Fax Transmittal Memo	# of Pages 7
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HCF-X14

11-23-93

BEACH NOURISHMENT MONITORING PROGRAM

GALVESTON, TEXAS

a proposal to

City of Galveston

from

Center for Texas Beaches and Shores
Texas Institute of Oceanography
Texas A&M University System

November 23, 1993

Introduction

One of the most viable solutions to the beach erosion on Galveston Island is the placement of additional sand. Beach nourishment or reconstruction is currently the best available technology with the least potential for negative effects. One of the least well known aspects which is very difficult to predict, is the frequency with which additional sand or renourishment will be required to maintain the desired beach.

The City of Galveston is planning to place approximately 715,000 cubic yards of sand on the beach from the submerged part of a bank adjacent to the southeast jetty. This material would be transported by pipeline to 10th Street where nourishment would commence and continue to 61st Street, a distance of approximately 3.7 miles.

The success of the beach nourishment is vital to the continued tourist industry at Galveston. The beach is quite limited in front of most of the seawall which is where most of the tourists visit the beach. It is believed that the nourishment of the beach will positively affect the tourist economy. This must be documented to adequately demonstrate the economic effectiveness of the nourishment project and to help shape the plans for future projects and cost sharing.

Although the environmental effects of beach nourishment are generally considered to be minor, it is important to monitor the effects of the project on the beach and the borrow area. This will be extremely important in the planning and design of future renourishment projects.

This proposal presents a monitoring program that is essential to understanding the actual performance of the completed project. This proposal includes biological, geological, engineering and economic monitoring and integration of the results into a plan for the refinement of future nourishment efforts. The results of each years monitoring efforts will be published in a report describing the data collected, response of the beach nourishment and the biological community and recommendations. The

monitoring reports will also make recommendations concerning the requirements for future nourishment efforts.

Monitoring of Profile Response

This task will begin with preconstruction surveys, and continue with surveys through the dredging process and periodic surveys afterward. The results of these surveys will define the longevity of sandfill and the dynamics of the movement of the nourishment along the beachface and offshore. The results will be useful in refining future renourishment design.

The surveys will have as a base the transects previously used by the USACOE and additional new transects as appropriate to the study. All transects will be tied to permanent monuments which will be set atop the seawall or other permanent, recoverable positions. Existing profile monuments will be used whenever possible. The profile measurements will be conducted along a line perpendicular to the beachface and will record the elevation of the beach above and below water out to a depth of approximately 25 ft below mean sea level. The profiles will be spaced approximately 500 ft apart. The area to be monitored will begin approximately 5000 ft northeast of the proposed point of placement and extend southwest approximately one mile with 500 ft spacing and another three miles with 1000 ft spacing.

Geologic sampling will be conducted along the same transects. The samples will be analyzed for grain size distribution over the beach and over time.

The data will be analyzed using the Beach Morphology Analysis Package (BMAP) developed by the U.S. Army Corps of Engineers and other techniques including Triangulated Irregular Networks (TINs). The response of the beach would be linked to the analyzed wind, wave and current conditions.

Wave Monitoring

The response of the newly placed sand will largely depend upon the wave energy on the shoreline. The wave activity generated by storm fronts is generally responsible for the majority of the movement of sand on and offshore and along the shoreline. This task will provide the wave information to understand the sediment transport.

Waves are currently monitored at several locations in deep water. Some of these measurements are conducted by the oil industry, the National Data Buoy Center and the LA-TEX program. The LA-TEX program currently has directional wave gauges located offshore of Freeport and Sabine Pass which may be adequate. If adequate data from these sites can be obtained, a standard irregular wave transformation program will be used to determine alongshore transport rates. If the data available do not adequately cover the site then a directional wave gauge will be placed offshore to provide the actual wave data near the site. Results from the wave gauge will be analyzed to provide alongshore transport rates. These results will also be used with SBEACH and GENESIS to compare with design predictions.

Borrow Area

It is quite probable that the same borrow site could be used when renourishment is required. Therefore, it is important that the subaerial site be monitored after the initial dredging to determine the ability of the site to recover from the operation. It is assumed that much of the material will recover to the site from the northeast side of the channel as the material enters across the jetty and the navigation channel from Bolivar Peninsula.

The monitoring plan would include quarterly bathymetric surveys of the borrow site with profiles extending onto Big Reef. Volumetric analysis of the data will reveal the accretion or erosion rate of the borrow site and the adjacent habitat.

Current measurements will also be made at the site to determine the relationship of the local tidal currents to the rate of sediment accretion. A bidirectional current meter will be deployed to determine the vertical distribution and computation of shear stress.

Biological Monitoring

Because Big Reef serves as habitat for the endangered Piping Plover, it is important to monitor the borrow site to determine that there are no lasting impacts from the dredging. In addition to the Piping Plover, several additional species of fauna and flora will be selected for routine monthly observation and counts. The exact species which will be monitored will be determined based on historical records and on the initial site visit

At the site of placement of the fill material, macro fauna and invertebrate monitoring will be conducted to observe the effect of the new materials on the biological productivity of the nourished area. Although there will be a major initial change in the biological characteristics of the site, it is expected that the populations will quickly recover. Moreover, with the increase in habitat the biological productivity of the nourished area should increase. The monitoring program will provide information demonstrating this recovery. This information will be quite useful in planning future renourishment efforts.

Aerial Photography and GIS

An extensive set of aerial photography exists for the Galveston area dating from the mid 1930's to present. These sets of photography together with available post-construction photography will be used in analyzing the coastal processes and the response of the beach nourishment project at Galveston. The existing GIS database of Galveston will be used to develop a model of the processes affecting the beach nourishment.

Economic Benefit

It has been firmly established at beach nourishment projects in New York, South Carolina and Florida that the tourist industry has directly benefited from the projects. Unfortunately, most projects do not observe or measure this benefit directly. In Galveston, there must be a direct, measured economic benefit to the tourist economy and therefore to the City before a long-term renourishment program can be confidently established. Those whose economy directly benefits can be asked, in a properly structured arrangement, to cost share in the continuation of the project to the proportion of their benefit as was done at Captiva Island, Florida.

An econometric study will be established to measure the direct benefits to the first, second and third tier of beneficiaries from the increase in the tourist economy. Actual beach counts, inventories and questionnaires will be used to show the increase in attendance and what led to the increase. This information will be extremely useful in getting grant monies from the State for augmenting the tourist industry through beach nourishment not only at Galveston but at other Gulf-front communities.

Professional Staff

The Center for Texas Beaches and Shores will establish an interdisciplinary professional team which will provide the experience in this type of project necessary for effective and thorough answers to questions about project performance. These professionals will consist of the following specializations:

Coastal Geologist	-	Prof. Ernie Estes, Ph.D. Prof. J. R. Giardino, Ph.D.
Coastal Engineer	-	Prof. Y. H. Wang, Ph.D., P.E. Prof. B. L. Edge, Ph.D., P.E.
Economists	-	Prof. Golam Mohammad, Ph.D.
Biologists	-	Prof. James Webb, Ph.D. Prof. Donald Harper, Ph.D.

These professionals will be drawn from the Galveston and the College Station Campuses of Texas A&M University. The Center will be directly responsible to the City of Galveston for providing a project manager, periodic and final reports and financial and professional accounting.

Prof. Wang and Prof. Edge will serve as Co-Principal Investigators. Complete resumes for each of these investigators are attached to this proposal.

Objectives

It is critical that the continued beach renourishment be based upon valid scientific and economic data. The above monitoring program will provide adequate data to give valid answers to the following questions:

1. How much offshore movement and alongshore movement of the material takes place annually?
2. How long will the beach last before it must be renourished?
3. Will the Piping Plover or its habitat be affected by the nourishment project?
4. At what point does the alongshore transport change from west to east?
5. What is the effect of the local wave climate on the onshore and alongshore movement of sand?
6. How is the economic benefit of the nourishment project distributed throughout the local economy?
7. Can Big Reef be used as a source for renourishment material?