State of Louisiana
Department of Natural Resources
Coastal Restoration Division

Monitoring Plan

for

Barataria Basin Landbridge Shoreline Protection (Phases 1, 2, and 3)

State Project Number BA-27 and BA-27c
Priority Project List 7, 8, and 9

August 2003
Jefferson and Lafourche Parishes

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LDNR/Coastal Restoration and Management

MONITORING PLAN

PROJECT NO. BA-27 BARATARIA BASIN LANDBRIDGE SHORELINE PROTECTION PROJECT (Phases 1, 2, and 3)

ORIGINAL DATE: October 11, 2001
REVISED DATE: August 14, 2003

Preface

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System (CRMS-*Wetlands*) for CWPPRA, this Monitoring Plan was reviewed to facilitate merging it with CRMS to provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. The implementation plan included review of monitoring efforts on currently constructed projects for opportunities to 1) determine if current monitoring stations could be replaced by CRMS stations, 2) determine if monitoring could be reduced to evaluate only the primary objectives of each project and 3) determine whether monitoring should be reduced or stopped because project success had been demonstrated or unresolved issues compromised our ability to actually evaluate project effectiveness. As a the result of a joint meeting with DNR, USGS, and the federal sponsor, the recommendations for this Monitoring Plan were to maintain it in its current form. Consequently, no changes were made as a result of the CRMS review.

Project Description

The Barataria Basin Landbridge Shoreline Protection Project Phases 1, 2, and 3 (BA-27) was approved under the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) on the seventh, eighth and ninth priority lists, respectively. The project area is located in Jefferson and Lafourche Parishes, Louisiana, along the shoreline/bankline of Bayous Perot and Rigolettes, Little Lake, and Harvey Cutoff (figure 1). This project will provide a total of 76,000-ft (23,165-m) of shoreline protection to this area.

Phase 1 of the project will consist of 14,000-ft (4,267-m) of shoreline protection along the west bank of Bayou Perot and 13,000-ft (3,962-m) along the east/south bank of Bayou Rigolettes. This portion represents about 35% of the total length of the proposed shoreline protection. Phase 2 will include 8,000-ft (2,438-m) along the east bank of Bayou Rigolettes, representing about 10% of the total length of the proposed shoreline protection. Phase 3 of the project consists of 9,000-ft (2,743-m) along the north shore of Little Lake, 11,000-ft (3,353-m) along the west bank of Bayou Perot, 6,000-ft (1,829-m) along the northeast shore of Little Lake, 9,600-ft (2,926-m) along the east bank of Bayou Perot, 2,700-ft (823-m) along the west bank of Harvey Cutoff, and 2,700-ft (823-m) along the east bank of Harvey Cutoff. The southern limits of Phase 3 shoreline protection along Little Lake may be extended during project design. The entire length of each Phase may not be built at once, but instead may be broken into several construction units. There

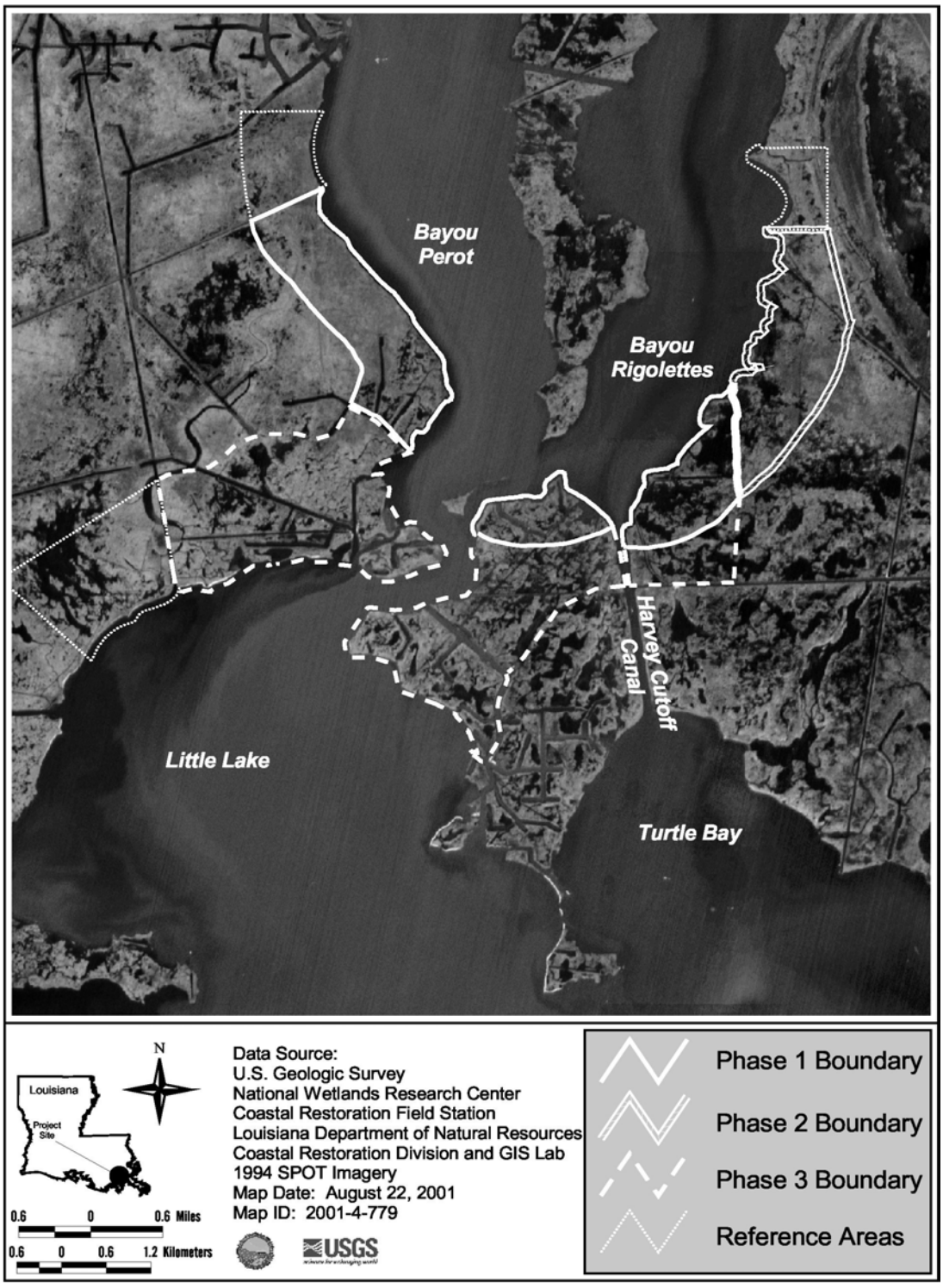

Figure 1. Barataria Basin Landbridge Shoreline Protection (BA-27) project and reference boundaries (Phases 1, 2, and 3).

is a Land Reclamation Agreement for this project which will formalize a compromise between the State and the private landowner(s) pertaining to ownership of lands, water bottoms, and mineral rights. Specific 'boundary' lines will be established upon completion of each construction contract.

The project area is located within the Barataria Basin, which is bounded on the north and east by the Mississippi River, on the west by Bayou Lafourche, and on the south by the Gulf of Mexico. The upper portion of the Barataria Basin is largely a freshwater-dominated system of natural levee ridges, baldcypress - water tupelo swamps, and fresh marsh habitats. The lower portion of the basin is dominated by marine/tidal processes, with barrier islands, saline marsh, brackish marshes, tidal channels, and large bays and lakes. Historically, a small meandering Bayou Perot, and the longer, narrower Bayou Dupont-Bayou Barataria- Bayou Villars channels provided limited hydrologic connection between the upper and lower basin. The hydrologic connections between the upper and lower basin are much greater today due to the Barataria Waterway, Bayou Segnette Waterway, Harvey Cutoff, and substantial erosion and interior marsh loss along and between the now-enlarged Bayou Perot and Bayou Rigolettes. Fortunately, there still exists a landmass, albeit deteriorating, that extends southwest to northeast across the basin, roughly between Lake Salvador and Little Lake. This landmass can be referred to as the 'Barataria Basin Landbridge'. The proposed 76,000-ft of shoreline protection aims to protect the functional integrity of this critical area of the Barataria Basin.

Brackish and intermediate marsh within the project area is dominated by marshhay cordgrass (*Spartina patens*). Other common species in brackish marsh areas include Olney threesquare bulrush (*Scirpus olneyi*), marsh morning glory (*Ipomoea sagittata*), black needle rush (*Juncus roemerianus*), and smooth cordgrass (*Spartina alterniflora*). Other common species in intermediate marsh areas include deer pea (*Vigna luteola*), cattail (*Typha* sp.), Olney threesquare bulrush, marsh morning glory, and wax myrtle (*Myrica cerifera*). Common species of submerged aquatic vegetation include Eurasian water-milfoil (*Myriophyllum spicatum*), coontail (*Ceratophyllum demersum*), wigeongrass (*Ruppia maritima*), water-celery (*Valisineria americana*), and pondweed (*Potamogeton* sp.) Lafitte-Clovelly Association soils, which are generally found in brackish marshes and have very poor drainage, are found throughout the project area.

Major factors contributing to excessive marsh loss in this area include the elimination of overbank flooding of the Mississippi River; closure of Bayou Lafourche at the Mississippi River; dredging of the Gulf Intracoastal Waterway, Barataria Bay Waterway, Harvey Cutoff Canal, and oilfield access channels; physical erosion due to wind, boat-wake, and tidal energy; subsidence; and sea level rise (USDA 2000). Shoreline erosion rates of 114, 103, and 70-ft/yr (34.7, 31.4, and 21.3-m/yr) for the period of 1985-1990 were reported for stations at the southwest bank of Bayou Perot and the east and southeast bank of Bayou Rigolettes, respectively (Swenson and Kinler 1997). Rates of 76, 101, and 97-ft/yr (23.2, 30.8, and 29.6-m/yr) were reported for those same locations for the period of 1990-1995. With no action, the CWPPRA EnvWG (1997, 1998, 1999) forecasted that, over 20 years, 1,870-acres (7.6-km^2) of emergent marsh would be lost in the project area, with 1,560-acres (6.3-km^2) due to shoreline erosion and 310-acres (1.3-km^2) due to interior losses. With the proposed

shoreline protection project, shoreline erosion would be eliminated in the project area, and a loss of only 300-acres (1.2-km^2) of interior emergent marsh would occur. Therefore, this alternative would prevent the loss of 1,570-acres (6.4-km^2) of shoreline and interior emergent marsh.

Reported rates of erosion in the project area and vicinity are highly variable with estimates ranging from 5-ft/yr (1.5-m/yr) to 114-ft/yr (34.7-m/yr) (USDA 2000). Because of these highly variable erosion rates, monitoring the success of this project will be most effective using a stratified design. The project area shoreline will be divided into three groups or 'strata' based on historical shoreline erosion rates (low, moderate, and severe), which will be calculated from recent and historical aerial photography of the area. Each stratum will be assigned a reference area for comparison which shows a similar intensity of shoreline erosion.

Because of the variance in shoreline configuration and substrate within the project area, multiple engineering techniques are being considered. The final engineering design is yet to be selected, but may include a combination of the following techniques: a) foreshore rock dike using a construction technique where the underlying organic substrate is displaced, b) foreshore rock dike using a construction technique which attempts to retain and compact the underlying organic substrate, c) foreshore rock dike with a lightweight core material, d) rock revetment, e) steel sheetpile structure, f) concrete sheetpile structure, and/or g) PVC sheetpile structure. Settlement plates will be installed at regular intervals along each structural type and will be evaluated through LDNR Operations and Maintenance. In March 2001, 400-ft (121.9-m) test structures of four different designs will be built at one location along Bayou Perot and one location along Bayou Rigolettes to determine the most appropriate construction technique. These tests will evaluate the integrity of the structures only, and will not attempt to compare the relative abilities of the structures at protecting the shoreline.

Project construction will involve the dredging of up to 160-acres (0.65-km^2) of bayou bottom for an access channel parallel to the location of the shoreline protection feature. The amount of area dredged will be dependent on the type of construction equipment used, tide conditions, and actual water depth. Where feasible, dredged material shall be placed in the open water between the protection feature and the shoreline, which may result in the creation of some emergent marsh. Where the shoreline protection feature would be located on the existing shoreline, dredge material shall be used to create marsh in oilfield canals or interior ponds. Where such interior features are absent, dredge material shall be placed in the open water of Bayou Perot, Bayou Rigolettes, or Little Lake with the channel being backfilled after construction.

By preventing the loss of 1,570-acres of brackish and intermediate marsh over 20 years, fish and wildlife habitat quality and detrital production in the project area will be much higher with the proposed shoreline protection plan. However, because that alternative will not completely eliminate loss of emergent marsh, there will be a decrease in fish and wildlife habitat quality and detrital production over time, albeit at a much slower rate than with the no action alternative. To allow continued aquatic organism ingress and egress, the following design parameters, as prescribed by NMFS, will be incorporated into the construction plan:

1. In any area where rock revetment would be installed, all historic channels will be left open, but lined with rock to prevent further enlargement.

2. For the east bank of Harvey Cutoff and the east bank of Bayou Rigolettes north of Harvey Cutoff, there will be a minimum of 500 total feet (152.4-m) of opening, with a sill set at least two feet (0.6-m) below average water level, distributed among a minimum of five locations. These openings will be distributed throughout the structure length with exact sizes and locations to be determined based on engineering surveys and associated field observations.

3. There will be approximately six locations where 75-ft (22.8-m) of opening will be incorporated and three locations where 100-ft (30.5-m) of opening will be incorporated. The length of individual openings will vary from 30 to 100-ft (9.1 to 30.5-m). The sill of each opening will be set at least two feet (0.6-m) below average water level.

Additional openings may be incorporated if necessary to allow adequate discharge of surface flow drainage, and active oil and gas canals will be left open.

Project Objective

1. Provide 76,000-ft of shoreline protection to areas along the west and south banks of Bayou Perot, the east and south banks of Bayou Rigolettes, the north and northeast banks of Little Lake, and the east and west banks of Harvey Cutoff in order to reduce or eliminate shoreline/bankline erosion of the area referred to as the 'Barataria Basin Landbridge'.

Specific Goal

The following measurable goal was established to evaluate the above objective:

1. Decrease the mean rate of shoreline/bankline erosion in subsections of the project area stratified according to historical erosion rates along Bayous Perot and Rigolettes, Little Lake, and Harvey Cutoff. This will be accomplished through the use of one or more of the following shoreline protection techniques: a) foreshore rock dike, b) foreshore rock dike with a lightweight core material, c) rock revetment, d) steel sheetpile structure, e) concrete sheetpile structure, and/or f) PVC sheetpile structure.

Reference Areas

Three 5,000-ft (1,524-m) sections of shoreline will be designated as reference areas. These sections will be located along the western side of Bayou Perot, the eastern side of Bayou Rigolettes and the northwestern shore of Little Lake (figure 1). Two randomly placed 500-ft (152-m) subsections within each reference area will be monitored using the same methodology as in the project area. Each strata of the project area will be assigned a reference area for comparison based on the similarity of shoreline erosion rates. Future shoreline projects in the area may necessitate the elimination of one or more of these reference areas.

CRMS will provide a pool of reference sites within the same basin and across the coast to evaluate project effects. At a minimum, every project will benefit from basin-level satellite imagery and land:water analysis every 3 years, and supplemental vegetation data collected through the periodic Chabreck and Linscombe surveys. Other CRMS parameters which may serve as reference include Surface Elevation Table (SET) data, accretion (measured with feldspar), hourly water level and salinity, and vegetation. A number of CRMS stations are available for each habitat type within each hydrologic basin to supplement project-specific reference area limitations.

Monitoring Limitations

Monitoring of the entire project area (76,000-ft of shoreline) is cost prohibitive; therefore, monitoring will be limited to approximately twenty percent of the shoreline behind each construction unit. To achieve the appropriate subsets for monitoring, the total length of each construction unit will be subdivided into 500-ft sections (figure 2). The number of sections randomly chosen for monitoring will be based on twenty percent of the total length of the construction unit rounded up to the nearest 500-ft. If multiple shoreline protection techniques are utilized within a construction unit, sections will be placed so that each technique is monitored.

Monitoring Elements

The following monitoring elements will provide the information necessary to evaluate the specific goal listed above:

1. Aerial Photography — To document long-term shoreline movement, color infrared aerial photography (1:6,000 scale) of the entire project and reference areas will be obtained. However, only a subset of the total acquired frames representing approximately 20% of the entire project and reference area shoreline will be georectified and analyzed with GIS for land/water ratio using standard procedures described in Steyer et al. (1995, revised 2000). Four sets of photography will be obtained: at the start of construction (2002), at the completion of construction (approximately 2005-2008), and beyond that at five year intervals (projected at 2013 and 2018).

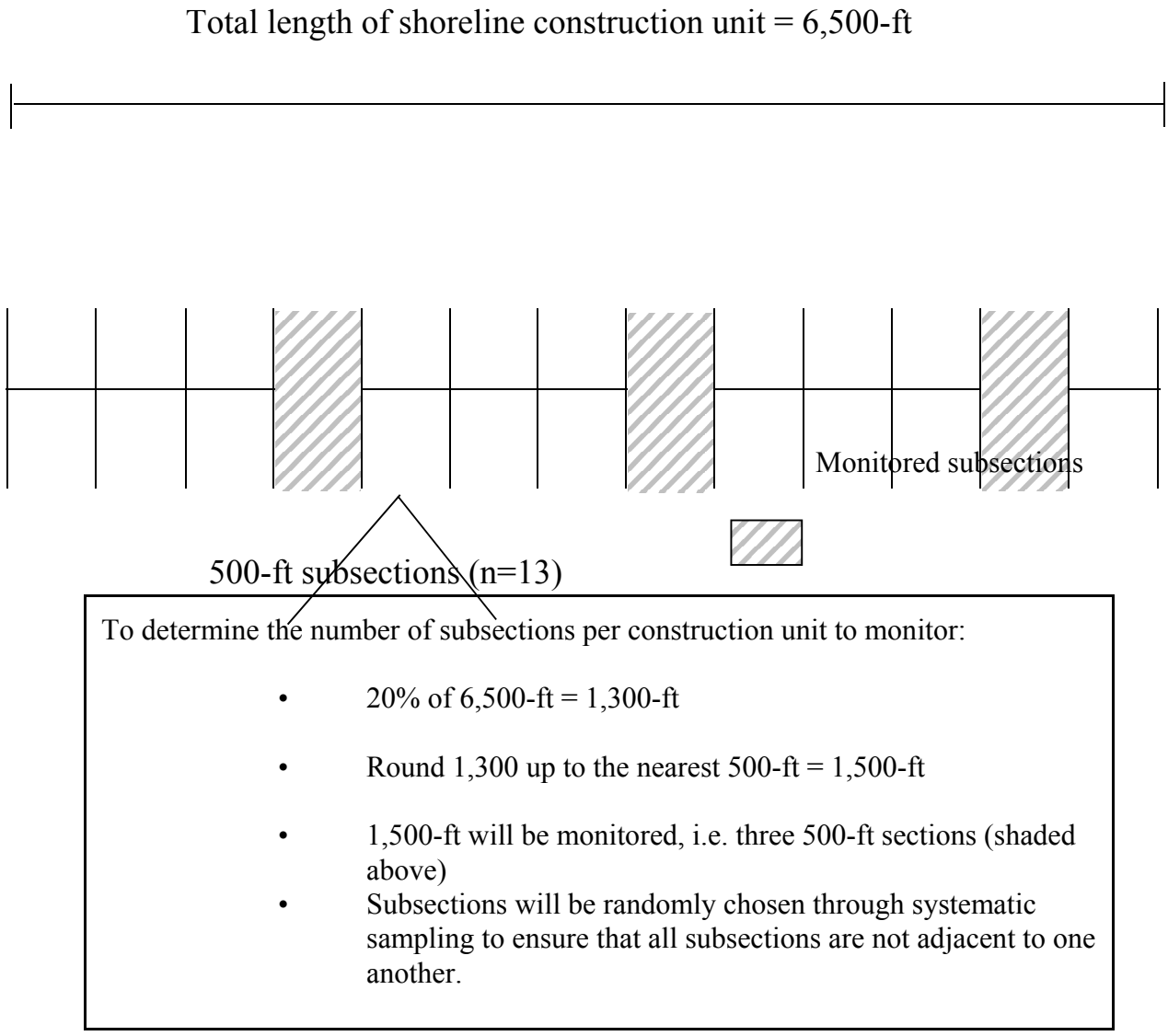

Figure 2. Example of monitoring design showing selection and layout of monitoring subsections for a hypothetical 6,500-ft (1,981-m) shoreline construction unit.

2. Shoreline Survey — To evaluate marsh edge movement behind shoreline protection structures in the project area and in designated reference areas, controlled GPS will be used to map marsh edge position of approximately 20% of the total project area shoreline using techniques described in Steyer et al. (1995, revised 2000). The areas surveyed will be the same as those analyzed for land/water ratio using aerial photography. In locations where dredged material is beneficially placed during construction, the perimeter of the disposal area will be mapped to aid in determining shoreline gain due to the placement of dredge spoil. GPS surveys will be conducted within 60 days after construction to determine "as built" conditions. Post-construction GPS surveys for each construction unit will be conducted in years 3 and 6.

Anticipated Statistical Analyses and Hypotheses

The following hypotheses correspond with the monitoring elements and will be used to evaluate the accomplishment of the project goal.

1. Analysis of Variance (ANOVA), descriptive, and summary statistics will be used to compare measured rates of shoreline movement between stratified subsections in the project area and their respective reference areas, and to compare shoreline changes in the project area from "as built" to subsequent sampling years. Data will be obtained from aerial photography and GPS surveys.

   Goal: To significantly reduce the rate of shoreline/bankline erosion due to wave action along the west and south banks of Bayou Perot, the east and south banks of Bayou Rigolettes, the north and northeast banks of Little Lake, and the east and west banks of Harvey Cutoff through the construction of one or more types of shoreline stabilization structures. *Note*: Some shoreline will be lost due to subsidence and some shoreline will increase due to deposition of dredge spoil from the construction access channel.

   Hypothesis A:

   H_0: Mean post-construction shoreline erosion rate of subsection *x* in the project area at time *i* will not be significantly less than the mean post-construction shoreline erosion rate of reference area *x* at time *i*.

   H_A: Mean post-construction shoreline erosion rate of subsection *x* in the project area at time *i* will be significantly less than the mean post-construction shoreline erosion rate of reference area *x* at time *i*.

Hypothesis B:

H_0: Shoreline erosion rates in the project area at time *j* will not be significantly less than or equal to the shoreline erosion rates at time *i*.

H_A: Shoreline erosion rates in the project area at time *j* will be significantly less than or equal to the shoreline erosion rates at time *i*.

Notes

1.	Implementation:	Start Construction of Phase 1, 2: End Construction of Phase 1, 2:	January 2002
		Start Construction of Phase 3: End Construction of Phase 3:	November 2003
2.	NRCS Point of Contact:	Quin Kinler	225-382-2047
3.	DNR Project Manager:	Ismail Merhi (Phase 1, 2, 3)	225-342-4127
	DNR Monitoring Manager:	Melissa Kay Hymel	504-280-4074

4. The twenty year monitoring plan and implementation budget for this project is $168,650 for Phase 1/Phase 2 and $93,897 for Phase 3. Comprehensive reports on coastal restoration efforts in the Barataria hydrologic basin will be available in 2005, 2008, 2011, 2014, and 2017. These reports will describe the status and effectiveness of the project as well as cumulative effects of restoration projects in the basin.

5. Erosions rates were estimated to be 28 to 114-ft/yr (8.5 to 34.7-m/yr) along the western shoreline of Bayou Perot, and 58 to 70-ft/yr (17.7 to 21.3-m/yr) along the eastern and southern shorelines of Bayou Rigolettes for the period of 1985 to 1990 (Swenson and Kinler 1997).

6. Entire coastal zone flights will be conducted periodically over the project life that will provide aerial photography that can be used in the evaluation of project impacts on the interior marsh. If aerial photography indicates potential interior marsh impacts, further evaluation will be considered.

7. References:

Coastal Wetlands Planning, Protection, and Restoration Act Environmental Work Group 1997. Barataria Landbridge Shoreline Protection Project Phase 1 Project Information Package. 12pp.

Coastal Wetlands Planning, Protection, and Restoration Act Environmental Work Group 1998. Barataria Landbridge Shoreline Protection Project Phase 2 Project Information Package. 13pp.

Coastal Wetlands Planning, Protection, and Restoration Act Environmental Work Group 1999. Barataria Landbridge Shoreline Protection Project Phase 3 Project Information Package. 22pp.

Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller, and E. Swenson 1995, revised 2000. Quality Management Plan for Coastal Wetlands Planning, Protection, and Restoration Act Monitoring Program. Open-file report no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97 pp. plus appendices.

Swenson, E. M. and Q. Kinler 1997. Wind-wave height, wave energy, and shoreline erosion estimates for the Bayou Perot-Bayou Rigolettes area. Unpublished report. 26 pp. plus Appendices.

U.S. Department of Agriculture, Natural Resources Conservation Service 2000. Project Plan and Environmental Assessment for Barataria Basin Landbridge Shoreline Protection Project Phases 1, 2, and 3 (BA-27), Jefferson and Lafourche Parishes, Louisiana. Alexandria, LA: 23pp.