration purposes. The wave model was calibrated utilizing ADCP data measured at two stations (offshore and nearshore) between December 17, 2008 and January 12, 2009. The flow model was calibrated based on the 1992 current and water level measurements collected for the original Inlet Management Study for Longboat Pass (ATM, 1993). Both wave and flow models have been shown to realistically simulate the typical waves and flow patterns in the study area and were combined to compute sediment transport and coastal morphology changes over time.

The morphological model calibration period extends from April-September 2015 through September 2017. The calibration period was selected based on data availability and the construction history in the study area, aiming for a time period where no beach nourishment was performed. The calibrated model was able to replicate the key observed morphology changes and longshore sediment transport in the study area.

With morphology models calibrated, conceptual engineering alternatives were developed and analyzed from a coastal process standpoint. The primary objective was to evaluate conceptual structural alternatives for performance in stabilizing Coquina Beach without disrupting the net sediment transport balance through Coquina Beach. Ten (10) preliminary alternatives were developed in a stepwise manner. These included seven (7) conceptual designs for shoreline stabilization of Coquina Beach with groins and breakwaters in various configurations, with the most promising alternative(s) simulated with three (3) different Longboat Pass jetty

configurations. Based on the results of preliminary alternatives analysis, several combined alternatives were developed and evaluated for time periods of one year and five years.

The preliminary alternatives included an existing condition alternative (no action, groins in their current condition), utilizing the 2017 topo-bathymetric data as initial bathymetry surface considered to be representative of an eroded condition of Coquina Beach. This is referred to as the "No Action" scenario that represents the baseline used for comparison with the other alternatives. The alternatives simulated in the modeling analysis included the following:

1. No Action (2017 bathymetry, groins in the current condition)
2. Removal of existing groins without replacement
3. Restoration of existing groins to their original length and condition
4. Removal of existing groin field and replacement with 8 Permeable Adjustable Groins
5. Removal of existing groin field and replacement with 4 Permeable Adjustable Groins
6. Removal of existing groin field and replacement with 8 100 ft breakwaters
7. Removal of existing groin field and replacement with 3 300 ft breakwaters

The alternative that presented the best balance of effectiveness in the area of high erosion at the north end of Coquina Beach with the least effect on the net sediment transport to the southern portion of Coquina Beach was Alternative 7: removal of existing groins and replacement with three breakwaters. The conceptual layout for this alternative included breakwaters that are approximately 300 feet long and located approximately 300 ft from shore. The one-year model results of the alternative analysis are provided in the summary below and the supporting figures.

Preliminary Model Results

The alternatives were analyzed from the perspective of maintaining the net transport between R-33 and R-41 as close as possible to the "No Action" scenario (Alternative 1) while balancing the erosion throughout the study area. To illustrate this concept, Figure 1 provides the longshore transport of the simulated alternatives between FDEP monuments R-33 and R-41 (jetty). The results show that the alternatives influence the sediment transport locally but generally preserve the overall net transport, except for Alternative 5 that reduced the net transport at R-41.

Alternative 7 (3 breakwaters) presented the best balance of targeted erosion control performance with the preservation of net transport of approximately 24,800 cy/year between R-33 and R-41 for the simulated time period. Based these results, Alternative 7 was used as the preferred alternative to simulate the Longboat Pass jetty reconstruction options, which included (1) restoration of current jetty, (2) jetty removal, (3) jetty extension of 100 ft, and (4) further jetty deterioration. The latter was simulated in the model with increased permeability of the structure to represent further deterioration of the jetty in the future, whereas the restored option was simulated with a reduced permeability to represent sand tightening and restoration of the jetty's stone head.

Based on the one-year simulations results, the best performing concepts were combined for evaluation with a five-year simulation in addition to the "No Action" scenario (2017 bathymetry, groins in the current condition). These final alternatives included removal of existing groin field and replacement with the 3 breakwaters (Alt 7), combined with jetty restoration and extension concepts.

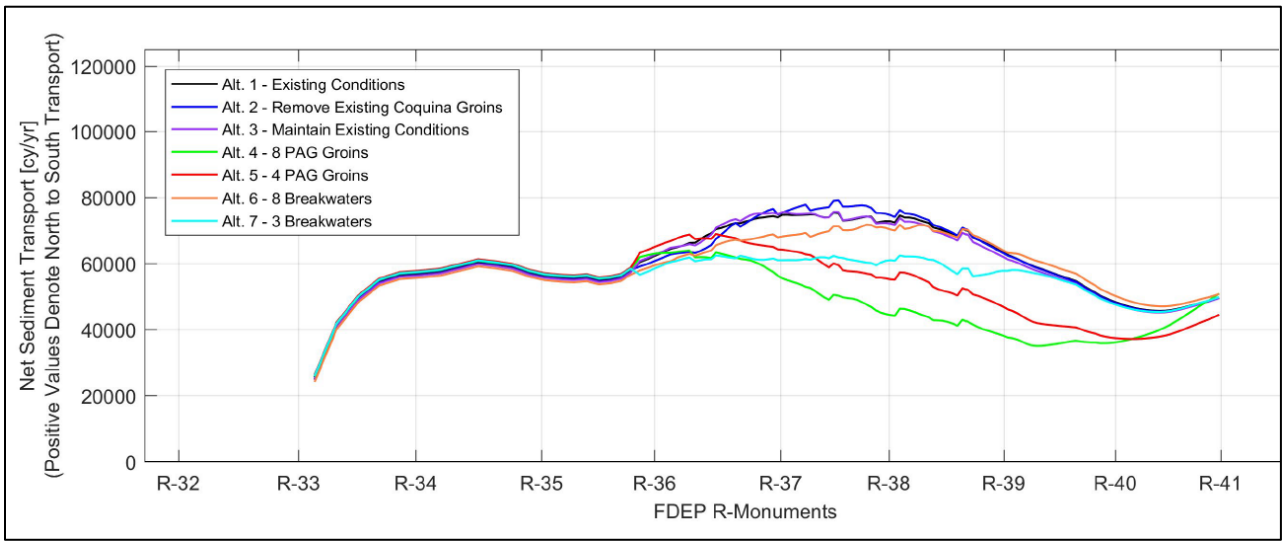

Figure 1. Longshore sediment transport of the simulated alternatives.

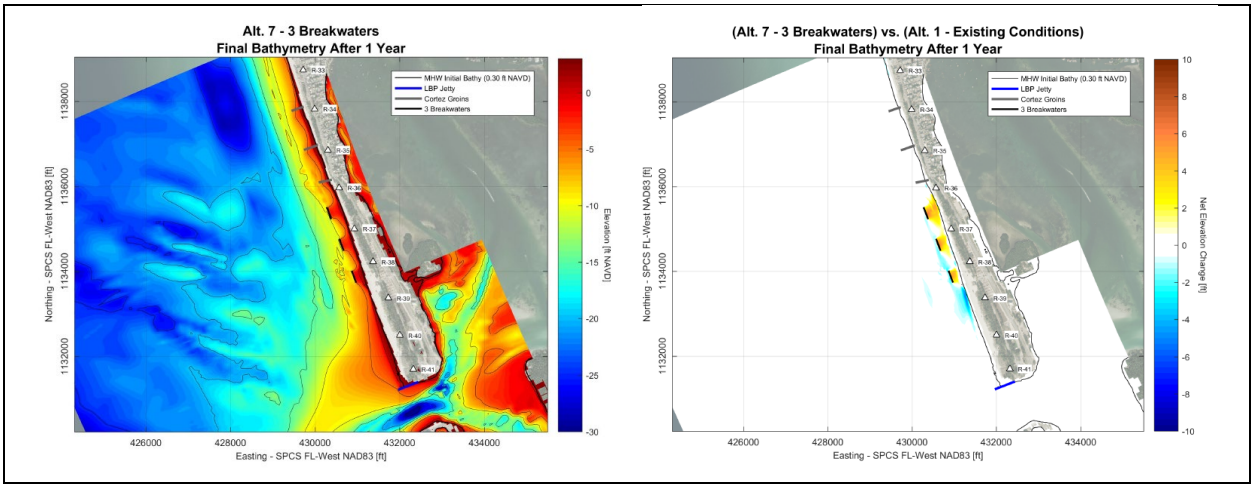

Figure 2. Alternative 7 final bathymetry after 1 year of simulation (left) and final bathymetry differences between Alternative 1 and Alternative 7 after 1 year of simulation (right).

Summary

The 5-year model results are presently under review and indicate that the alternative with groin removal and replacement with 3 breakwaters would maintain a net sediment balance through Coquina Beach similar to the no action scenario with the jetty restored. Additionally, the combined final alternatives were also each simulated with the 2021 beach fill template to evaluate the condition of a post-nourished beach in recognition of the overall coastal management program. When combined with a jetty extension, the sand transport into Longboat Pass appears to be reduced as the extended jetty slows sand transport moving southward, especially with the 2021 beach fill template in place. These results are still being evaluated for performance vs. cost effectiveness from a feasibility standpoint and will be presented in the final feasibility study report.