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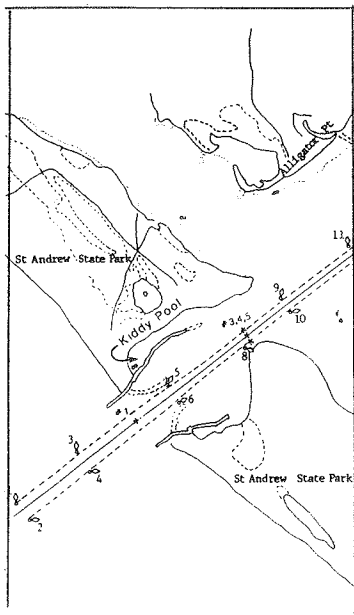
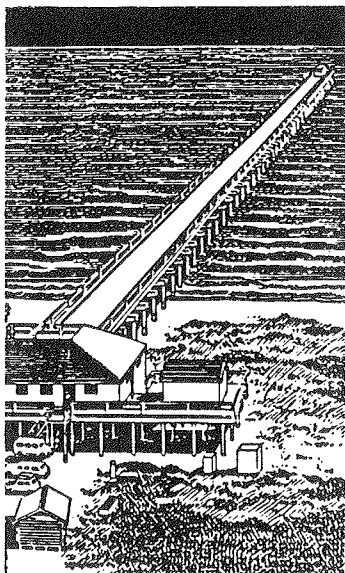
A STUDY OF SAND WAVES IN THE PANAMA CITY, FLORIDA, ENTRANCE CHANNEL

by

W. Jeff Lillycrop, Julie Dean Rosati, David D. McGehee

Coastal Engineering Research Center

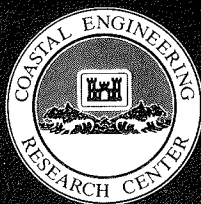
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PREFACE

The US Army Engineer District, Mobile (SAM), requested the US Army Engineer Waterways Experiment Station's (WES's) Coastal Engineering Research Center (CERC) to conduct a study of sand waves in the St. Andrew Bay entrance channel located near Panama City, Florida. Funding authorizations by SAM were granted in accordance with Intra-Army Order No. AD-86-3018.

The study was conducted at CERC under general direction of Dr. James R. Houston and Mr. Charles C. Calhoun, Jr., Chief and Assistant Chief, CERC, respectively; and under direct supervision of Mr. Thomas W. Richardson, Chief, Engineering Development Division (CD); and Ms. Joan Pope, Chief, Coastal Structures and Evaluation Branch (CD-S). The study was conducted by Mr. W. Jeff Lillycrop, Ms. Julie D. Rosati, and Mr. David D. McGehee, CD. Report figures were drafted by Messrs. Perry Reed and Leslie Wallace, CD. Report editing was performed by Ms. Shirley A. J. Hanshaw, Information Products Division, Information Technology Laboratory, WES.

Throughout the study, coordination was maintained with Mr. Pete Robinson of SAM. The Panama City Area Office assisted with field data collection and general site support through the following individuals: Messrs. Alton Colvin, Harry Peterson, Jack Branning, and "Gator" Brown.

Acting Commander and Director of WES during publication of this report was LTC Jack R. Stephens, EN. Technical Director was Dr. Robert W. Whalin.

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CONVERSION FACTORS, NON-SI TO SI (METRIC)
UNITS OF MEASUREMENT

Non-SI units of measurement used in this report can be converted to SI (metric) units as follows:

<u>Multiply</u>	<u>By</u>	<u>To Obtain</u>
cubic yards	0.7645549	cubic metres
feet	0.3048	metres
feet per second	0.5921	knots
inches	2.54	centimetres
knots (international)	0.5144444	metres per second
miles (US statute)	1.609347	kilometres
square miles	2.589998	square kilometres
tons (2,000 pounds, mass)	907.1847	kilograms

A STUDY OF SAND WAVES IN THE PANAMA CITY, FLORIDA, ENTRANCE CHANNEL

PART I: INTRODUCTION

Background

1. At the request of the US Army Engineer District, Mobile (SAM), a study of sand waves in the Panama City Entrance Channel was conducted by the Waterways Experiment Station's (WES's) Coastal Engineering Research Center (CERC). Sand waves in the entrance channel to St. Andrew Bay are a navigation hazard and a maintenance problem. Although ships rarely bump bottom, sand waves can grow large enough to reduce authorized channel depths. Within about 18 months after dredging, sand waves having heights as great as 15 ft* are present and must be removed. To maintain the inlet channel, frequent over-depth dredging is required.

2. Little is known about the formation and migration of sand waves. What is known comes mostly from laboratory flume test results of sand ripples to explain the much larger bed forms. From flume tests it is known that sand waves form only under certain flow conditions and require a sufficient sand source. To mitigate sand wave formation and increase the maintenance dredging interval, flow velocities must be modified and/or the sediment supply reduced.

3. In an effort to reduce dredging requirements, tests were conducted to study potential changes to the inlet to modify existing flow conditions and to determine methods for reducing the amount of sediment entering the channel. A complete background investigation of the study area was performed, including a review of all available literature. An evaluation of inlet hydraulics was conducted and a computer model used to simulate inlet hydraulics. Sediment sources were identified and various alternatives were considered to reduce the amount of sediment entering the channel from these sources.

Study Location and General Conditions

4. The study site is located at the entrance channel to St. Andrew Bay, Panama City, Florida (Figure 1). Comprising an area approximately 100 miles

* A table of factors for converting non-SI units of measurement to SI (metric) units is presented on page 3.

from Pensacola, Florida, and about 100 miles from the Florida state capital at Tallahassee, the St. Andrew Bay system consists of four adjacent bays: St. Andrew Bay, West Bay, East Bay, and North Bay (Table 1). For purposes of this report, St. Andrew Bay will be used to refer to the complete system, including all four bays, unless otherwise specified. The area of the bay system is approximately 108 square miles.

Table 1
Bay System Size

<u>Bay</u>	<u>Surface Area</u> <u>square miles</u>	<u>Mean Depth</u> <u>mlw*</u>
West	27.5	7.7
North	10.4	8.3
St. Andrew	40.9	15.5
East	29.2	12.4

* Mlw = mean low water.

5. The entrance channel and jetties, completed in 1934, separate Lands End Peninsula from what is now Shell Island. The channel is a federally maintained navigation channel consisting of a 450-ft wide, 32-ft-deep (mlw) approach channel from the gulf. The channel narrows to 300 ft wide about half-way through the inlet throat but remains 32 ft deep into the bay. The inlet is stabilized by two stone jetties spaced 1,500 ft apart.

6. The complete Panama City Harbor Navigation Project consists of the entrance channel, a small channel in Grand Lagoon, and the bay channel which crosses St. Andrew Bay and connects to the Panama City port facilities. The complete project, including authorized channel dimensions, is shown in Figure 1. Land adjacent to the inlet is owned by the State of Florida, and the west side of the inlet has been developed for recreational use.

7. The inlet cross section is generally shallower on the east side, with depths averaging about 6 to 12 ft. Actual navigation channel depth varies with location and condition of the sand waves but generally is about 30 to 35 ft. Along the west side of the inlet the natural inlet thalweg has created a scour problem along the jetty, generating depths as great as 45 to 50 ft.

8. Sediment within the study area consists of fine- to medium-grained

