DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO
ATTENTION OF

CEWES-CD-SE (1110-2-1403b) 10 November 1989

MEMORANDUM FOR RECORD

SUBJECT: Initial Conclusions Regarding Emergence of New Shoals in Vicinity of Sand Island Berm

1. In the summer of 1989, a Dauphin Island boatman reported "emergent land at the Corps' berm site." The Corps of Engineers (CE) had constructed the berm in question (a 6000-ft-long bar) during January and February of 1987 by placing sands along the 19-ft-mllw contour about 7000 ft west of the navigation channel from which the material was dredged. The CE is monitoring the fate of this Sand Island Bar. Other berms in the area included an adjacent, smaller mound and a deeper, much larger mound 2 miles farther offshore. All three submerged berms are being monitored as a basis for developing improved monitoring and prediction methods.

2. It seemed unlikely that natural accretion could have elevated the shallower berms to the sea surface. On the survey before the reported emergence, these berms had crested near 14-ft mllw. Conceivably wave sheltering could have contributed to emergence of shallower ebb-tidal deposits about 800 ft leeward of the disposal bar. In either case, the Corps' monitoring commitment required documentation of any emerging shoals whether they were on the disposal bar or on adjacent natural features where emergence may or may not be related to dredged material placement.

3. The history of adjacent natural shoal development was needed to place the current emergence in context and to better interpret the role of the placed berm on adjacent features and processes. To make this determination, the Mobile District contracted with Woolpert Consultants for controlled aerial photography at several scales. The mission was flown on 9 August 1989. The Waterways Experiment Station's Coastal Engineering Research Center prepared archived imagery for comparison with the latest conditions.

4. Transparent overlays were prepared at appropriate scales to relate features visible on imagery to the deeper bathymetry of the berms, specifically, the 14-ft mllw contours of the Sand Island Bar and Mound from a March 1987 survey (Figure 1). The overlays can be accurately positioned by superimposing

ROUTING:
1. CEWES-CD-SE (Dr. Yen-hsi Chu) OVI
2. CEWES-CD-S (Ms. Joan Pope)
3. CEWES-CD (Mr. Thomas W. Richardson)
4.
5. CEWES-CD-SE (Mr. Edward B. Hands)
6. CEWES-CD-S (Mrs. Daughtry) (file)

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surveyed and photographed features of the east end of Dauphin Island, the offshore Lighthouse, and the offshore gas well belonging to Shell Oil Company.

5. Images from the following dates where selected for closer analysis:

a. 19 February 1979 False color IR 1:24,000 Aerial photograph

b. 22 September 1979 Black & White 1:12,000 Aerial photograph

c. 6 March 1986 False color IR 1:24,000 Aerial photograph

d. 17 October 1986 False color IR 1:24,000 Aerial photograph

e. 27 April 1987 False color IR 1:12,000 Aerial photograph

f. 28 April 1987 False color IR 1:100,000 SPOT satellite

g. 8 August 1989 False color IR 1:12,000 Aerial photograph

h. 9 August 1989 False color IR 1:24,000 Aerial photograph

6. Comparison of these images led to the following conclusions:

a. Sand Island was much narrower, longer, and farther southeast of Dauphin Island on the earliest examined aerial photography (1979) than in any of the more recent images. The most dramatic changes to Sand Island probably occurred during Hurricane Frederic. The eye of Frederic passed just to the west end of Dauphin Island on 12 September 1979 (Figure 2). Unfortunately, the 22 September 1979 photography does not cover Sand Island or the offshore area of the berms.

b. Overwash and most of the erosion during Frederic was on the low, western portion of Dauphin island. The east end of the Island is unusually high and stable for a barrier island. Nevertheless, a comparison of pre- and post-hurricane imagery reveals some interesting storm related changes.

c. One impact was to open a breach through Little Dauphin Island into Dauphin Island Bay. This breach, known as Drury Pass, remained open and appears to have changed little from September 1979 to April 1987. The Corps closed the breach in April/May 1989 with dredged material. The breach remained closed as evident on the imagery from August 1989.

d. In February 1979, about 8000 ft separated the western end of Sand Island from Dauphin Island. A small islet existed in the gap at this time. The gap narrowed to only 2000 ft on the next coverage (1986); and seems to

have continued to narrow, being only about 1600 ft wide on the latest mosaic (1989).

e. A series of early charts (see Figure 3) shows the gap has been as wide as 9200 ft (1894) and as narrow as about 2300 ft (1921 and 1929). Sand Island thus seems narrower now than at any known time in the last 100 years.

f. In the 18th century, a large lagoon existed on the gulf side of the southeast section of Dauphin Island and served as the French colony's inner harbor (Otvos 1979). Sometime later, the entrance closed, creating the basin known today as French Lake. In 1979 just before Hurricane Frederic, a mild protuberance in the Dauphin Island shoreline was evident opposite the east end of French Lake.

g. Beaches on the east end of Dauphin Island suffered extensive erosion during Hurricane Frederic. A set of groins was left stranded offshore when the beaches on the east end of the island receded. Less than 2 miles away, there was little change on the previously mentioned mild protuberance. But by March 1986, the protuberance had grown into a prominent bulge with an exaggerated shoreline indentation to the east.

h. This S-shaped salient has persisted. It grew perceptively between 1986 and 1989. Rapid growth of this undulation, while Sand Island was in its most westward and closest position to Dauphin Island, may be more than coincidence. Hands and Bradley (1990) speculated the salient could be related to refracted waves transmitted over and through passages around Sand Island.

i. The August 1989 imagery also shows what appears to be a narrow plume of suspended sediment extending about 4000 ft south from the Lighthouse. Waves were small that day from the east. This imagery suggests that ebb tidal currents can create sufficient turbulence for suspension and transport of ambient sediment at least 4000 ft before it settled out of sight or dispersed. Examination of the tide and wind conditions would help establish how often such flow conditions occur.

j. The only emergent shoal near the berm on the latest imagery was 7000 ft north of the northwest end of the Sand Island Bar. It was not emergent but was visible and, therefore, very shallow on the previous (April 1987) imagery. Clearly, it must be the recently reported "emergent land."

k. This shoal had also been emergent in February 1979 and in March and October 1986. Then it was submergent in April 1987 and now has reemerged. It is part of a band of shoals trending southeast from Sand Island. This band of shoals lies 7000 to 13000 ft northwest of the Sand Island Bar and is coincident with the eastern section of the pre-Frederic Sand Island. This band of

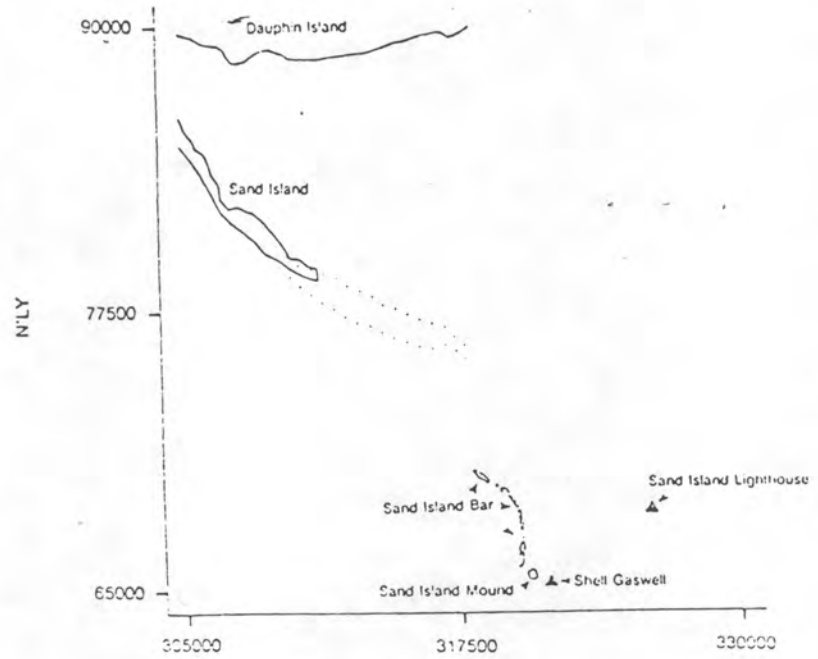

Figure 1. Location map.

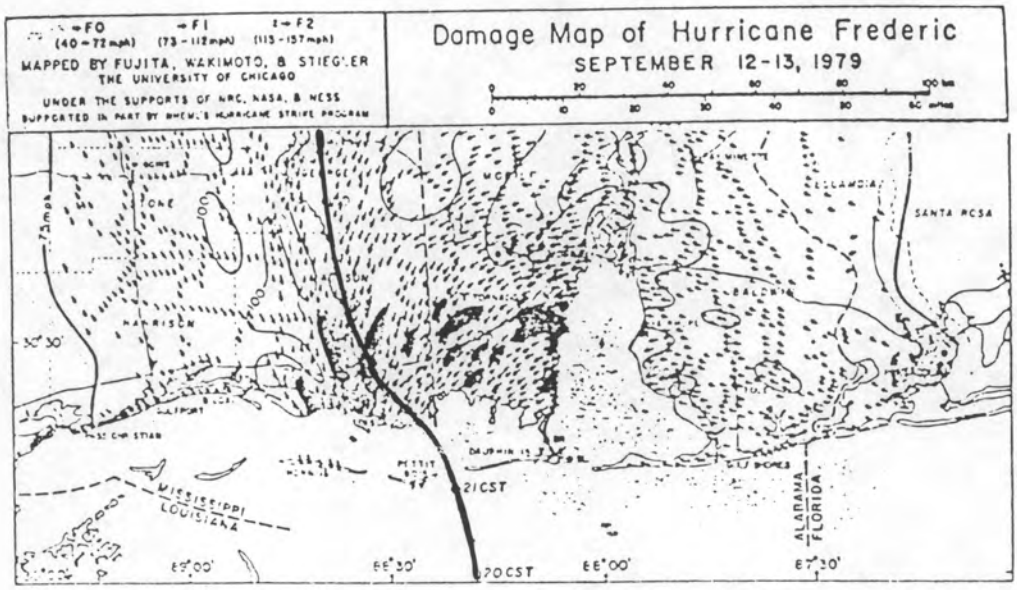

Figure 2. Path of Hurricane Frederic and pattern of damaging winds (modified from Fujita, Wakimoto, and Stiegler, 1979).

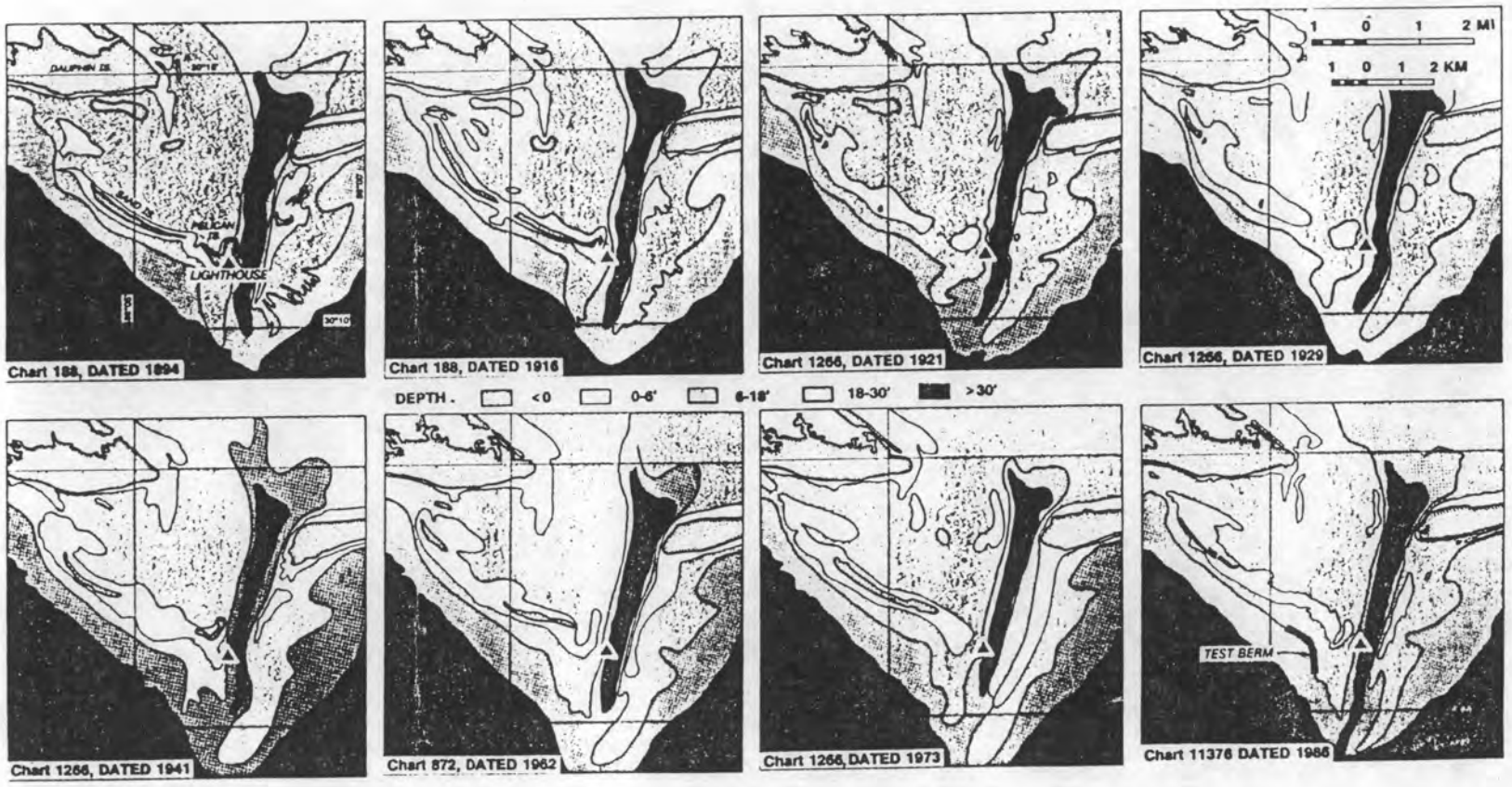

Figure 3. Historic charts of Dauphin and Sand Islands (from Hands and Bradley, 1990).

shoal remained visible (either emergent or very shallow) on all examined imagery.

1. An islet existed south of these shoals much closer to the berm site but only before berm construction. In February 1979, this islet was only 2600 ft northeast of the point that was to be the berm center 8 years later. The first post-Frederic imagery does not extend offshore. The next imagery (March 1986) shows the islet even closer to the berm site (2000 ft north). In April 1987 the islet was no longer emergent but remained visible as a shoal both on the aerial and satellite (SPOT) imagery. It was farther from the berm (3500 ft north) and submergent on the last imagery (August 1989).

7. In summary, the presently "emergent land" is part of an extensive shoal complex that has emerged and submerged frequently, but actually changed little since their formation, during Hurricane Frederic, by erosion of the previously more extensive Sand Island. The "emergent land" is a relatively long way from the berm site. Islets have existed much closer to the berm site. If the dredged material berm were promoting shoal emergence, it would be most obvious on these nearby, formerly emergent islets. Instead, they are submerged on all post-placement imagery. These observations suggest that the presence of the disposal bar has not been an important factor in the most recent shoal emergence. The emergence, since berm placement, would have probably occurred regardless of berm construction.

EBHands

EDWARD B. HANDS
Coastal Structures and Evaluation Branch
Engineering Development Division
Coastal Engineering Research Center