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COMPREHENSIVE MONITORING REPORT NO. 1
For the period May 8, 1997 to May 8, 2001

Coast 2050 Region 3

POINT AU FER ISLAND HYDROLOGIC RESTORATION TE-22 (PTE22-24)

Second Priority List Hydrologic Restoration Project
of the Coastal Wetlands Planning, Protection, and Restoration Act
(Public Law 101-646)

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ABSTRACT

The project was initiated in 1995, on the eastern and southern portions of Point Au Fer Island in Terrebonne Parish, LA, USA, with the goal of reducing marsh erosion rates, canal widening, and shoreline retreat. There were three phases constructed to achieve these goals: Phase I included seven canal plugs, and Phases II and III received rock armor to protect a portion of shoreline exposed to the Gulf of Mexico. Phase III abuts Phase II and was constructed in the Spring of 2000. While this phases contribution toward achieving project goals will be considered in future reports, it is seldom mentioned throughout this report due to its recent addition and inability to affect the previous years shoreline movement near Phase II. Canal edge position, adjacent to canal plugs (Phase I), was measured before and after plug construction in April and May 1997, respectively, as well as a second post-construction measurement in April 2000. There were no significant differences in the rate of canal widening between pre- and post-construction periods. Additionally, pre- and post-construction land/water analyses of the project area (all phases) were conducted to aid in the determination of plug and rock armor efficacy in achieving the projects goals. Land/water analyses indicated that the project area gained land during the post-construction period, nearly countering the loss experienced during the pre-construction period. However, due to low water levels caused by a sustained drought (during most of the post-construction period), extensive areas of mudflats made land/water analysis difficult and the results should be interpreted with caution. At this point, we find it difficult to assess the projects ability to achieve the above stated goals since the two data sets contradict each other. However, we feel knowledge has been gained regarding future monitoring design, operation and maintenance planning, and structure selection.

INTRODUCTION

The Point Au Fer Island Hydrologic Restoration (TE-22) project was designed to preserve and protect the islands inland marsh by re-establishing the original hydrologic regime. Additionally, the project was intended to restore and reinforce the shoreline, as well as prevent breaching of the Gulf of Mexico into Mobil Canal (figure 1). Seven canal plugs and nearly two miles of rock armor have been constructed to achieve the above stated goals, respectively. The project was federally sponsored by the National Marine Fisheries Service (NMFS) and locally sponsored by the Louisiana Department of Natural Resources, Coastal Restoration Division (LDNR/CRD) under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA, Public Law 101-646, Title III). Point Au Fer Island is located approximately 6 miles southeast of the mouth of the Atchafalaya River. The island is bordered by the Gulf of Mexico to the south, Atchafalaya Bay to the west, Fourleague Bay to the north and northeast, and Oyster Bayou tidal pass to the east (figure 1). The project area is 5,120 acres (2,072 ha) of brackish/saline marsh and a latticework of oil and gas canals with their associated spoil banks. There are three phases, though phase II and III are adjoining. Phase I (figure 2) is 3,408 acres (1,379 ha) and Phases II and III (figure 3) are collectively 1,712 acres (693 ha).

For well over a century, small trenasses branching from southern Louisiana's bayous have been dug, usually by shovel, by hunters and trappers for pirogue access into the marsh interior. Through the processes of wave action, storm events, and boat traffic, these canals have enlarged in both width and length, and become visible and influential features in the landscape. In 1938, the dredging of canals greatly increased in scale. Oil and gas were found in abundance under the marshes of southern Louisiana, and landowners and corporations started dredging the approximately 11,800 miles (19,000 kilometers) of access canals present to this day (Turner et al. 1994b). The dredging of access canals, sometimes as short as 100 feet (30.5 m) in length or as long as several thousands of feet (> 305 m) in length (Turner et al. 1994a), has been identified as a contributor to significant wetland loss throughout southern Louisiana (Swenson and Turner 1987).

Over the past three decades, significant money and time have been invested in an effort to restore wetland functions lost or diminished as a result of dredging activities in Louisiana. For example, Swenson and Turner (1987) were one of the first to examine the hydrologic regimes of impounded marshes throughout southern Louisiana. Abernethy and Gosselink (1988) examined the feasibility of backfilling pipeline canals in various marsh habitats. Turner et al. (1994b) developed formulae for spoil bank gapping to achieve a desired flow rate of water entering and leaving marshes. Additionally, they provided a framework for decision-making concerning hydrologic restorations of spoil-bank bordered wetlands. Craig et al. (1979) calculated the exponentially increasing land loss in coastal Louisiana as a result of oil and gas access canals. Turner and Lewis (1997) re-evaluated canal impacts on land loss and habitat function, and found that while habitat change is unpredictable, it will occur as a result of altered hydrology.

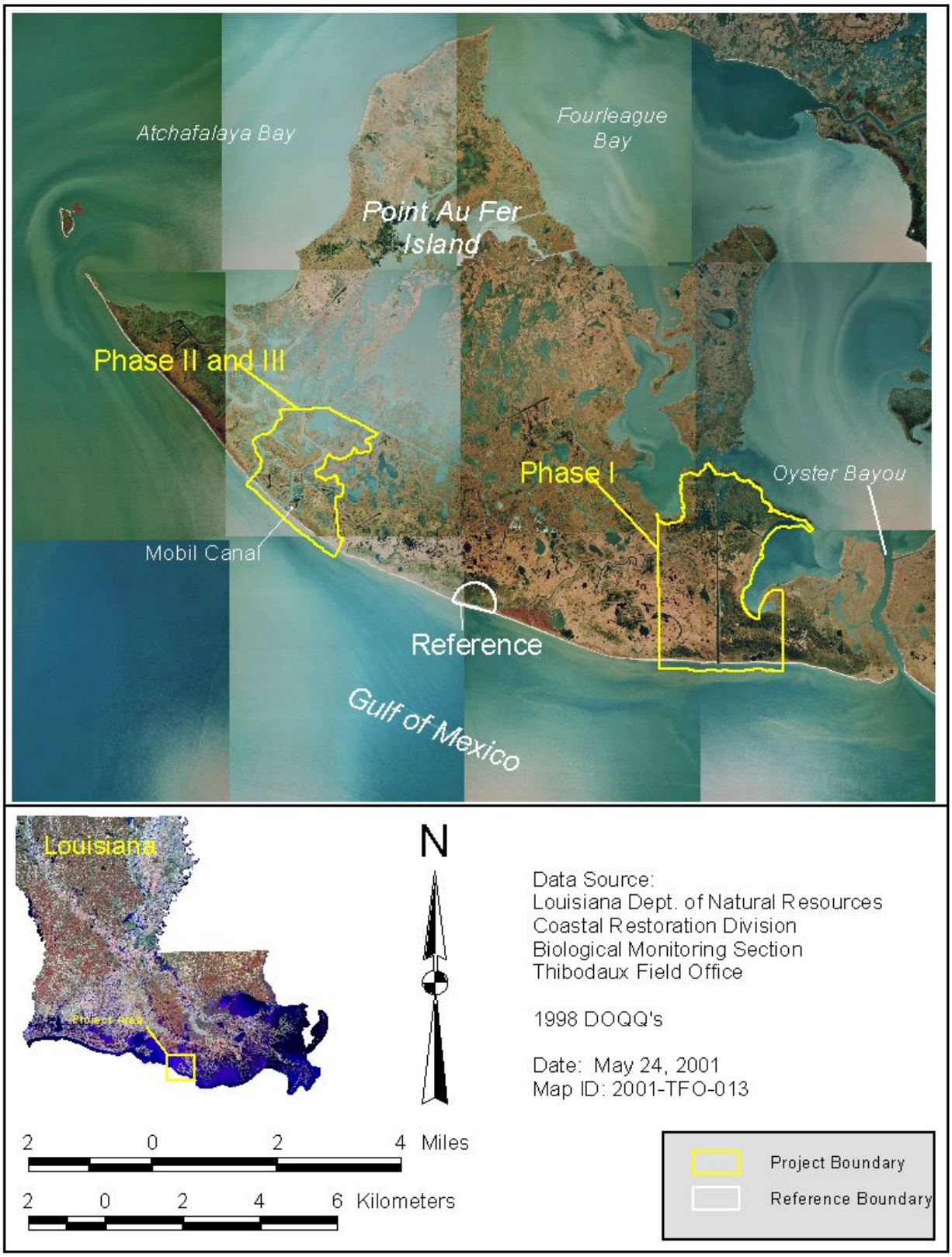

Figure 1. Location and vicinity of the Point Au Fer Island Hydrologic Restoration (TE-22) project.

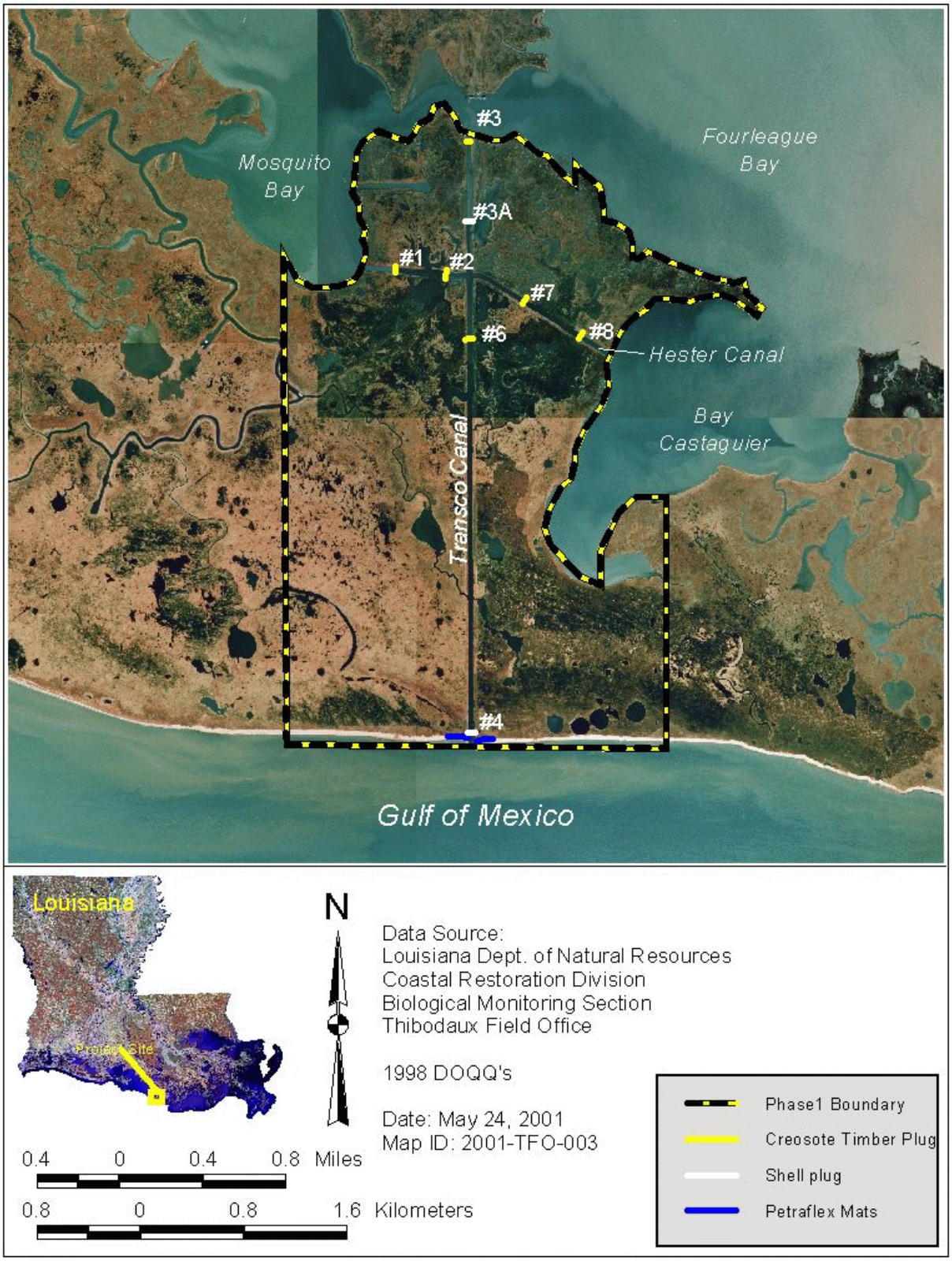

Figure 2. Point Au Fer Island Hydrologic Restoration (TE-22) project - Phase I boundary and project features.

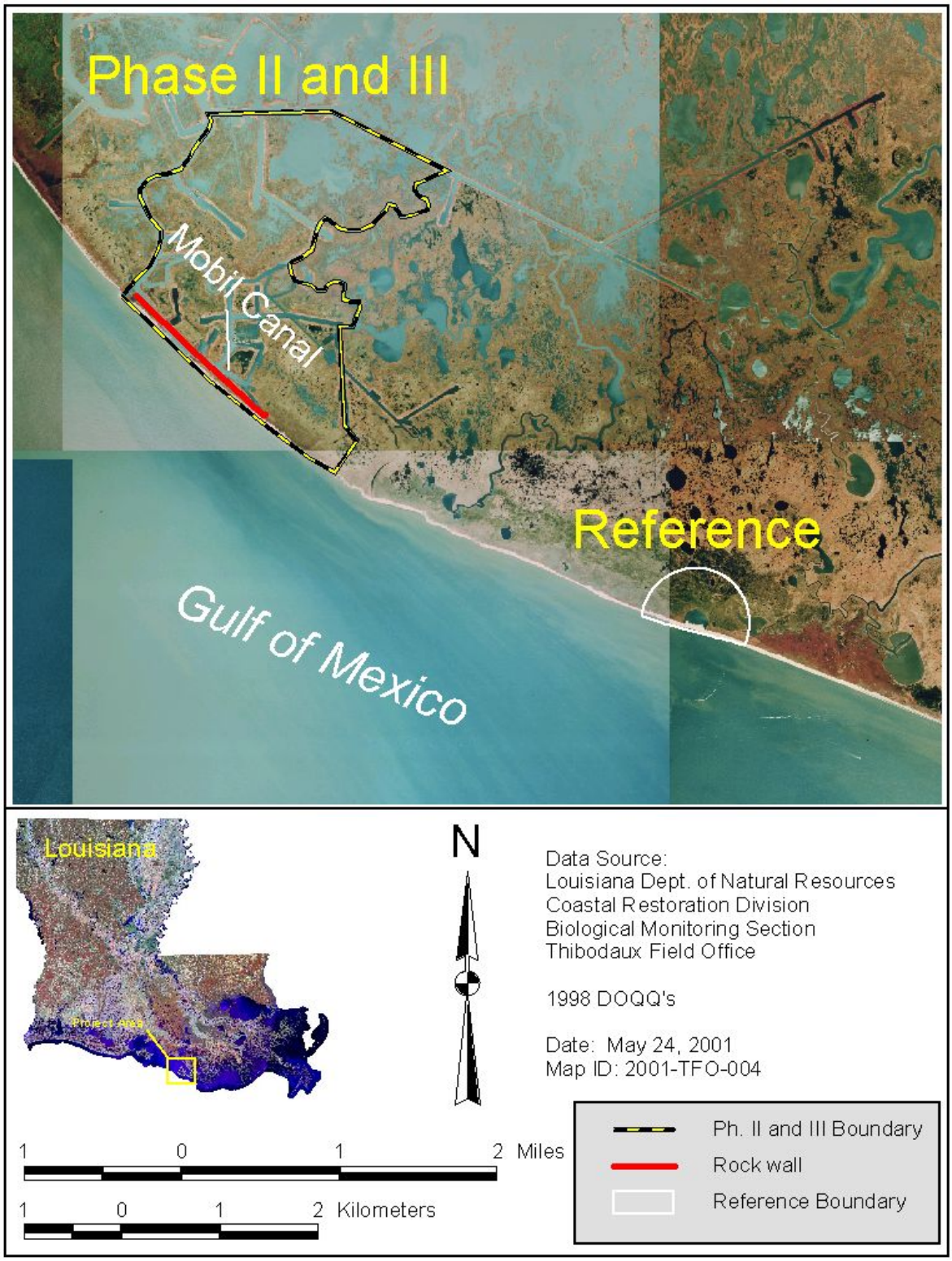

Figure 3. Point Au Fer Island Hydrologic Restoration (TE-22) project - Phase II and III boundary and features, and reference area boundary.

Wetland loss rates have been drastic for years; especially during Louisiana's oil boom from approximately the mid-1950's to the late-1970's, and these losses are both the direct and indirect result of oil and gas access canals (Gagliano 1973, Craig et al. 1979, Scaife et al. 1983, Turner et al. 1983, Deegan et al. 1984). From 1955 to 1978, canals were most likely the cause of 30% - 59% of Louisiana's total coastal wetland loss (0.85%/year) (Turner and Cahoon 1987). By 1978, an area equivalent to 8.7% of Louisiana's wetland area was converted to either a canal or spoil bank (Baumann and Turner 1990). This project area embodies the mechanisms for wetland loss that the above researchers have identified: oil and gas canals extending from the Gulf of Mexico into the northern reaches of the island, continuous spoil banks that impede hydrologic flow, and desirable access to hunting and fishing grounds. Here we report observations of canal width and land/water ratios made during one pre-construction visit (1995) and two post-construction visits (1997 and 2000).

The project objectives of Phase I are to reduce marsh loss and the potential for saltwater intrusion from storm surges and high tides, and restore hydrologic circulation to conditions present before the dredging of the pipeline canals. In Phases II and III, the objective is to reduce the chance of breaching between the Gulf of Mexico and the Mobil pipeline canal during overwash events, thereby reducing the potential for interior marsh loss.

The specific goals established to evaluate the effectiveness of the project are:

1) Reduce the rate of marsh loss (Phase I).

2) Reduce the rate of canal widening (Phase I).

3) Maintain or decrease local shoreline erosion rate within the project area (Phase II and III).

METHODS

Project Features

Phase I - Two canals were designated to be plugged: 1) the Hester Canal which extends east to west, and 2) the Transco Canal which was dredged in a north-south alignment to facilitate the transmission of oil and gas resources from the Gulf of Mexico to on-shore facilities (figure 2). A total of seven plugs were constructed across the two pipelines in late April 1997 - four in Hester Canal and three in the Transco Canal. Of the eight constructed, six were timber canal plugs (figure 4) and two were oyster shell plugs. Each timber canal plug was constructed using creosote treated pilings and lumber that extended across the canal, and the ends were reinforced with oyster shell. These plugs are designated as #1, 2, 3, 6, 7, and 8 (figure 2). Plugs #3A and 4 were constructed using oyster shell underlain with geotextile fabric (figure 5).

Figure 4. Creosote timber plug. One of seven plugs built by LDNR/CRD within the Phase I project area.

Additionally, due to suspected shoreline erosion on either side of the Transco plug (figure 5), a total of 125 Petraflex® articulated concrete mats were added to the southern portion of Phase I during the Phase III construction period. Mats measured 8 ft (2.44 m) wide by 20 ft (6.1 m) long, and were laid perpendicular to the shoreline. Sixty-seven mats were placed west of the plug (536 feet; 163.4 meters) and fifty-eight to the east (464 feet; 141.4 meters).

Figure 5. Shell plug #4 after breaching (lower left) with the Transco plug and the Gulf of Mexico in the background. Photo was taken prior to Phase III construction.

Phase II - The original intent of this phase was to backfill the oil well access canal known as Mobil Canal (figure 3). It was determined to be not economically feasible, therefore, the project was changed to a shoreline protection system (figure 6). In a joint financial effort between the LDNR/CRD, the NMFS, and the Mobil Oil and Exploration Company, approximately 3,600 ft (1,097 m) of 200 pound (90.72 kilogram) class stone underlain with a combination of geo-textile grid, filter cloth, and geo-textile woven fabric were constructed in the Spring of 1997. Construction was completed on May 7, 1997. The structure ranges from 25 ft to 33 ft (7.62 to 10.05 m) wide with an average height of 2.67 ft (0.81 m). There is a section of the shoreline referred to as the "breach area" - located near the eastern edge of the Phase II rock armor (figure 7). Within this area, the stone width was increased to a range of 35 ft to 45 ft (10.67 to 13.72 m), and varied in height from 3 ft to 4 ft (0.914 to 1.22 m), to compensate for the possibility of future breaches.

An additional 388 linear ft (118.26 m) of 250 lb. (113.4 kg) class stone was added to Phase II during the Phase III construction period, specifically from May 11 - 12, 2000. The stone was added to the "breach area" to increase the rock armor elevation another 1 ft to 2 ft (0.31 to 0.61 m).

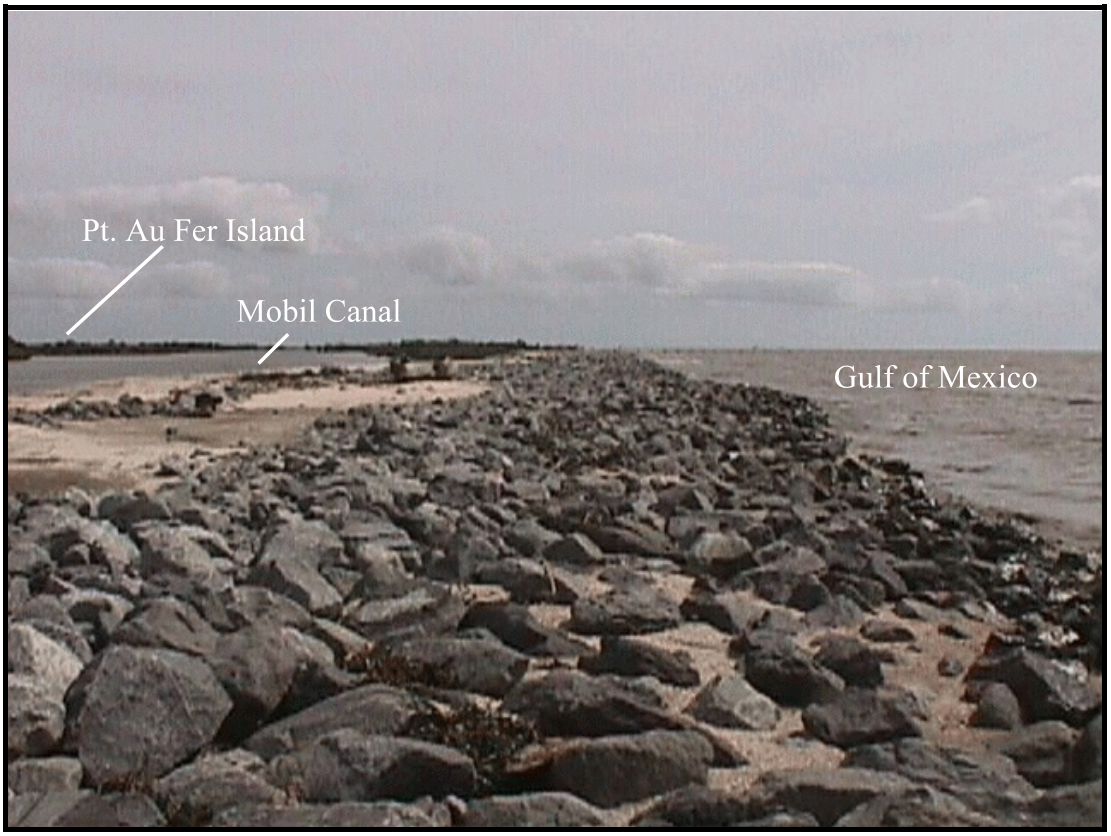

Figure 6. Rock wall armoring the shoreline along the southern portion of Phase II, looking east.

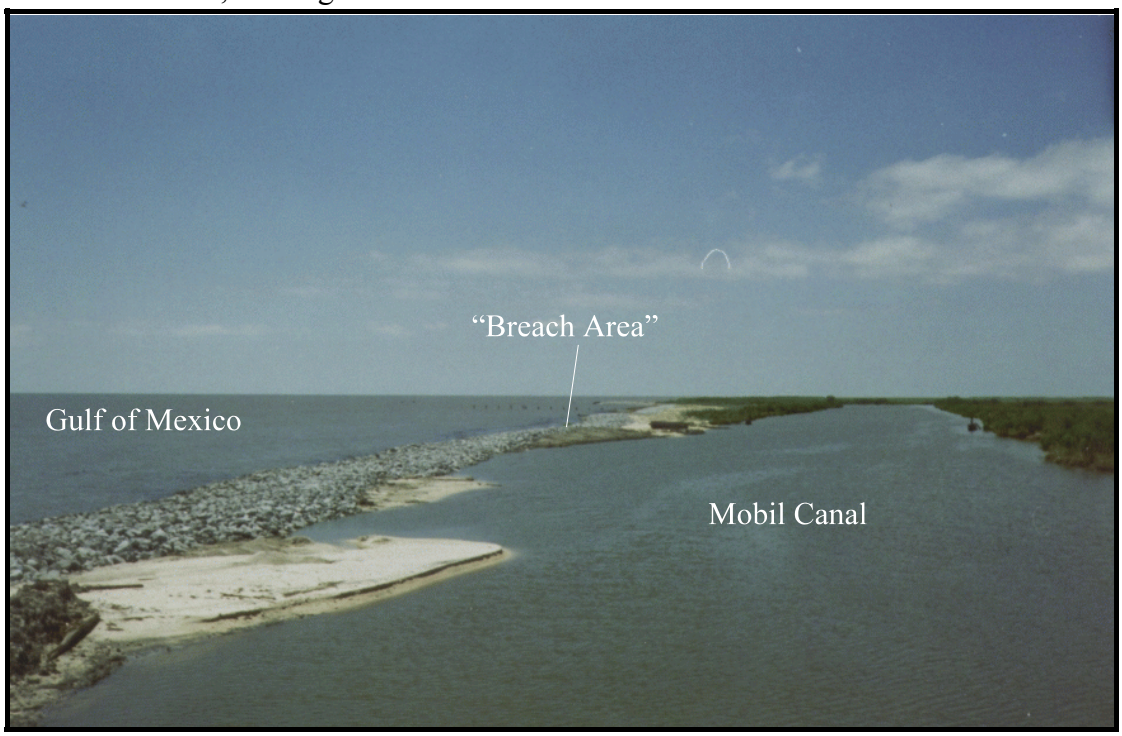

Figure 7. The "breach area" following the placement of rock armor (Phase II construction), looking west.

Phase III - This phase was not included in the original design of the project, but was deemed necessary in 1999 when two possible breaches were identified along the shoreline adjacent to the Mobil Canal (H. Thibodeaux, pers. comm., 2001). Construction of this phase was completed on June 4, 2000 and included extending the rock armor on each end of Phase II. These additions added 3,037 and 625 linear ft (925.68 and 190.5 m) of rock to the eastern and western edges, respectively, and were constructed with 250 lb. (113.4 kg) class stone underlain with woven geo-textile fabric.

Additionally, as mentioned above, the height of the rock in the "breach area" (Phase II) was increased, Petraflex® articulated concrete mats were added near plug #4 (Phase I), and plug #4 was re-built using oyster shell.

Monitoring Design

A detailed description of the monitoring design over the entire project life is outlined by Fugler (1998). Measurable variables chosen to evaluate project effectiveness were land/water analysis and canal width.

Land/water Analysis: To address the goal of reducing the rate of marsh loss in Phase I, the U.S. Geological Survey's National Wetlands Research Center (NWRC) in Lafayette, Louisiana obtained 1:24,000 scale near-vertical color-infrared aerial photography on December 26, 1994 (pre-construction), November 24, 1997, and November 15 and 27, 2000 (post-construction). Although construction was completed in late April 1997, the pre-construction period for land water analyses will be December 26, 1994 to November 24, 1997. All analyses of images taken after November 24, 1997 will be considered post-construction. Upon completion of the flights, the original photography was checked for flight accuracy, color correctness, cloudiness and archived at the NWRC. The duplicate photography was indexed, scanned at 300 pixels per square inch, and georectified using ground control data collected with a global positioning system (GPS) with sub-meter accuracy. The individually georectified frames were assembled to produce a mosaic of the project and reference areas (Figures 8A-C).

Using the ERDAS Imagine® geographic information systems (GIS) remote sensing package, each pixel of the photo-mosaic was analyzed and classified to determine land to open water ratios (Figures 9A-C). All areas characterized by emergent vegetation, wetland forest, or scrub-shrub were classified as land, while open water, aquatic beds, and non-vegetated mud flats were classified as water. A percent accuracy of the classification was performed using GIS software by randomly generating 100 points and distributing them throughout the image. Each point was then identified, labeled, and compared to the original classification. The comparisons yielded 90 pixels classified correctly and 10 incorrectly - a 90 percent accuracy level.

A reference area was chosen to provide comparisons of land loss between the rock-armored shoreline of Phases II and III, and a portion of unarmored shoreline east of the project area, in order to determine project effectiveness. The area was chosen based on its proximity to the Phase II and III area, its direct exposure to the wave action and storm events of the Gulf of Mexico, and the lack of future plans to armor the shoreline.

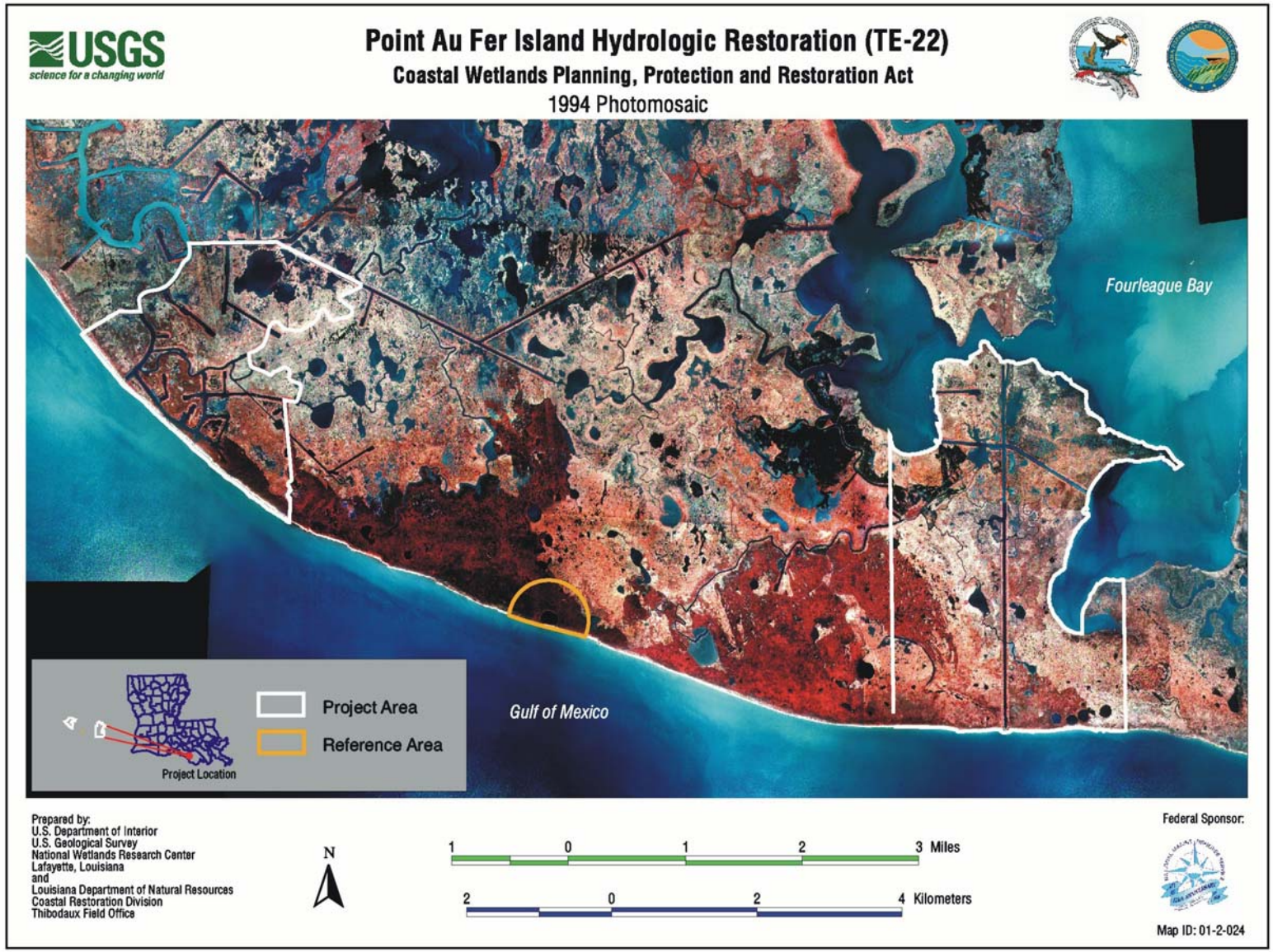

Figure 8A. 1994 photomosaic of the Point Au Fer Island Hydrologic Restoration (TE-22) project using 1:24,000 scale near-vertical color infrared aerial photography.

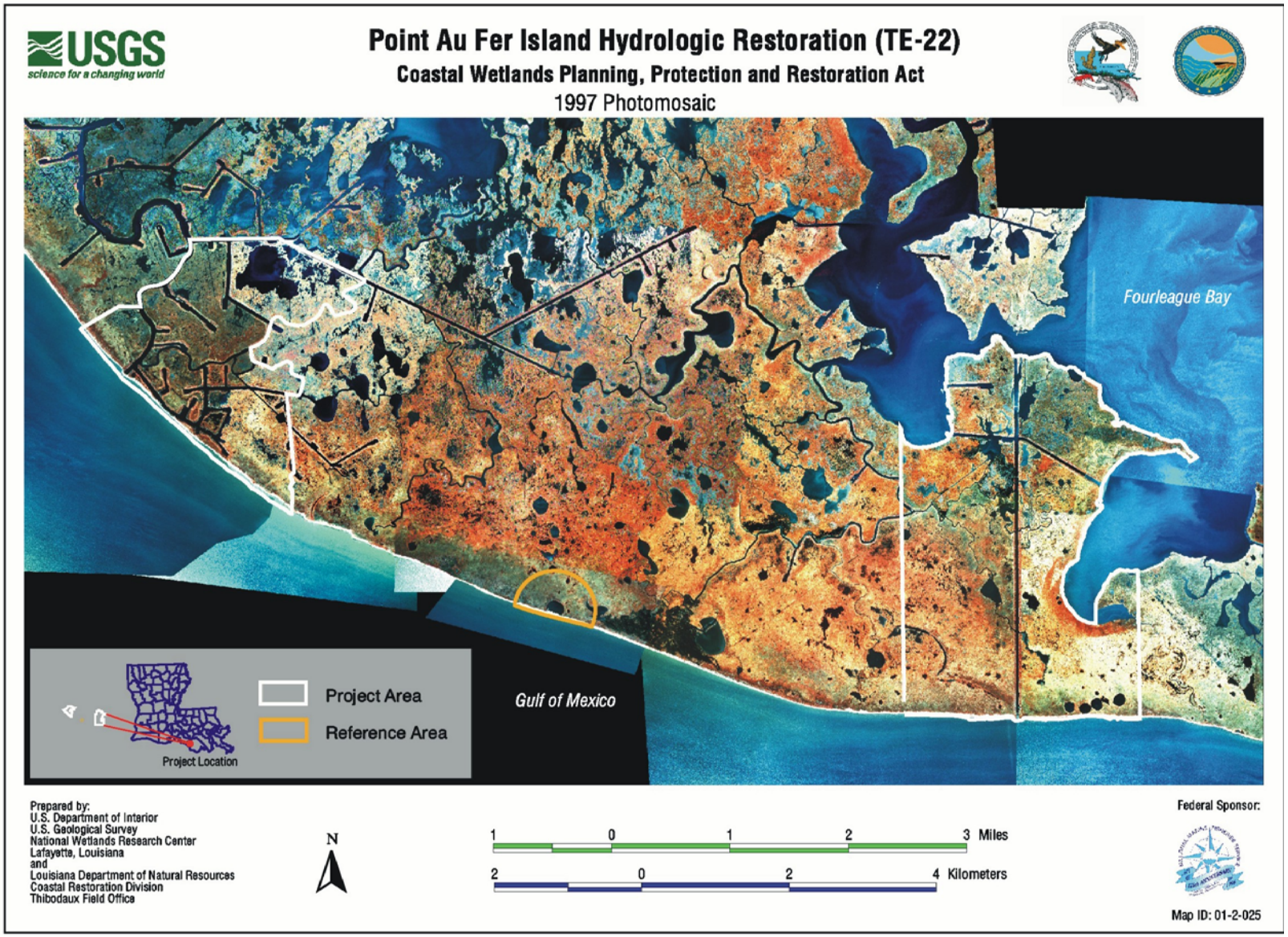

Figure 8B. 1997 photomosaic of the Point Au Fer Island Hydrologic Restoration (TE-22) project using 1:24,000 scale near-vertical color infrared aerial photography.