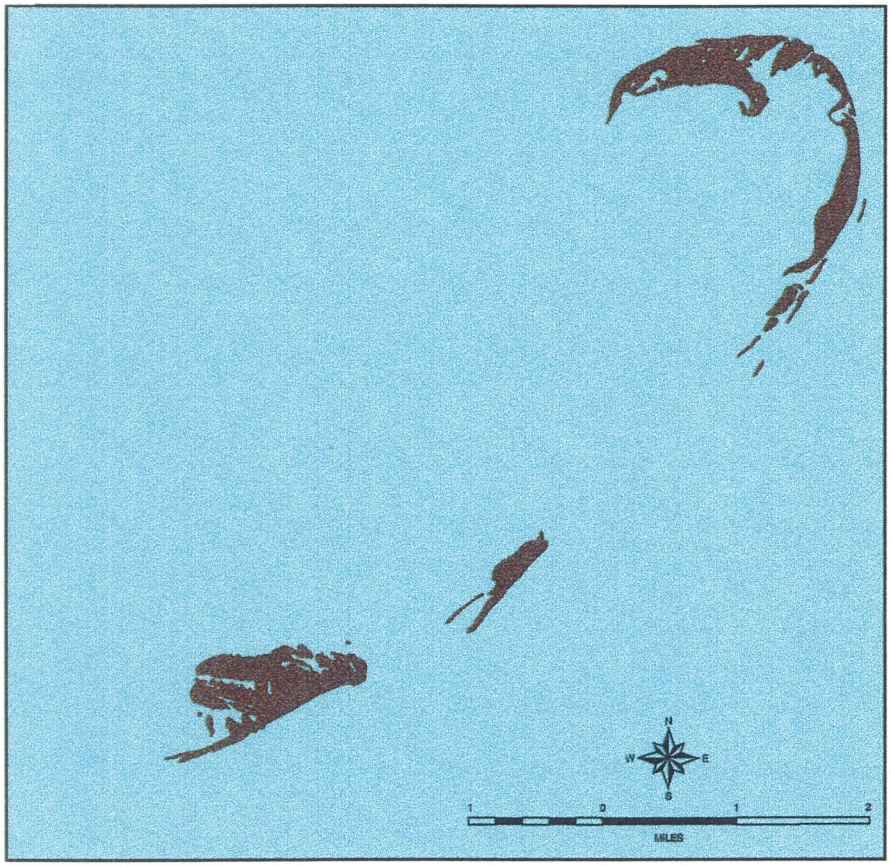
U.S. Army Corps of Engineers - New Orleans District
Louisiana State University - Coastal Studies Institute

BENEFICIAL USE MONITORING PROGRAM 1996 ANNUAL REPORT

Part 4: Results of Monitoring the Beneficial Use of Dredged Material at MRGO - Breton Island.

Base Year 1985 thru Fiscal Year 1996



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1997

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INTRODUCTION

Breton Island is the southernmost island of the Chandeleur transgressive barrier island arc and is located on the southern side of the Mississippi River Gulf Outlet (MRGO) navigation channel that passes through Breton Sound on its way to the Gulf of Mexico (Figure 1). Breton Island is composed of sands derived from the abandoned St. Bernard delta complex. Beach ridges, recurved spits, and washover fans make up the landscape of Breton Island. This island is plagued by high rates of erosion and land loss. Breton Island is part of the Breton Island National Wildlife Refuge.

The Beneficial Use Monitoring Program (BUMP) at Louisiana State University - Coastal Studies Institute (LSU-CSI) is documenting the beneficial use of dredged material using aerial photography, geographical information system (GIS) analysis, and field surveys through the sponsorship of the US Army Corps of Engineers - New Orleans District (USACE-NOD). The techniques and methodology used in the current BUMP analysis is explained in Penland and Westphal (1996). BUMP results are provided in map series, annual reports, and scientific literature.

This is an updated report, building on information that was reported at the 1997 Dredging Conference held in May of 1996.

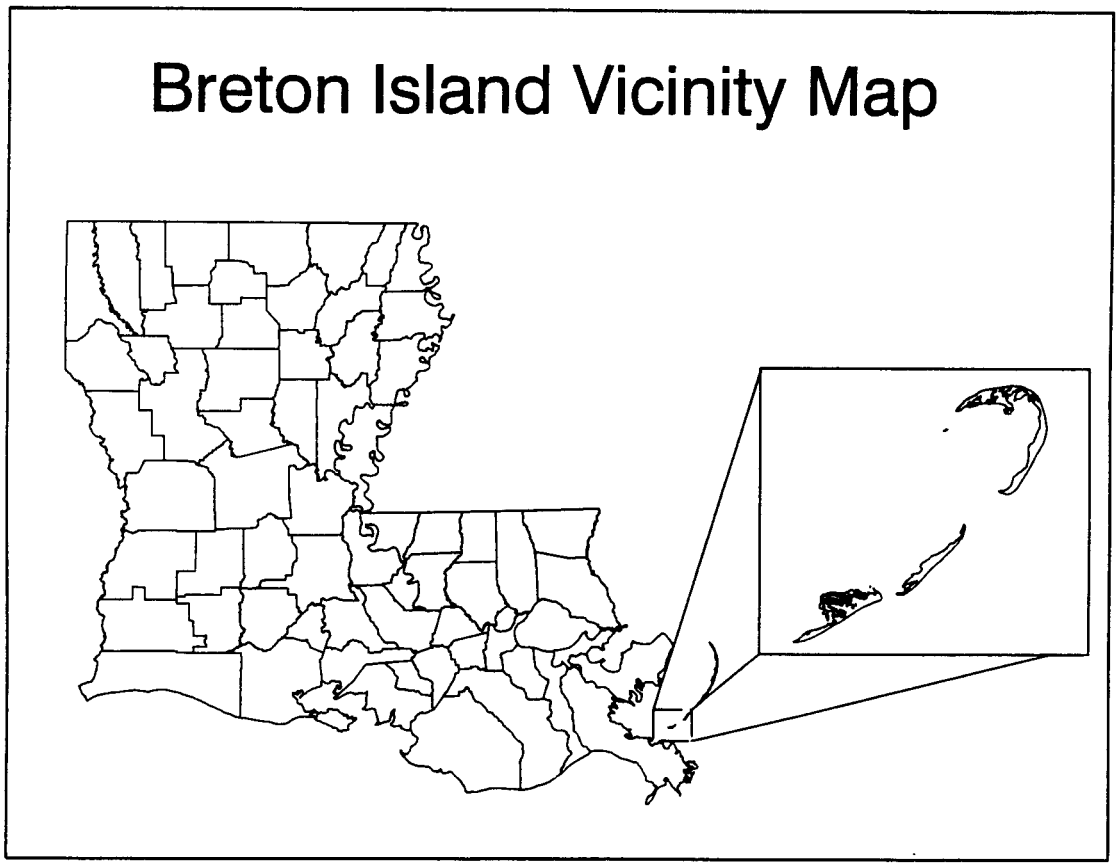

Figure 1. Location map of the Mississippi River Gulf Outlet (MRGO) - Breton Island BUMP study area in Louisiana.

In this report, LSU presents the data acquired through the Beneficial Use of Dredged Materials Program (BUMP) during Year 2 for MRGO - Breton Island. This is the fourth section of the nine part BUMP Year 2, 1996 Annual Report. The nine parts are:

Part 1: Introduction and Methodology
Part 2: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Mile 47-59
Part 3: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Jetties
Part 4: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Gulf Outlet, Louisiana - Breton Island
Part 5: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River Outlet, Venice, Louisiana - Baptiste Collette Bayou
Part 6: Results of Monitoring the Beneficial Use of Dredged Material at the Mississippi River, Baton Rouge to the Gulf of Mexico, Louisiana - Southwest Pass
Part 7: Results of Monitoring the Beneficial Use of Dredged Material at the Houma Navigation Canal, Louisiana - Bay Chaland
Part 8: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Lower Atchafalaya River Horseshoe
Part 9: Results of Monitoring the Beneficial Use of Dredged Material at the Atchafalaya River and Bayous Chene, Boeuf, and Black, Louisiana - Atchafalaya Bay/Delta and Bar Channel

Breton Island is being monitored to by the dredged material BUMP to determine the benefits of an offshore feeder berm to the adjacent shoreline. Breton Island is suffering from shoreline erosion rates in excess of 100 ft/yr and land loss rates of 6 acres/yr. The Breton Island feeder berm has two goals: shoreline nourishment and wave protection. The potential exists for onshore/longshore sediment transport from the feeder berm to nourish Breton Island and slow or halt the rate of shoreline erosion. The second benefit of the feeder berm is to potentially reduce and alter the nearshore wave climate in such a manner as to reduce or locally reverse shoreline erosion. Figure 2 shows the location of the Breton Island feeder berm and the MRGO channel.

Using vertical aerial photography, LSU produced shoreline maps for December 1990, April 1995, November 1995, and November 1996. In May 1995, transects were established on Breton Island and elevation and vegetation profile data were obtained. In August 1996, transects were revisited, and new transects added, but no new elevation profile data were obtained. Figure 3 shows the limits of the BUMP study site, including the minimum area of coverage of the aerial photography and the area digitized.

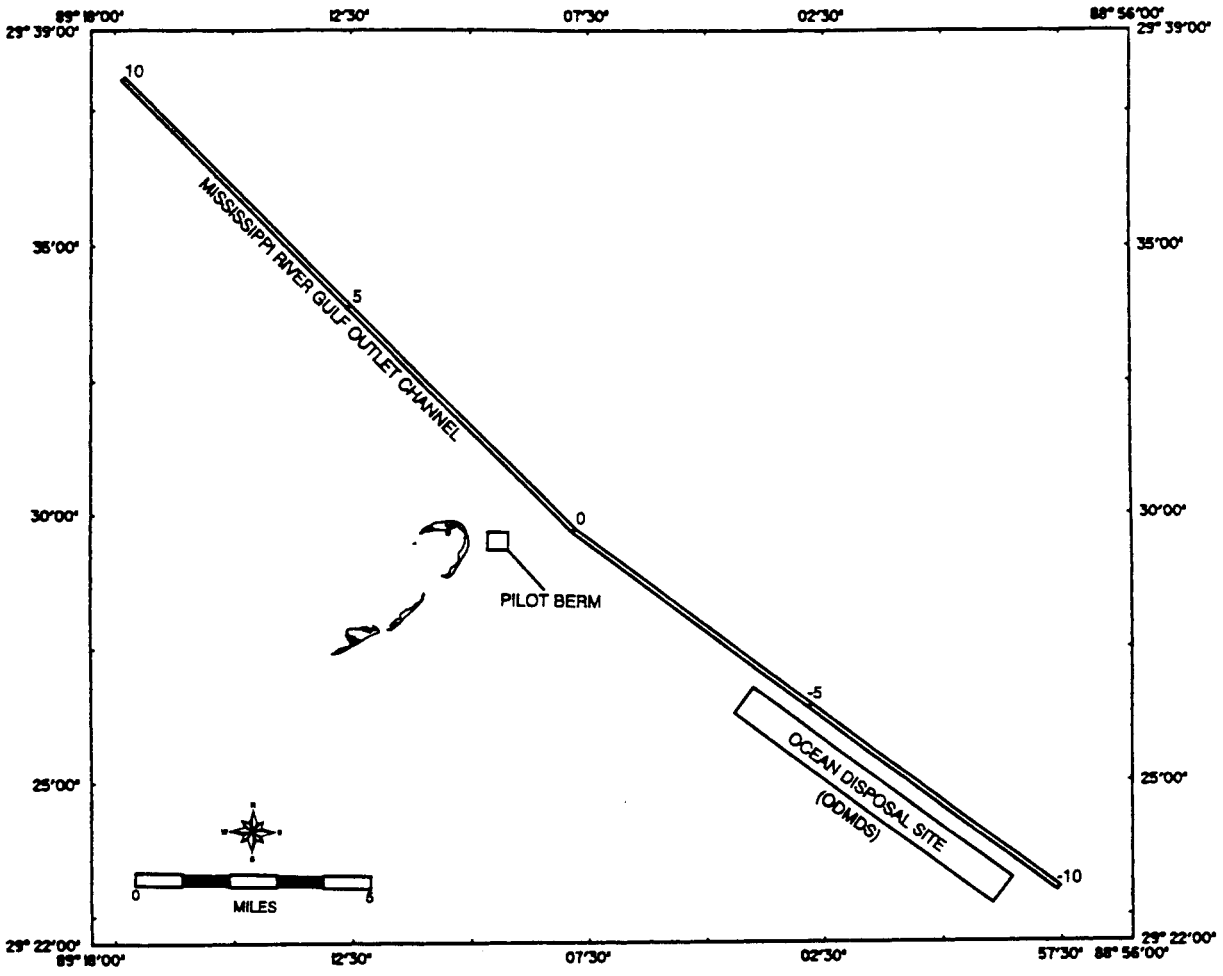

Figure 2. The location of the beneficial use of dredged material offshore feeder berm in relation to Breton Island.

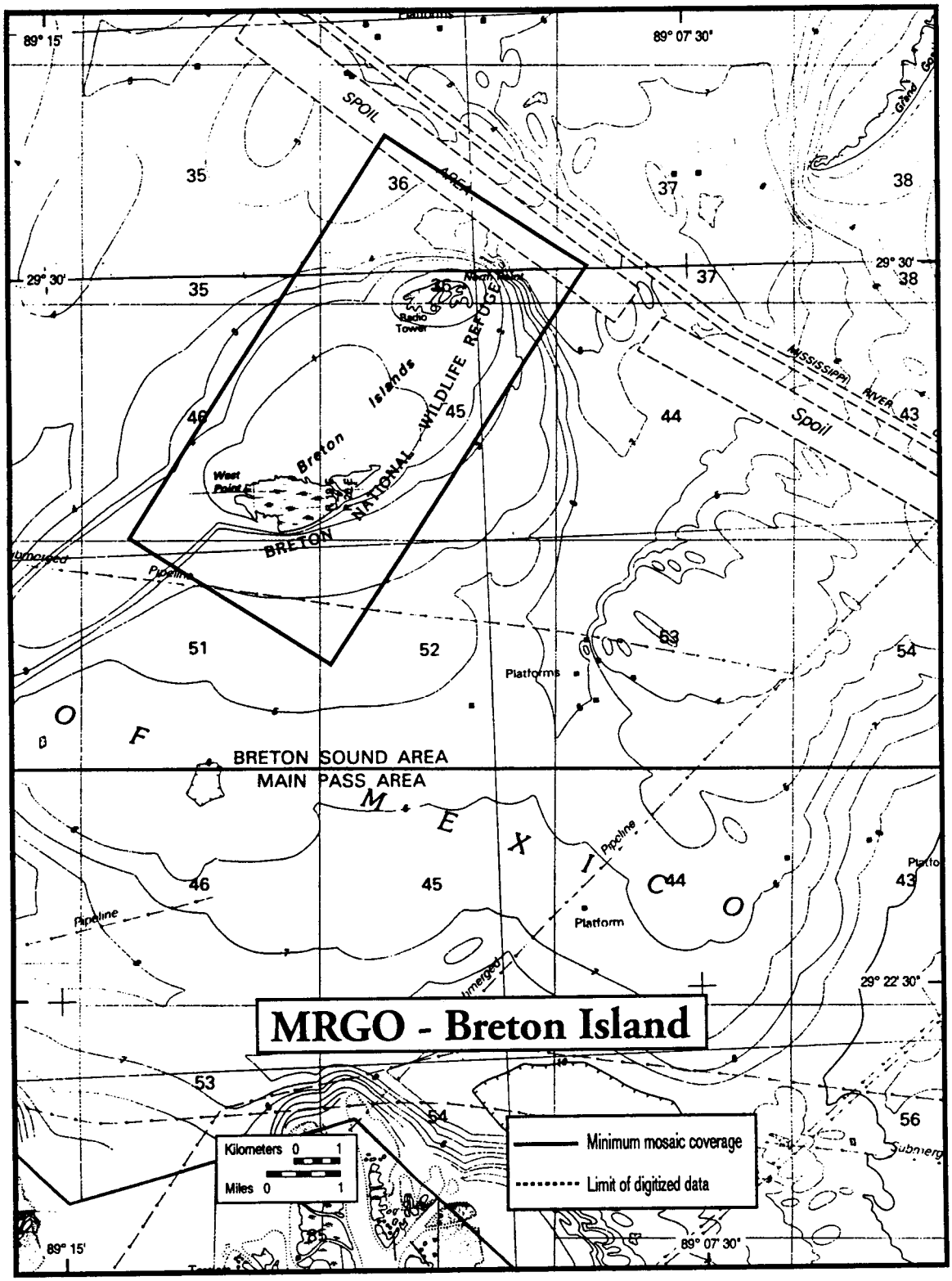

Figure 3. Location of the MRGO - Breton Island dredged material BUMP study area. The minimum limits of the air photo mosaics and the area digitized are presented.

NAVIGATION CHANNEL AND DREDGED MATERIAL DISPOSAL HISTORY

The Rivers and Harbors Act of 1956 authorized the USACE-NOD to construct and maintain a deep-draft navigation channel 36 feet deep by 500 feet wide from the Inner Harbor Navigation Canal in New Orleans to the Chandeleur Islands (Mile 66.0 to Mile 0) and a channel 38 feet deep by 600 feet side from the islands to the 38-foot contour in the Gulf of Mexico (Mile 0 to Mile -9.0). Construction of the Mississippi River Gulf Outlet (MRGO) channel was initiated in 1958 and enlargement to full project dimensions was completed in 1968. Maintenance of discontinuous reaches of the channel has been accomplished on an annual basis since construction was completed.

Historically, shoal material from the bar channel (Mile) to Mile 9.0) was removed by hopper dredges and placed into an Environmental Protection Agency designated ocean dredged material disposal site (ODMDS) located southwest of the navigation channel. During annual coordination prior to the Fiscal Year 1992 maintenance event, the Louisiana Department of Natural Resources (DNR) asked USACE-NOD) to investigate the feasibility of berm construction with dredged material from the MRGO bar channel. According to DNR, construction of a berm adjacent to Breton Island could nourish and /or protect the island from continued erosion.

Scientists from the USACE Waterways Experiment Station's Coastal Engineering Resource Center (CERC) assisted USACE-NOD with development of a plan to construct and monitor a near shore berm. CERC recommended construction of a *pilot* near shore berm 1) To determine the constructability of a berm using a hydraulic cutterhead pipeline dredge; 2) to investigate the mounding potential of the extremely fine-grained dredged material; and 3) to monitor dispersion of the berm. Little, if any, experience existed for constructing a near shore berm by hydraulic pipeline using such fine-grained material. Therefore, experience gained form constructing and monitoring the pilot near shore berm would be used to assess the feasibility of a larger berm to benefit Breton Island.

USACE-NOD determined the dredged material placement location and approximate configuration with guidance form CERC. Monitoring consisted of pre- and post-construction hydrographic surveys, seabed drifter studies, sediment sampling, dredging operations inspection and documentation, and data analysis.

Approximately 1.7 million cubic yards of dredged material from the Mile 0 to Mile -2.5 reach of the MRGO bar channel was placed at the pilot near shore berm location in September, 1992. Post-construction surveys revealed that approximately 400,000 cubic yards of the dredged material placed at the pilot near shore berm site remained in a mound at the site following construction.

FIELD SURVEY RESULTS

Elevation Profile Surveys

In May of 1995, profile transects were established and surveys were conducted along four transects. Storm surges removed the original benchmarks during the summer of 1995 and winter of 1996. The field effort in 1996 consisted of re-establishing old sites and establishing a few additional sites. However, because of events beyond our control, no elevation data was ever acquired during 1996. Figure 4 is an elevation profile from 1995 that is included as an example of conditions on Breton Island.

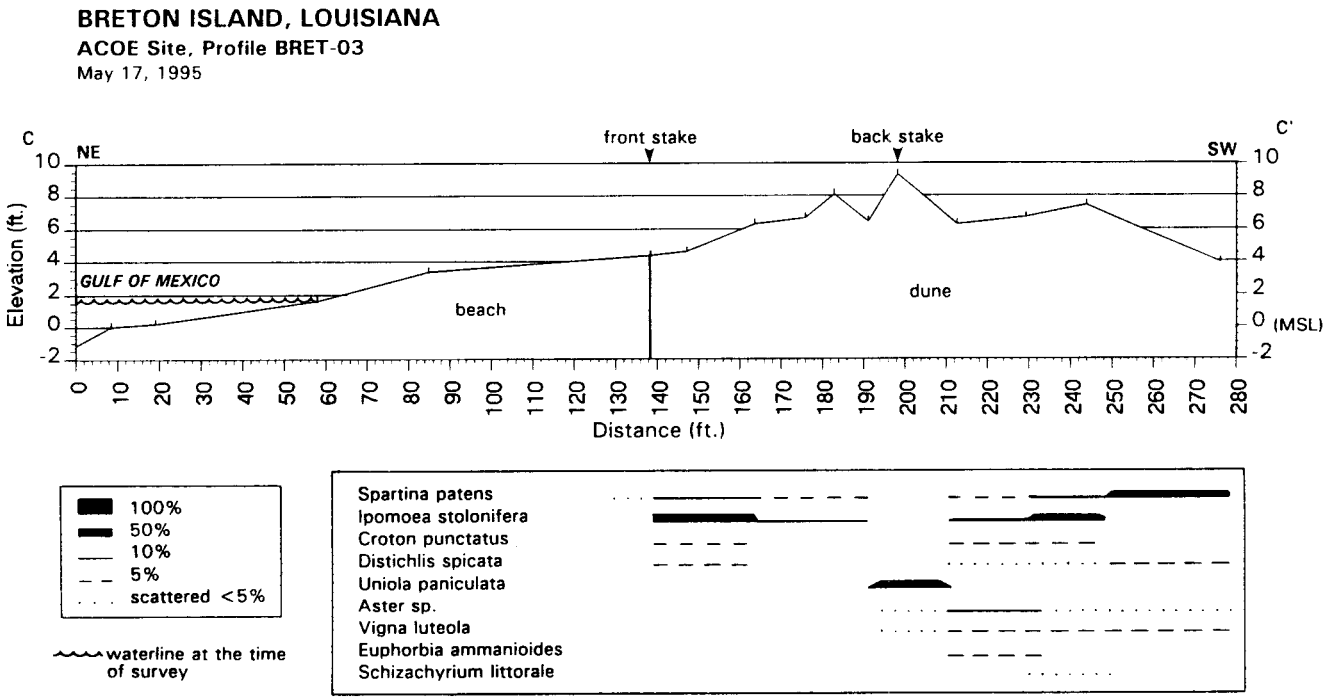

Figure 4. Profile BRET-03 obtained on May 17, 1995 from the MRGO-Breton Island BUMP study area with vegetative communities added.

Vegetative Character

The overall marsh type for this area would be classified as salt marsh represented by *Spartina alterniflora*. The other vegetative habitats found at this site were dune zones of *Spartina patens* or *Uniola paniculata*; barrier island shrub/scrub zones of *Myrica cerifera*, *Baccharis halimifolia*, and *Sesbania drummondii*; and high marsh or upland-grassland dominated by *Spartina patens*. All habitats are considered natural except for the part within the Kerr Magee facility. A brief species list of this area is included in Appendix A.

GIS ANALYSIS

Long-term Shoreline Change History: 1869-1985

Figure 5 graphs the spatial history of the study area between 1869 and 1996 based on data from the U.S. Geological Survey - Louisiana Barrier Island Erosion Study: Atlas of Shoreline Changes, which was updated by the BUMP (Table 1). The study area in 1869 was measured at 820.4 acres and in 1985 it was measured at 252.1 acres. This is an area decrease of -568.2 acres and an average long-term area decrease of -4.9 acres per year.

Breton Island decreased in area between 1869 and 1922 by -669.7 acres or 18 percent. The average rate of change between 1869 and 1922 was -2.97 acres/yr. In contrast, by 1951, the island area expanded to +719.1 acres at a rate of +1.73 acres/yr. During the period 1951 to 1978, this trend reversed and Breton Island experienced a great amount of area loss. Island area was reduced by 52 percent, with a loss of -370.7 acres at a rate of -13.3 acres/yr. In 1985, Breton Island measured 252.1 acres, which is a decrease of -96 acres since 1978 at a rate of -13.7 acres per year. Breton Island's central area was breached by the 1985 hurricanes, leaving two resistant ends that experienced limited change.

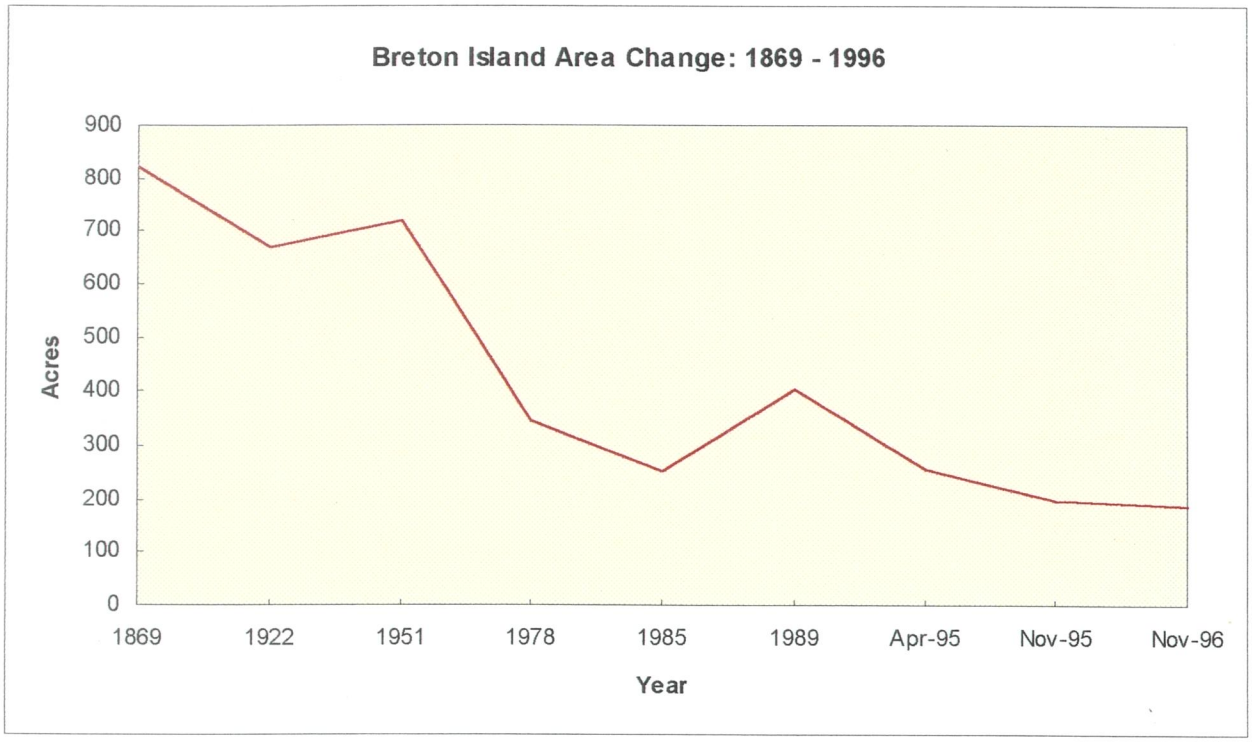

Figure 5. Graph of the area of the BUMP Breton Island study area over time. Data for 1869, 1922, 1951, 1978, and 1989 from McBride, et al. 1992. Data for 1985, 1995, and 1996 are from the USACE-NOD dredged material BUMP.

TABLE 1
Breton Island area: 1869-1996

Year	1869[1]	1922[1]	1951[1]	1978[1]	1985*	1989[1]	April 1995*	Nov 1995*	Nov 1996*
Area in Acres	820.4	669.7	719.1	348.4	252.1	405.3	257.3	199.9	179.9

[1]From McBride, et al., 1992.
*BUMP data

Figure 6 depicts the land loss and land gain history for Breton island between 1869 and 1985. The average rate of shoreline erosion at Breton Island is -19.5 feet per year for the period of 1869 to 1985. Figure 7 shows the 1869 and 1985 shorelines with the same transect lines as those used in the USGS barrier island atlas to calculate linear shoreline change data. Table 2 lists the individual shoreline change statistics for this time period.

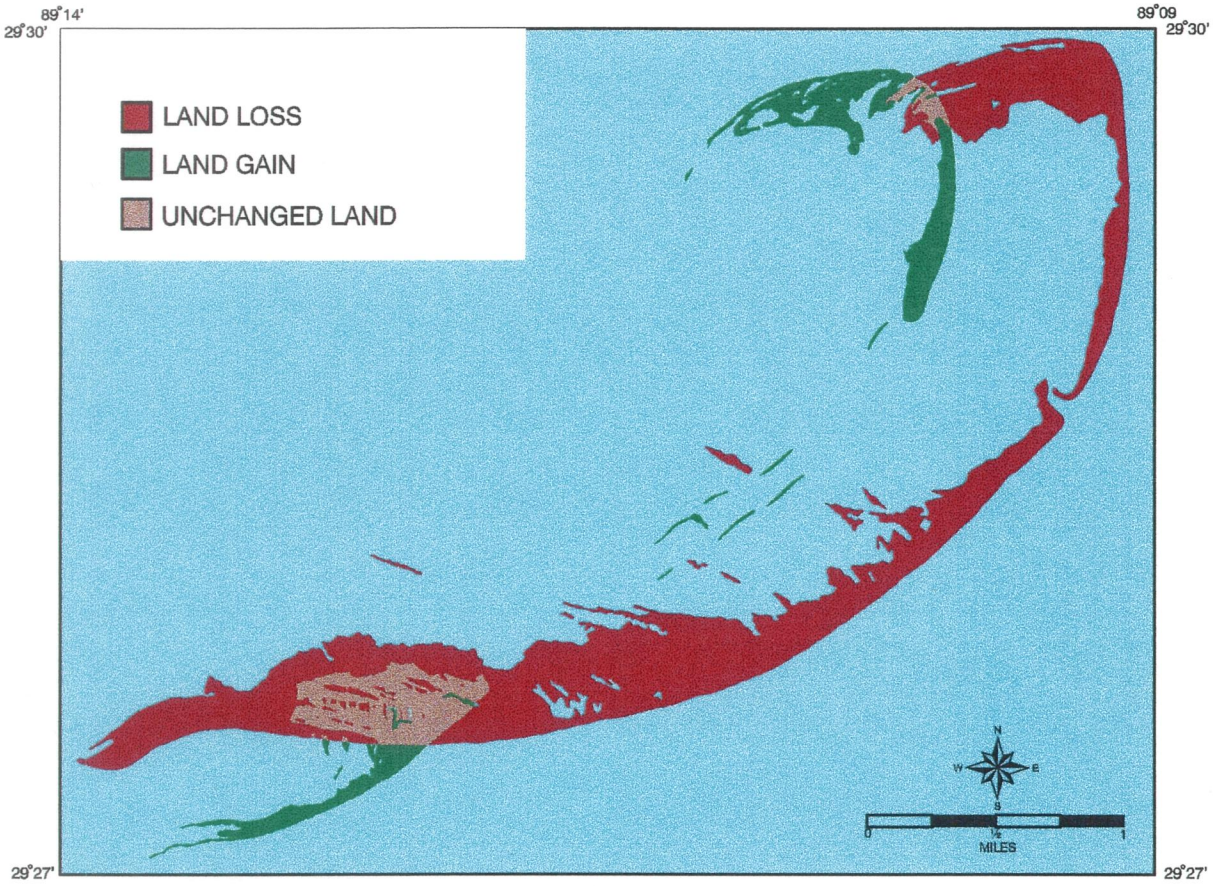

Figure 6. The land loss and land gain history of Breton Island between 1869 and 1985 (Source: 1869 shoreline - McBride, et al. 1992; 1985 shoreline - BUMP).

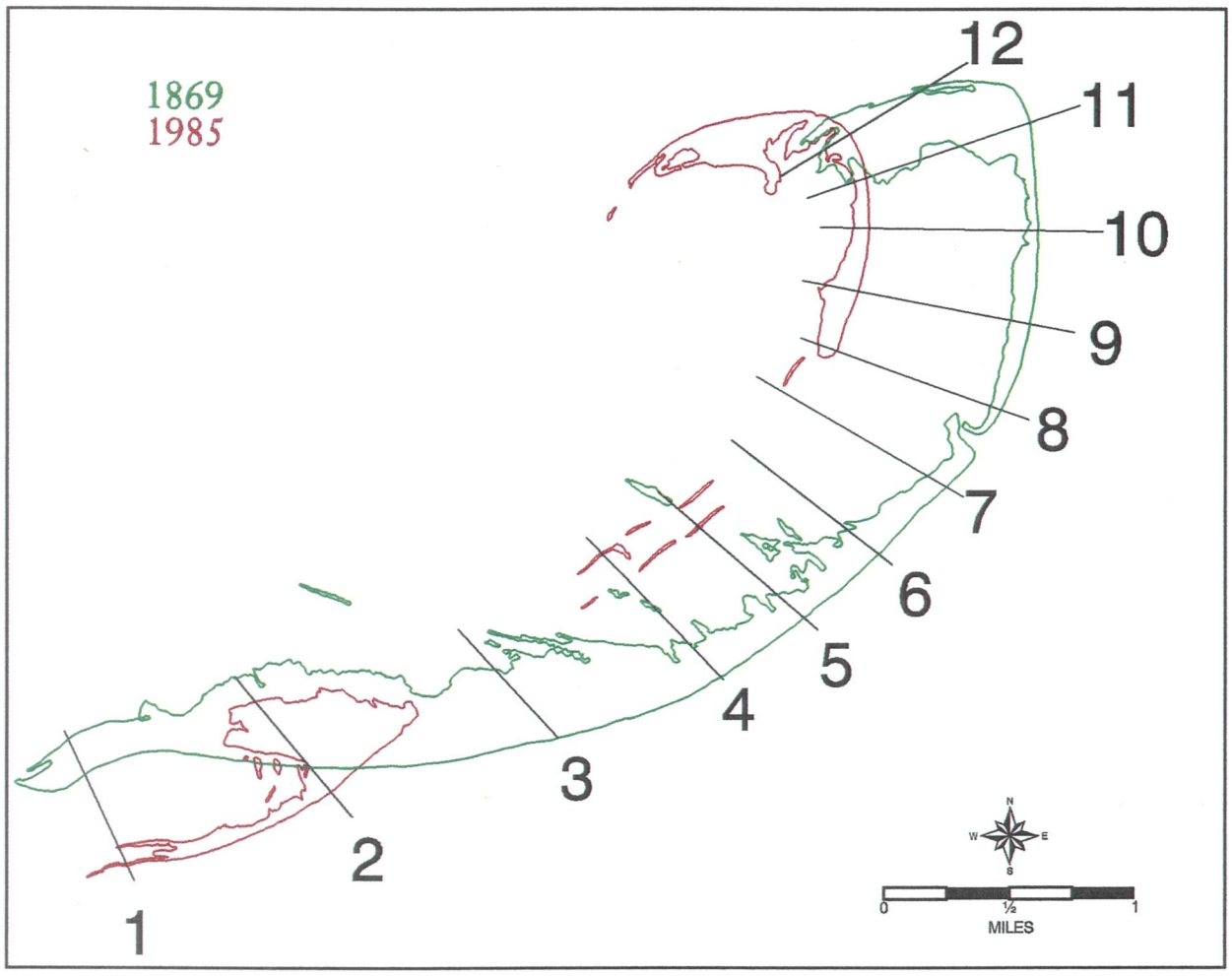

Figure 7. The 1869 and 1985 shorelines with the same transect lines used in McBride, et al. (1992) to calculate linear shoreline change data.

TABLE 2
Breton Island Shoreline Change: 1869-1985

Transect #	1	2	3	4	5	6	7	8	9	10	11	12	Total Average
Shoreline Change (feet)	+2112	+662	--	-3588	-2916	--	--	-3692	-3690	-3568	-3655	-2013	-2260.9
Rate of Change (ft/yr)	+18.2	+5.7	--	-30.9	-25.1	--	--	-31.8	-31.8	-30.8	-31.5	-17.4	-19.5

BUMP Analysis: 1985-1996

Area Change

The benchmark year for the dredged material BUMP is 1985. The first monitoring year for MRGO-Breton Island is April 1996. The digital January 1989 shoreline from McBride et al. is used to improve the resolution of the BUMP analysis. Table 3 depicts the change in total area of Breton Island and Figure 8 shows the trends of land loss and land gain between December 1985 and November 1996. There was an overall loss of -72.2 acres at a rate of -6.6 acres per year during this 10.9-year time period.

Figure 9 shows the areas of land loss and land gain between December 1985 and April 1995. In December 1985, the area of Breton Island was measured at 252.1 acres. By January 1989, the area of Breton Island increased to 405.3 acres. This is an increase of +153.2 acres at a rate of +49.7 acres per year which is attributed to barrier island recovery processes following the 1985 hurricanes. Between 1985 and 1989, the breach through the central part of Breton Island infilled and shoaled to form a broad washover terrace upon which a hummocky dune field was established. Between January 1989 and April 1995, Breton Island experienced another erosional period due to storm surges from hurricanes Gilbert and Florence in 1989, Hurricane Andrew in 1992 and numerous other storms. In April 1995, Breton Island was measured at 257.3 acres which represented a decrease of -148 acres at a rate of -23.7 acres per year.

Figure 10 shows the areas of land loss and land gain between April 1995 and November 1995. In November 1995, Breton Island was measured at 199.9 acres (Table 1). There was an overall loss of -57.4 acres at a rate of -98.4 acres per year during this eleven month time period. The loss occurred predominately along the Gulf shoreline including much of the mid-island shoal and because of breaches formed in narrow parts of the island. This was offset by a small amount of accretion on the inner shoreline of the island and spit elongation.

Figure 11 shows the areas of land loss and land gain between November 1995 and November 1996. In November 1996, Breton Island was measured at 179.9 acres (Table 1). There was an overall loss of -20.0 acres during this one year time period. Breaches widened and Gulf shore erosion continued.

TABLE 3
Breton Island Area Change: 1985-1996

Period	Area Change (acres)	Rate of Change (acres/yr)
Dec 1985 - Jan 1989	+153.2	+49.7
Jan 1989 - Apr 1995	-148.0	-23.7
Apr 1995 - Nov 1995	-57.4	-98.4
Nov 1995 - Nov 1996	-20.0	-20.0
Dec 1985 - Nov 1996	-72.2	-6.6

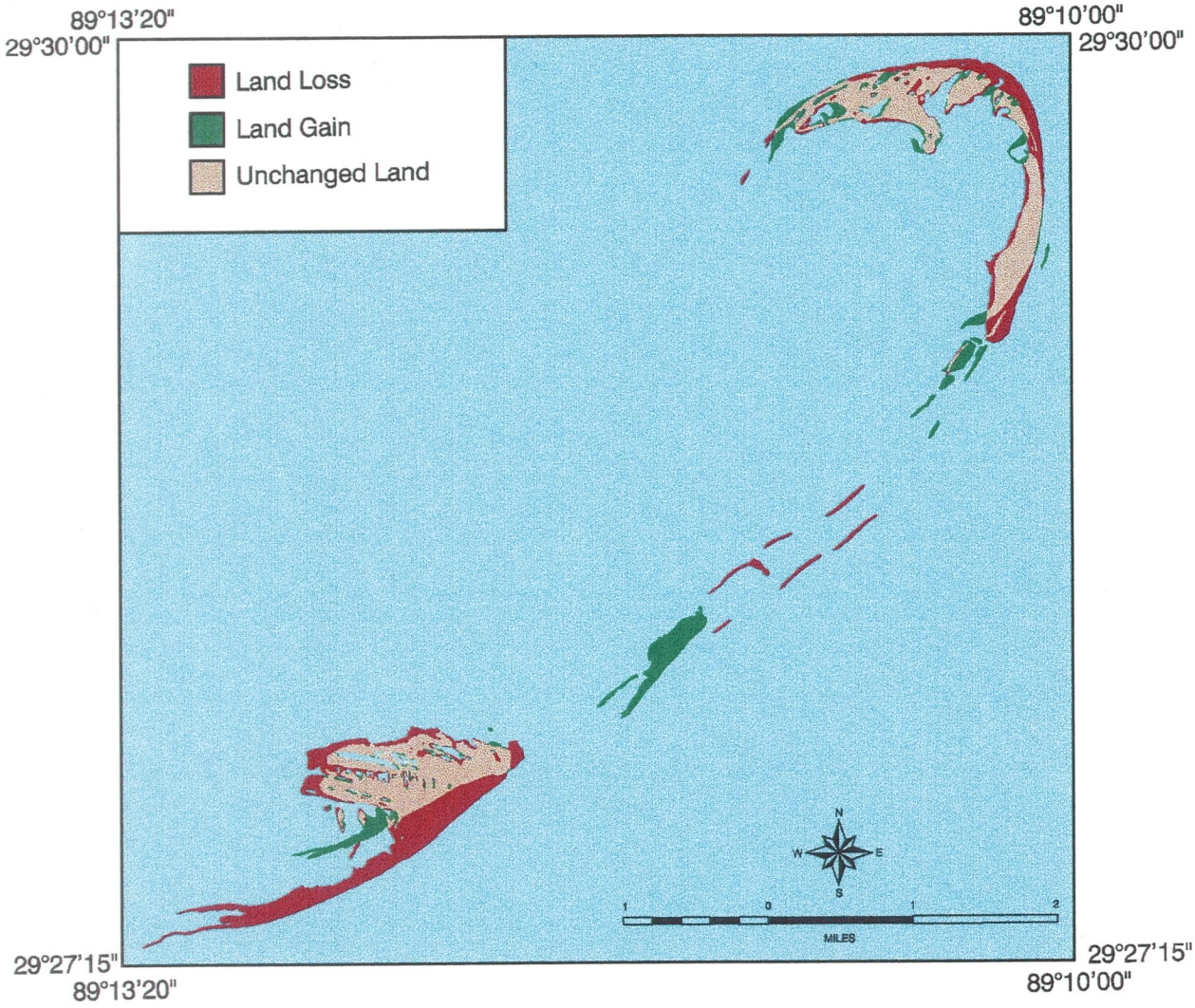

Figure 8. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing December 1985 and November 1996.

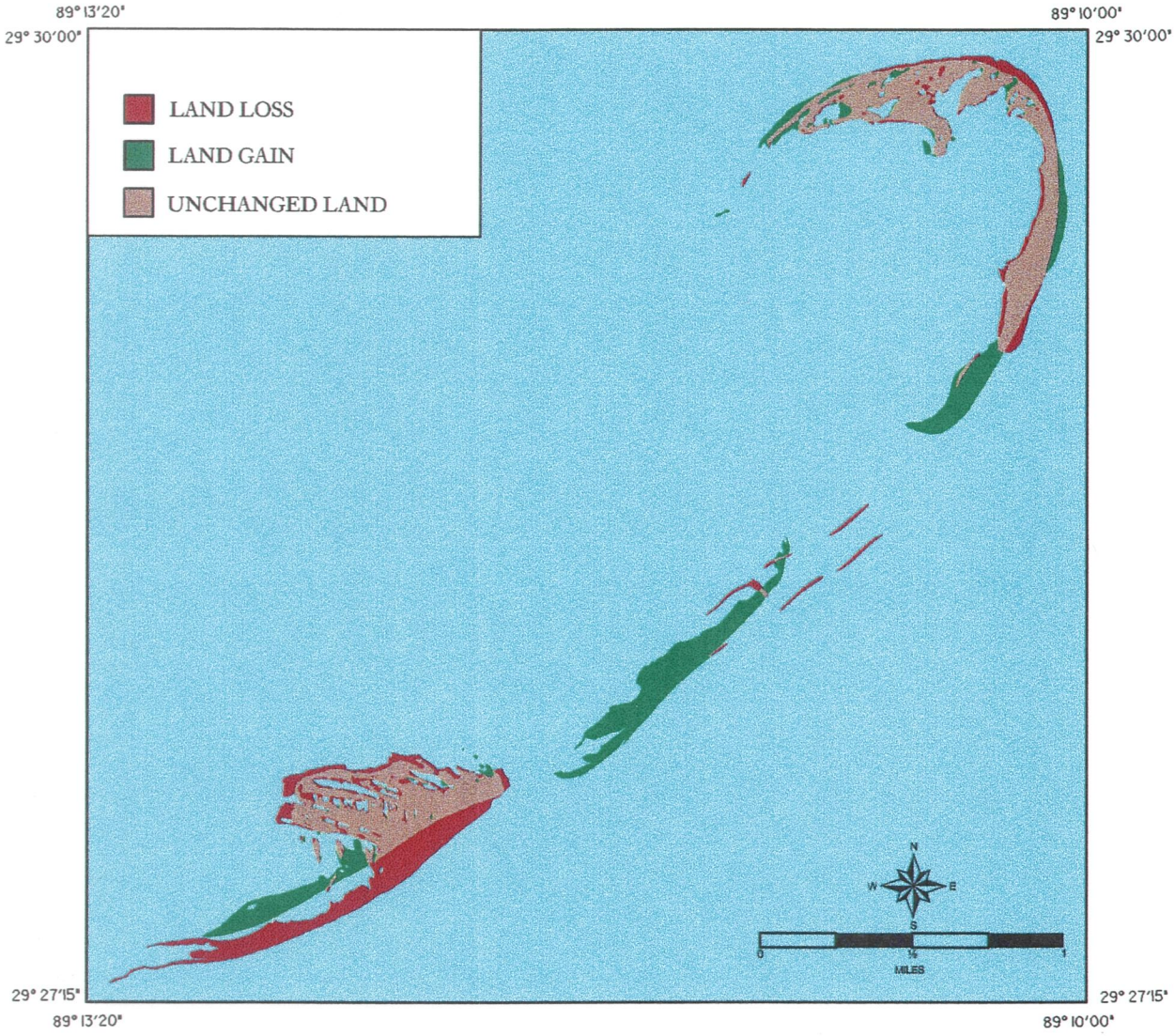

Figure 9. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing December 1985 and April 1995.

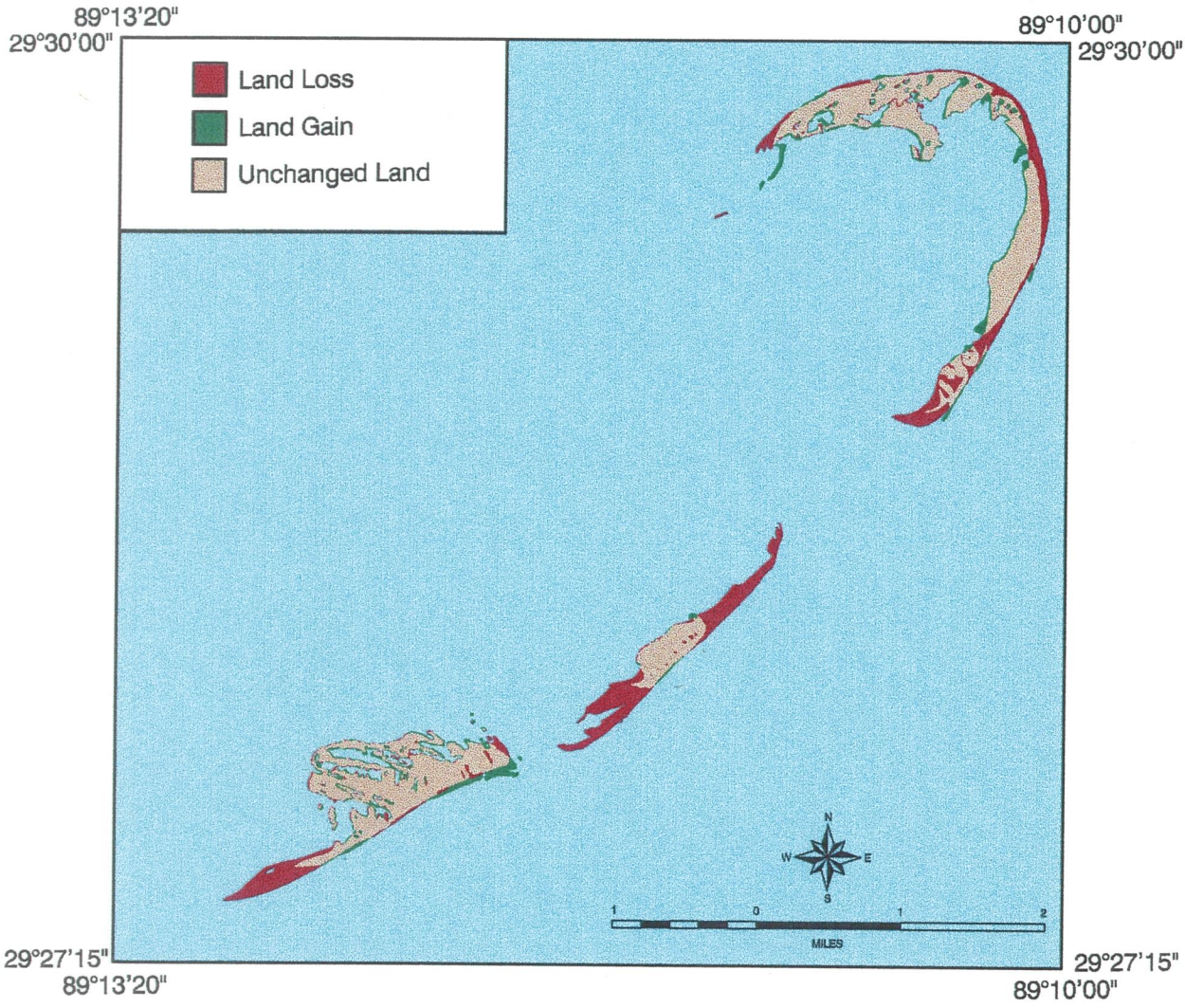

Figure 10. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing April 1995 and November 1995.

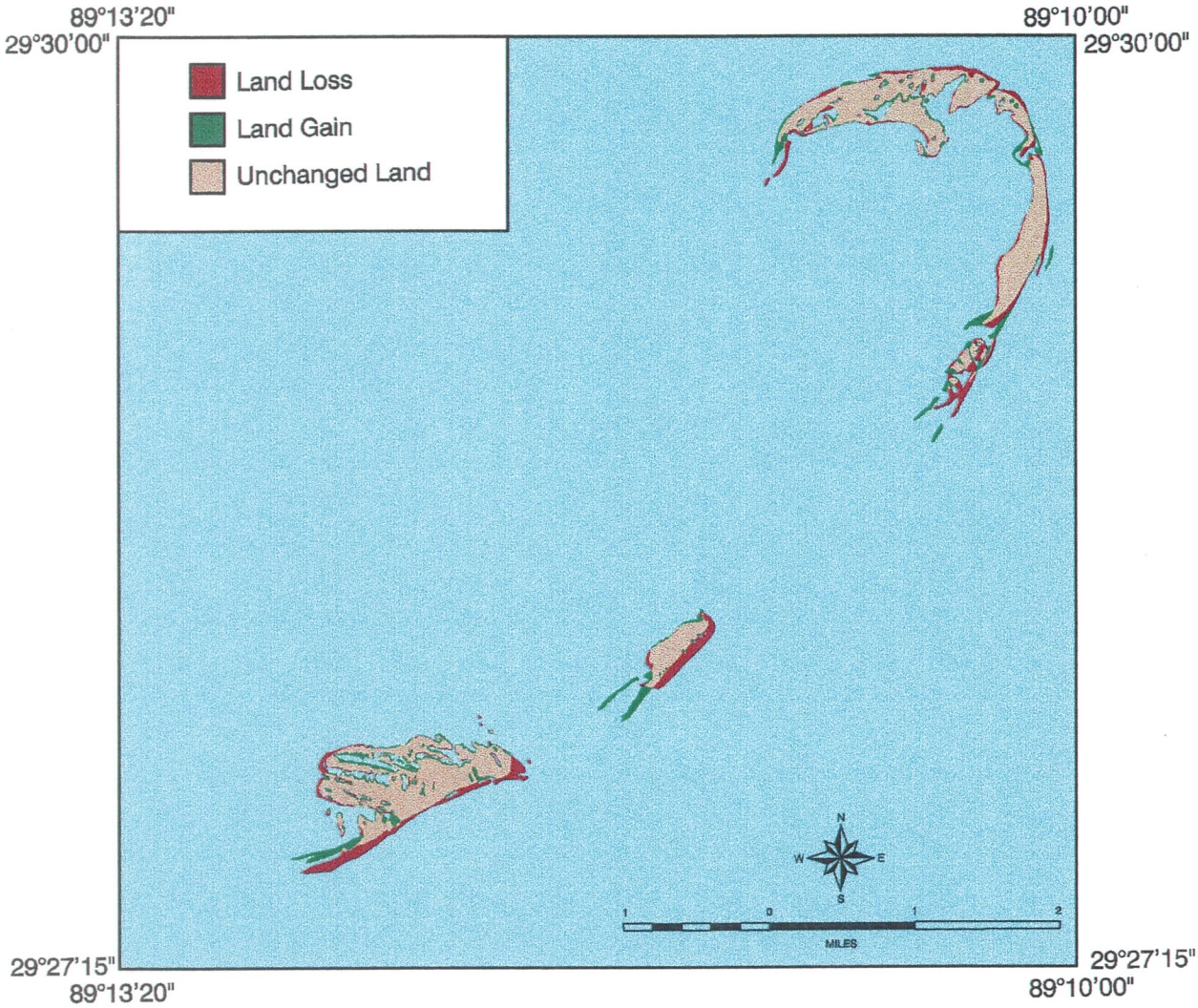

Figure 11. Land loss/gain map of the MRGO - Breton Island BUMP study area comparing November 1995 and November 1996.

Linear Change

Figure 12 shows the same shoreline change transects as those used in the USGS barrier island atlas, and table 4 lists the individual shoreline change statistics for December 1985, January 1989, April 1995, November 1995, and November 1996. The Gulf of Mexico shoreline prograded an average of +126.1 feet between 1985 and 1989 at a rate of +40.9 feet per year. There were areas of significant shoreline gain in the central portions of Breton Island where hurricane recovery processes rebuilt the island. Between January 1989 and April 1995, the Gulf of Mexico eroded an average of -145.9 feet at a rate of -23.3 feet per year. The seven month period between April 1995 and November 1995 showed the highest rate of erosion isolated in this study with an average retreat of -163.9 feet per transect line for an average rate of -281.0 feet per year. In contrast, the next period of measurement between November 1995 and November 1996 showed an overall average rate of increase as +5.3 feet for the year. The average amount of shoreline change for the entire BUMP analysis between December 1985 and November 1996 is a retreat of -298.1 feet at a rate of -27.3 feet per year.

An interesting pattern of shoreline change was recognized during the BUMP analysis period. In the areas immediate adjacent to the pilot berm, transects 9 ant 10 showed significant shoreline progradation when adjacent areas experienced erosion between 1985 and April 1995 (Figure 8) and less erosion than other areas during other periods. Figure 12 shows an enlargement of this area and its proximity to the pilot berm. The unpublished drifter study by the USACE-NOD shows significant onshore movement of the drifters from the pilot berm area to the Breton Island shorelines. The aerial photograph in Figure 20 shows the large beach protuberance in 1994 immediately adjacent to the pilot berm.

TABLE 4
Breton Island Shoreline Change: 1985-1996

Transect #	1	2	3	4	5	6	7	8	9	10	11	12	Average
1985-1989 Shoreline Change (feet)	+159	-221	--	+831	-76	--	--	+74	+119	+130	+97	+22	+126.1
1985-1989 Rate of Change (ft/yr)	+51.6	-71.8	--	+269.8	-24.7	--	--	+24.0	+38.6	+42.2	+31.5	+7.1	+40.9
1989-Apr 1995 Shoreline Change (feet)	--	-343	+261	-355	--	--	-254	-251	-98	+5	-120	-158	-145.9
1989-Apr 1995 Rate of Change (ft/yr)	--	-54.9	+41.8	-56.8	--	--	-40.6	-40.2	-15.7	+0.8	-19.2	-25.3	-23.3
Apr 1995-Nov 1995 Shoreline Change (feet)	--	-33	-602	-252	--	--	-20	-230	+56	-163	-159	-72	-163.9
Apr 1995-Nov 1995 Rate of Change (ft/yr)	--	-56.6	-1032.0	-432.0	--	--	-34.3	-394.3	+96.0	-279.4	-272.6	-123.4	-281.0
Nov 1995-Nov 1996 Shoreline Change (feet)	--	-66	+85	--	--	--	-28	+186	-101	-17	+60	-77	+5.3
Nov 1995-Nov 1996 Rate of Change (ft/yr)	--	-66	+85	--	--	--	-28	+186	-101	-17	+60	-77	+5.3
1985- 1996 Shoreline Change (feet)	--	-663	--	-729	--	--	--	-220	-24	-45	-120	-286	-298.1
1985- 1996 Rate of Change (ft/yr)	--	-60.7	--	-66.8	--	--	--	-20.2	-2.2	-4.1	-11.0	-26.2	-27.3

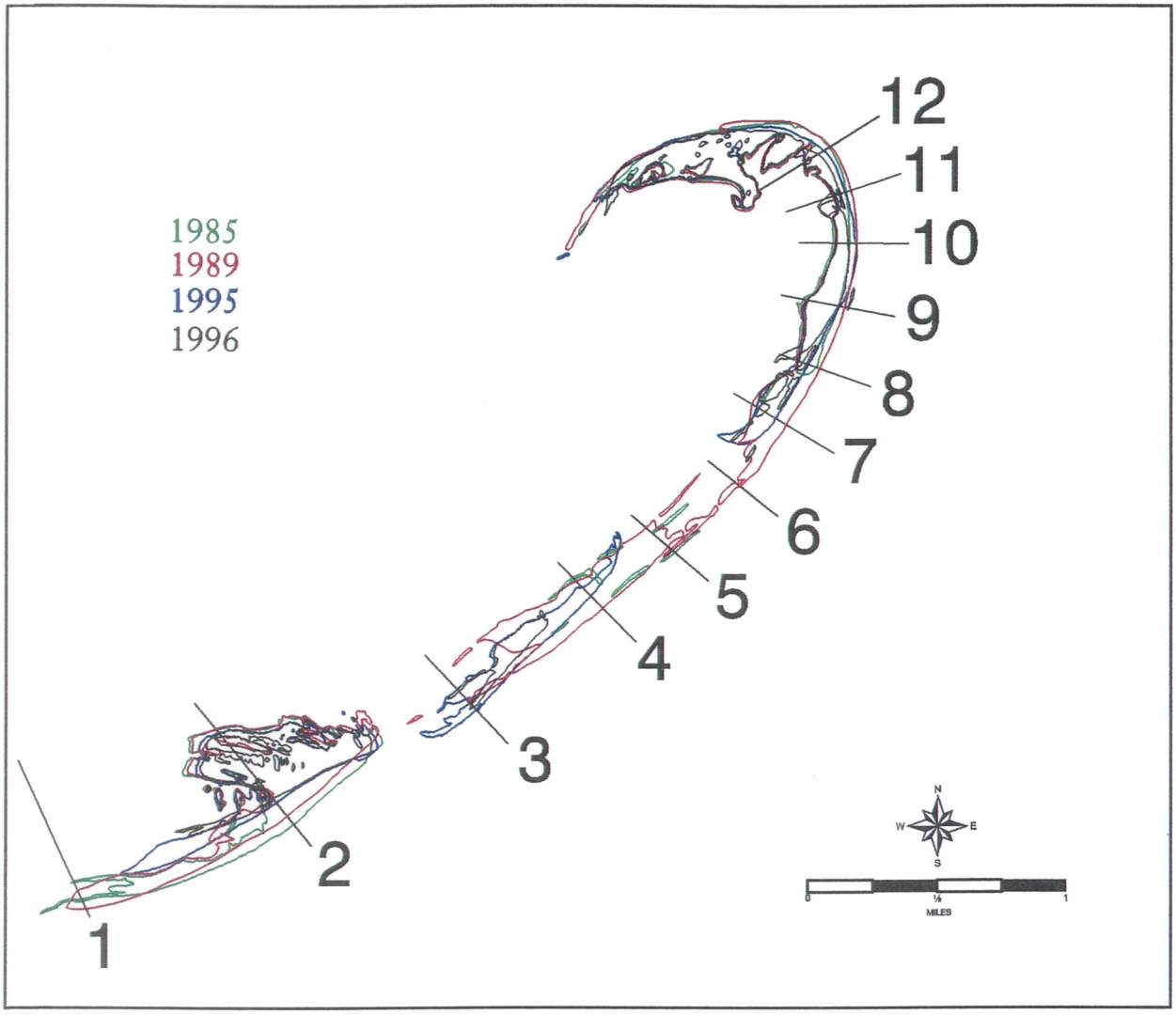

Figure 12. The December 1985, January 1989, April 1995, and November 1996 shorelines with the same transect lines used in figure 7 to calculate linear shoreline change data.

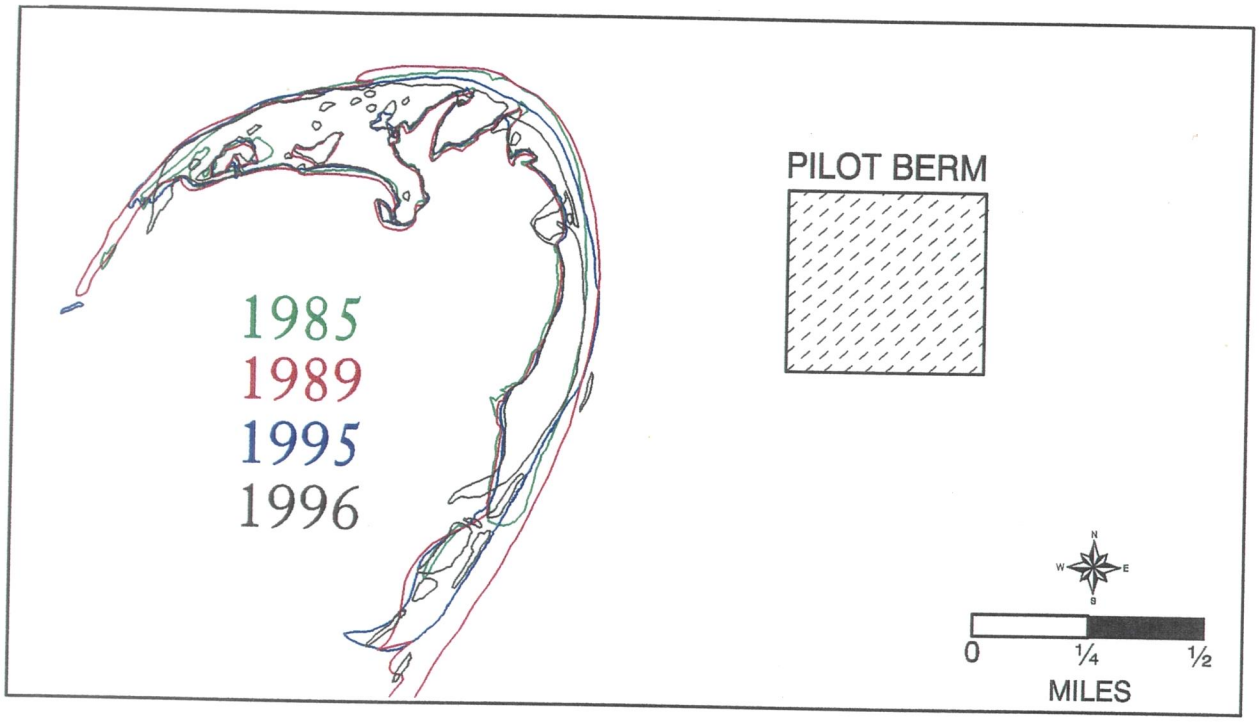

Figure 13. The December 1985, January 1989, April 1995 and November 1996 shorelines in relation to the position of the pilot berm.

Figure 14. Oblique aerial photograph of Breton Island taken on July 29, 1994 showing the large beach protuberance immediately adjacent to the pilot berm. The view is to the south.

CONCLUSIONS

1. The BUMP baseline documented that Breton Island is experiencing rapid erosion and land loss. Between 1869 and 1985 Breton Island decreased in area -568.2 acres at a rate of -4.9 acres per year. The average rate of shoreline change for this period was -19.5 feet per year.

2. During the BUMP monitoring period of 1985-1996, Breton Island recovered from the impacts of the 1985 hurricanes as evidenced by the +153.2 acre area increase by 1989. Since 1989, Breton Island lost -225.4 acres of land to the impact of Hurricane Andrew in 1992 and other storms during this time period

3. The USACE-NOD built a pilot berm in 1993. Along the shoreline immediately adjacent to the pilot berm, a large beach protuberance developed after 1993. Measurements indicate that the shoreline of the protuberance accreted +56 feet between April 1995 and November 1995 while the adjacent shoreline eroded more than -163 feet, and between November 1995 and November 1996, an area just down-drift of the protuberance area accreted +186 feet.

REFERENCES

McBride, R.A., Penland, S., Hiland, M.W., Williams, S.J., Westphal,K.A., Jaffe,B.E., Sallenger,A.H., 1992. Analysis of barrier shoreline change in Louisiana from 1853 to 1989. Chapter in: Louisiana Barrier Island Erosion Study - Atlas of Shoreline Changes in Louisiana from 1853 to 1989; Williams, S.J., Penland, S., and Sallenger, A.H. Editors. U.S. Geological Survey Miscellaneous Investigation Series I-2150-A, p. 36-97.

APPENDIX 4A

LIST OF VEGETATIVE SPECIES
IN THE MISSISSIPPI RIVER GULF OUTLET - BRETON ISLAND

LIST OF VEGETATIVE SPECIES
IN THE MISSISSIPPI RIVER GULF OUTLET -BRETON ISLAND

An alphabetical list of observed and collected plant species follows. This list is not complete, but is meant to establish vegetative character and indicate dominant species observed. The list includes the species name, alternate scientific names, common names, and general habitat description for each plant. The habitat information was taken from the Manual of the Vascular Flora of the Carolinas or The Smithsonian Guide to Seaside Plants of the Gulf and Atlantic Coasts.

Aster tenuifolius L. . . . . perennialsaltmarshaster
perennial; salt and brackish marshes

Baccharis halimifolia L. . . . . groundselbush
shrub; elevated sites in fresh to saline marshes

Borrichia frutescens (L.) . . . . . sea ox-eye
shrub; brackish marsh or upper elevations of salt marsh

Cakile geniculata . . . . . sea rocket
succulent annual; coastal sand dunes, overwash areas, sand flats

Calystegia sepium (L.) Brown . . . . . hedge bindweed
twining vine; fields, roadsides and waste places

Cenchrus tribuloides L. . . . . large sand spur
sprawling perennial; dunes, sandy fields and woods

Chloris petraea Schwartz. . . . . finger grass
tufted perennial; dunes and sand flats

Croton punctatus Jacquin. . . . . beach tea
woody, short-lived perennial; sand dunes along the coast

Cynanchum palustre (Pursh) Heller . . . . . climbing milkweed vine
perennial twining herb; salt marshes and coastal hammocks

Cyperus spp. . . . . nut sedges

Distichlis spicata (L.) Greene . . . . . salt grass
rhizomatous perennial; brackish marshes and flats

Eragrostis sp. . . . . love grass

Euphorbia ammanioides HBK. . . . . seaside spurge
Prostrate annual; sand dunes along the coast, sandy barrens

Ipomoea stolonifera (Cyrillo) Poiret. . . . . beach morning glory
perennial vine; beach dunes

Iva frutescens L. . . . . marsh elder
shrub; brackish marshes, upper elevations of salt marshes

Hydrocotyle bonariensis Lam. . . . . sand pennywort
prostrate, creeping perennial; among beach dunes, moist open sandy areas

Myrica cerifera L. . . . . wax myrtle
shrub or small tree; sand flats, pinelands and marshes

Paspalum vaginatum Sw. . . . . seashore paspalum
rhizomatous perennial; fresh to brackish marsh

Phragmites australis (Cav.) Trin. ex Steud. . . . . roseau cane
tall, rhizomatous, perennial reed; tidal marshes, pond margins, elevated sites in saline marshes

Salicornia bigelovii Torrey . . . . . glasswort
succulent annual; saline marsh, salt flats

Schizachyrium littorale Bick. . . . . maritime bluestem
perennial; dunes, above drift lines

Sesbania drummondii (Rydb) Cory. . . . . yellow rattlebox
(Daubentonia longifolia (Cav.) DC.)
shrub; sandy soils, salt spray community, elevated areas in fresh to saline marsh, scrub pine woods

Solidago sempervirens L. . . . . seaside goldenrod
perennial; brackish marsh or saline sand

Spartina alterniflora Loisel. . . . . oyster grass
coarse perennial; salt and brackish marshes

Spartina patens (Aiton) Muhl. . . . . marsh hay cordgrass
rhizomatous perennial; brackish marsh, low dunes, sand flats

Sporobolus virginicus (L.) Kunth. . . . . coastal dropseed
creeping, rhizomatous perennial; salt or brackish marshes, overwash areas, swales, dunes, salt flats

Vigna luteola (Jacq.) Benth. . . . . deer pea
trailing or twining vine; waste places, elevated areas bordering marshes, low fields

Uniola paniculata L. . . . . sea oats
coarse, rhizomatous perennial; dunes, beaches, loose sands near seashores