



**State of Louisiana
Department of Natural Resources
Coastal Restoration Division**

Monitoring Plan

for

**GIWW - Perry Ridge West Bank
Stabilization**

State Project Number CS-30
Priority Project List 9

December 2013
Calcasieu Parish

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LDNR/Coastal Restoration and Management

MONITORING PLAN
PROJECT NO. CS-30 (PCS-26ii) PERRY RIDGE WEST
ORIGINAL DATE: October 22, 2002
REVISED DATE: August 14, 2003, December 12, 2013

Preface

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System (CRMS-*Wetlands*) for CWPPRA, updates were made to this Monitoring Plan to merge 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 Perry Ridge West project is a shoreline protection project from the 9th priority list of the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA), comprised of 1,132 acres (458 ha) of fresh and intermediate marsh located in Calcasieu Parish, Louisiana. The project area is bounded to the south by the Gulf Intracoastal Waterway (GIWW) from Perry Ridge west to the Sabine River, and is outlined in figure 1. This area has exhibited tremendous wetland vegetation loss since 1956, as indicated by habitat change analyses conducted by the USGS National Wetlands Research Center (NWRC) in Lafayette, Louisiana and the Louisiana Department of Natural Resources (LDNR) (figure 2). Currently, 489 acres (198 ha) of the 1,132 total acres (458 ha) are classified as emergent marsh and the remaining 643 acres (260 ha) as shallow open water. The estimate of wetland loss during the next 20 yr with no action taken is 385 (156 ha) acres, or 79% of the remaining emergent marsh area.

The GIWW is the dominant hydrologic influence in the project area, the construction of which has caused the area to become a tidal system. The use of double-wide barges, allowed in the section of the GIWW adjacent to the project area, has accelerated wave-induced erosion of the remaining spoil bank and marsh vegetation. The current estimate of the rate of shoreline erosion along the GIWW is 3.9 ft/yr (1.2 m/yr) (U.S. Department of Agriculture, Natural Resources Conservation Service [USDA-NRCS] 1999). Amplification of the effects of meteorological events has occurred as well, as water levels can fluctuate as much as 2 ft (0.7 m) due to strong northerly winds and 10 ft (3 m) during a tropical storm or hurricane. The habitats of primary importance in the project and adjacent

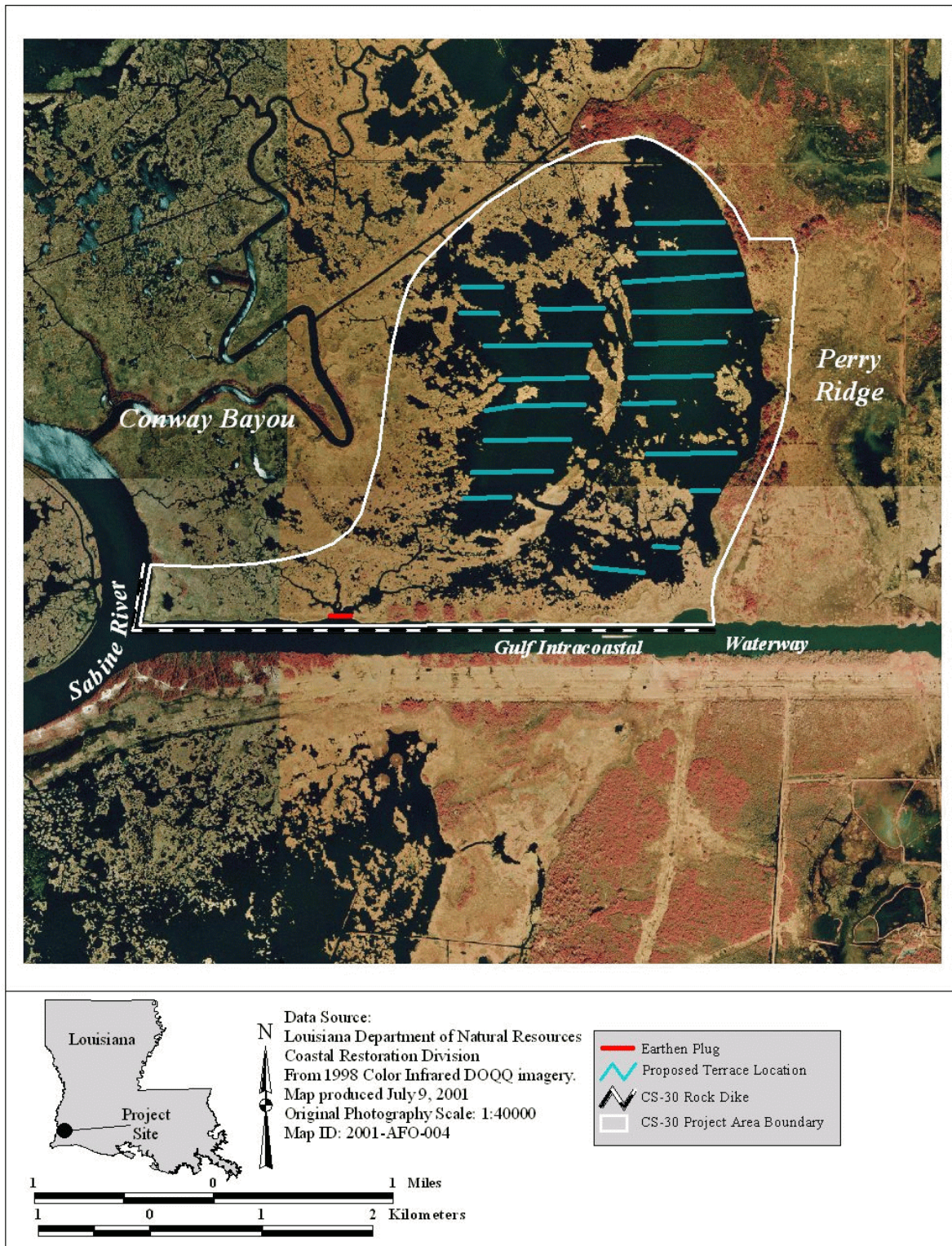
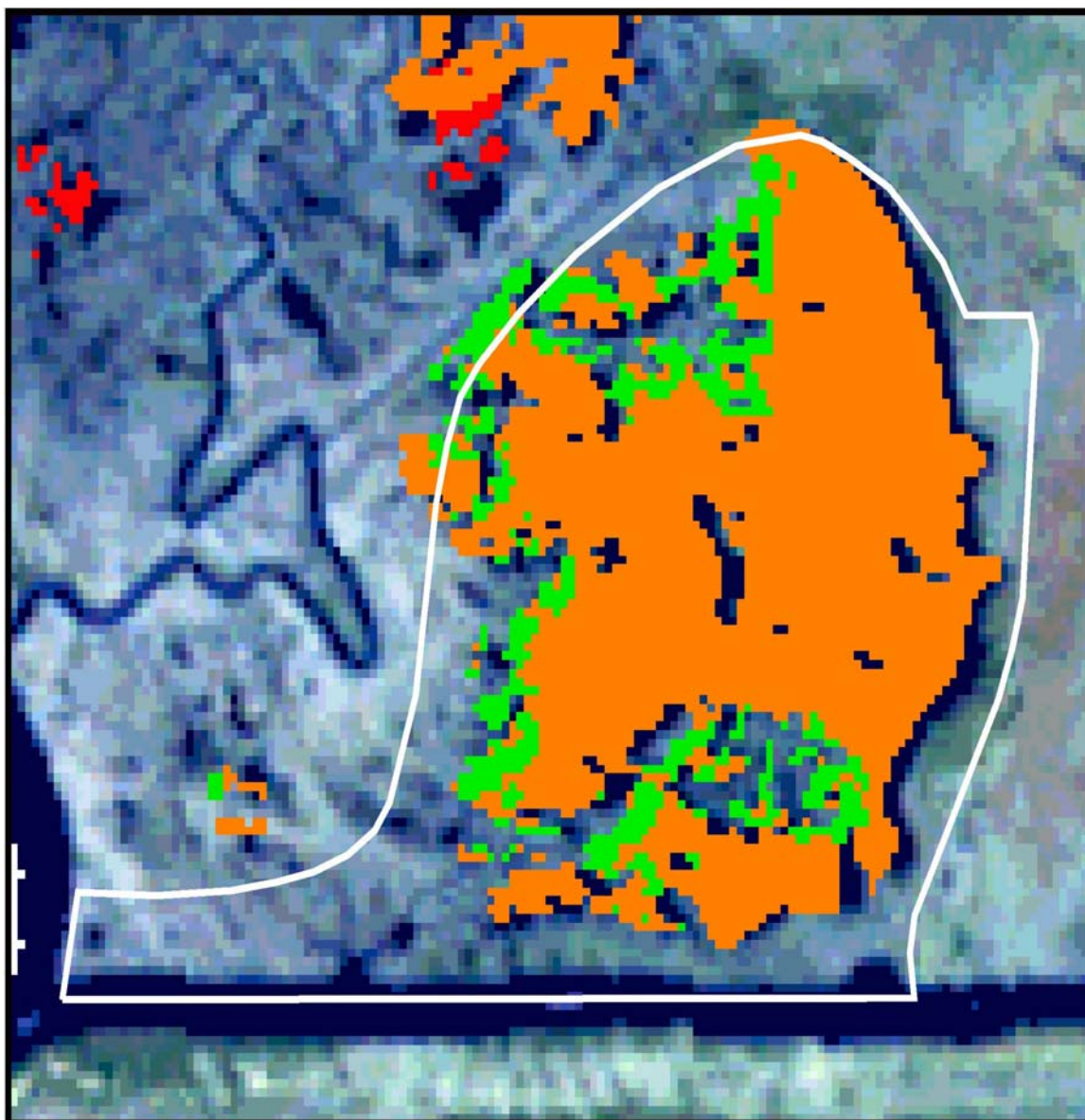


Figure 1. Perry Ridge West project location and features.



1956 - 1990 Loss/Gain Analysis				
Color	Class	Acres	Hectares	Percent
Orange	1956 - 1978 Loss	-659.93	-267.06	48.89
Yellow	1956 - 1978 Gain			
Red	1978 - 1990 Loss	96.22	38.94	48.89
Green	1978 - 1990 Gain			
	Totals	-563.71	-228.13	

Data Source:
 U.S. Geologic Survey
 National Wetlands Research Center
 Coastal Restoration Field Station
 Louisiana Department of Natural Resources
 Coastal Restoration Division and GIS Lab
 1956-1990 Loss/Gain Analysis
 1993 TM Satellite Imagery
 Map Date: September 19, 2001
 Map ID: 2001-4-868



0.2 0 0.2 Miles



USGS
 science for a changing world

Figure 2. Perry Ridge West project land loss/gain analysis for the period 1956-1990.

areas are the GIWW, fresh and intermediate emergent marsh, open water, and scrub-shrub vegetation (Chabreck and Linscombe 1978, 1988; U.S. Department of Agriculture, Soil Conservation Service 1988). Dominant emergent vegetation species present in and adjacent to the project include *Spartina patens* (marshhay cordgrass), *Sagittaria lancifolia* (bulltongue arrowhead), and *Panicum hemitomon* (maidencane). Common submerged aquatic vegetation (SAV) species found within the open water areas of the project include *Potamogeton* spp. (pondweed), *Ruppia maritima* (widgeongrass), and *Myriophyllum spicatum* (spike watermilfoil) (USDA-NRCS 2001). The area in general exhibits a strong maritime character due to the influence of the Gulf of Mexico, the GIWW, and various channels, bayous, and other water bodies. The climate of the Perry Ridge West area and vicinity is characterized as humid subtropical (USDA-NRCS 2000).

A similar project, the Perry Ridge Shoreline Protection project (CS-24 [PCS-26i]), protects 5,945 acres (2,378 ha) of intermediate marsh, pine ridge uplands, and shallow open water directly east of the CS-30 project area (Courville 1998). This CWPPRA project, from the 4th priority project list, was constructed in 1999 and consists of 24,000 linear ft (7,300 m) of free-standing rock dike which parallels the northern bank of the GIWW, approximately 60 ft (18.3 m) from the bank. The CS-24 project was designed as the first half of protection measures employed for the marshes adjacent to Perry Ridge, and a portion of the CS-30 project area served as a reference site in determining the effectiveness of the original rock dike.

Project Goals and Strategies/Coast 2050 Strategies Addressed

CWPPRA projects are reviewed prior to authorization of construction funds for compatibility of project goals with those in Coast 2050 (Louisiana Coastal Wetlands Conservation and Restoration Task Force and Wetlands Conservation and Restoration Authority 1998), and for the probability that proposed restoration strategies will accomplish those goals. Project goals and strategies are provided to LDNR by the sponsoring federal agency through the Environmental Assessment (EA) and/or Wetland Value Assessment (WVA) for the project. The following goals and strategies for the Perry Ridge West project were provided by the USDA-NRCS (1999, 2000).

Project Goals:

- 1) Reduce erosion along the north bank of the GIWW to protect interior marshes
- 2) Create marsh habitat
- 3) Maintain submerged aquatic vegetation (SAV) habitat

Project Strategies:

- 1) Use of hard structures to break wave energy impacting shoreline along GIWW and Sabine River, and repairing a large breach in the spoil bank to eliminate tidal exchange.
- 2) Construction of earthen terraces in open water areas of interior emergent marshes to reduce fetch and wave energy, retain sediments, and maintain SAV habitat.

- 3) Use of vegetative planting to stabilize terraces and increase emergent marsh vegetative cover.

These project goals are consistent with the Coast 2050 common strategy of stabilizing major navigation channels and the region 4 specific strategy of stabilizing the GIWW from east of Perry Ridge to the Texas state line (Balkum 2000). Terracing is an important common strategy of the Coast 2050 plan that will be used and evaluated in this project. The retention of sediments by the constructed terraces should “assure vertical accumulation to achieve sustainability”, which is one of the strategic goals of Coast 2050. Sustained SAV growth, due to the reduction of turbidity, should improve system linkages, another important strategic goal of the Coast 2050 plan (Balkum 2000).

Project Features

This project will protect the shoreline of the project area through the use of 12,000 linear ft (3,660 m) of free-standing rock dike which will run parallel to the existing shoreline approximately 60 ft (18.3 m) from the bank. The length of the rock dike includes 9,500 linear ft (2,900 m) along the north bank of the GIWW and an additional 2,500 ft (760 m) north along the Sabine River. The settled height of rock dike will be 4 ft (1.2 m) North American Vertical Datum of 1988 (NAVD88) with settlement plates installed along the entire length of the rock dike at 1,000 ft (305 m) intervals. The addition of an earthen plug, approximately 350 ft (107 m) in length, will serve to close a breach in the existing spoil bank of the GIWW adjacent to the project, thereby reducing water exchange and the subsequent tidal influence of the GIWW on the project area.

The project includes additional features that would classify it not only as a shoreline protection project but also a vegetative planting and terracing project (figure 1). A total of 22,952 linear ft (6,996 m) of shallow water terraces with a 4 ft (1.2 m) minimum top width, at a settled elevation of 2.5 ft (0.7 m) (NAVD88), will be constructed in open water areas in the interior emergent marsh. The target settled elevation of the terraces was derived from the average marsh elevation in the surrounding project area (Guidry 2002). Final length, acreage, and settled height of the constructed rock dike and terraces will be documented by the LDNR Coastal Restoration Division (CRD) Engineering Section with their Construction Completion Report and subsequent Operations and Maintenance (O&M) to ensure that project strategies 1 and 2, as well as their ability to meet Coast 2050 strategy expectations, have been met. Terrace elevation is especially critical to project success as the creation of wetland habitat is the desired outcome of construction and not upland or subaqueous structures. After construction, 9,400 trade-gallon size containers of *Schoenoplectus californicus* (California bullwhip) will be planted along the perimeter of the constructed terraces at an elevation of 0.1 ft (0.03 m) NAVD88, as stated in project design drawings provided by the federal sponsor.

Monitoring Goals

Priorities:

The Perry Ridge West project is classified as a shoreline protection project. However, the environmental assessment and other documentation state that the project is also expected to create marsh directly, through the construction of the terraces, and indirectly as a result of sediment retention by the terraces. Maintaining the frequency of occurrence of SAV within the shallow open water areas of the project is also a focus. This presents the problem of having insufficient resources for an evaluation of all anticipated project benefits. Therefore, monitoring efforts will focus on evaluating project effects on land/water ratios and SAV. Analysis of land/water ratios in the project and reference areas will be used to determine direct and indirect effects of the constructed terraces on marsh acreage. The shoreline protection component of the project will be monitored using aerial photography collected for the analysis. Direct shoreline measurements will be collected on the adjacent CS-24 project area, designed as the first half of a two-project shoreline protection strategy for the Perry Ridge wetlands, which is affected by similar hydrologic conditions. Shoreline monitoring stations, situated on the GIWW spoilbank at 1000 ft intervals, are currently monitored every 3 yr to detect shoreline changes present in the CS-24 project area. Vegetative plantings, marsh vegetation on constructed terraces, and structural integrity of the rock dike and terraces will be monitored via visual inspections by the Engineering Section of CRD during O&M surveys and by CRD Monitoring personnel during SAV sampling. Any variation from expected results will be documented and evaluated.

Specific Monitoring Goals:

- 1) Determine any direct (i.e. creation of land due to terrace construction) and/or indirect changes in land/water ratios in the project area north of the GIWW
- 2) Determine changes in the frequency of occurrence of SAV within the shallow water areas of the project and reference areas
- 3) Detect the presence and magnitude of erosion of the northern shore of the GIWW along the southern project boundary

Reference Area:

Monitoring of both project and reference areas provides a means to achieve statistically valid comparisons, and is the most effective means of evaluating project impacts. In order to evaluate terrace effectiveness over time, a reference area will be monitored simultaneously with the project. Data collected will be used to make statistically valid comparisons of the frequency of occurrence of submerged aquatic vegetation in shallow open water areas with and without the terrace component of the project. Similarities in vegetative community, soil type, hydrology, proximity to the project area, and the amount and type of boat traffic on the GIWW were the criteria used in selecting this reference area.

The only area with similar features to the project area useful in evaluating terrace effectiveness lies within the existing CS-24 project. The other areas that could be considered for a reference area along the GIWW do not have the same soil type and are not affected by similar hydrologic influences, specifically the GIWW and Sabine River. The reference area occurs east of Perry Ridge, within the large open water areas in the CS-24 project area. This area is subject to the same amount of boat traffic, similar vegetation and soil types, and a similar ratio of open water to vegetated marsh as the project area. The presence of a rock dike for shoreline protection, when constructed in the project area, will characterize both areas. This similarity will allow for evaluating the effects of the terracing component of the project.

No appropriate reference area could be established for the shoreline protection element of the project. The only area with similar features to the project area useful in evaluating the effectiveness of the rock dike for shoreline protection occurs in the CS-24 project area, which has already been protected.

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 sampling. A number of CRMS stations are available for each habitat type within each hydrologic basin to supplement project-specific reference area limitations.

Monitoring Strategies

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

1. Aerial Photography In order to evaluate shoreline movement and the extent of interior emergent marsh creation (direct and indirect) in both the project and reference areas, near-vertical, color-infrared aerial photography (1:12,000 scale) will be obtained once prior to construction in 2001, and in post-construction years 2005, and 2010. The photography will be georectified using standard operating procedures described in Steyer et al. (1995, revised 2000), and shoreline position and land/water ratios will be determined.
2. Submerged Aquatic Vegetation (SAV) To evaluate the effects of earthen terraces on SAV habitat, a modification of the rake method (Chabreck and Hoffpauir 1962) will be used to estimate SAV occurrence. The project and reference areas will each be monitored along 6 transects divided equally among 3 representative shallow ponds (Figure 3). Each transect will have a minimum of 25 sampling stations and will be oriented toward the

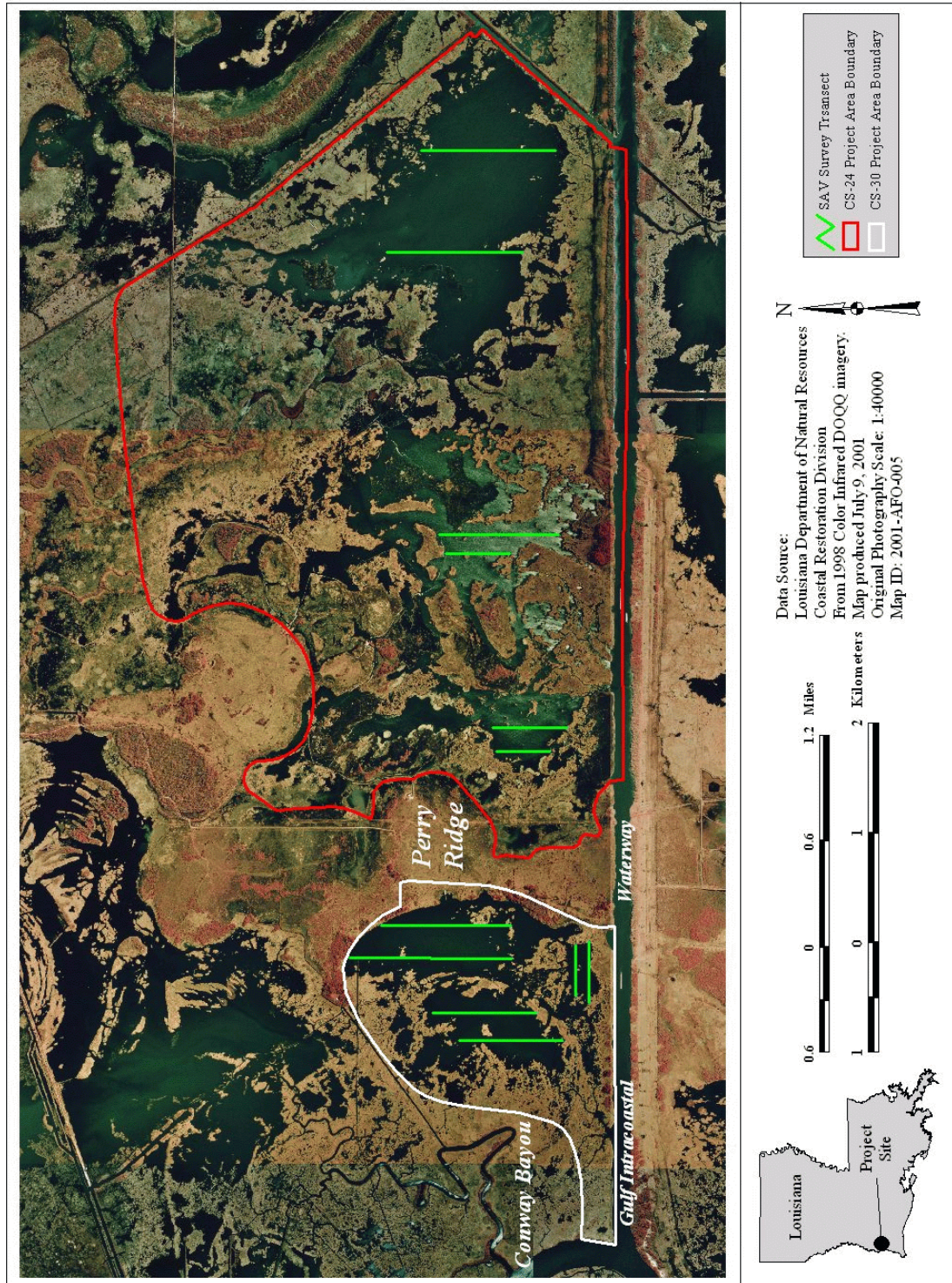


Figure 3. Representation of SAV sampling transects for the Perry Ridge West project and reference areas. Actual transects will be oriented toward the prevailing wind..

prevailing wind. At each station, aquatic vegetation will be sampled by dragging a garden rake on the pond bottom for about 1 second. The presence of vegetation will be recorded to determine the frequency of aquatic plant occurrence (frequency = number of occurrences/number of stations x 100). When vegetation is present, the species present will be recorded in order to determine the frequencies of individual species (Nyman and Chabreck 1996). SAV abundance will be sampled in 2000 (pre-construction), and in 2003, 2005, 2007, 2010, 2015, and 2020.

3. Additional Data Concurrent with SAV sampling, photographs will be taken of constructed terraces and associated vegetation, rock dike, and possible sedimentation behind the rock dike.

Anticipated Statistical Analyses and Hypotheses

The following describes hypotheses and associated statistical tests, if applicable, used to evaluate each of the specific goals and thus the effectiveness of the project. The numbers to the left correspond to the monitoring elements described above. These are followed by statements of the project goals, and the hypotheses that will be used in the evaluation.

1. Aerial Photography: Descriptive and summary statistics on historical data (for 1956, 1978, and 1988) and data from color-infrared aerial photography collected pre- and post-construction will be used to 1) evaluate land/water ratios and changes in the rate of marsh loss/gain in the project area, and 2) compare with that in the CS-24 interior marsh which serves as a reference for the terracing portion of this project. In addition, GIS interpretations of the historical data and pre- and post-construction aerial photography will be used for evaluating long-term movement of the project area shoreline along the GIWW.

Goals: Increase land/water ratio in the project area north of the GIWW

Reduce erosion of the northern shore of the GIWW along the southern boundary of the project

2. Submerged Aquatic Vegetation: To determine the project effects on SAV, an Analysis of Variance (ANOVA) will be used to compare % occurrence between project and reference over the 5 sampling periods. The project will be assumed to have impacted SAV if % occurrence changes differently in project and reference areas as indicated by a significant interaction (Ott 1993). Should the null hypothesis not be rejected, the possibility of negative effects will be explored.

Goal: Maintain frequency of occurrence of SAV in shallow open water in the project area.

Hypothesis 1:

H₀: Mean % occurrence of SAV in the project area will not be significantly greater than that in the reference area post-construction.

H_a: Mean % occurrence of SAV in the project area will be significantly greater than that in the reference area post-construction.

Hypothesis 2:

H₀: Mean % occurrence of SAV in the project area after project implementation will be significantly different than before project implementation.

H_a: Mean % occurrence of SAV in the project area after project implementation will not be significantly different than before project implementation.

Notes

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|----|---|---------------------|-------------------|
| 1. | Proposed Implementation: | Start Construction: | November 12, 2001 |
| | | End Construction: | July 31, 2002 |
| 2. | NRCS Point of Contact: | Dexter Sapp | (318) 473-7688 |
| 3. | DNR Project Manager: | Ismail Merhi | (225) 342-4127 |
| | DNR Monitoring Manager: | Mark Mouledous | (337) 482-0661 |
| | DNR RTS Manager: | Kyle Balkum | (225) 342-9429 |
| 4. | The twenty year monitoring plan development and implementation budget for this project is \$94,167. Periodic comprehensive reports on coastal restoration efforts in the Calcasieu-Sabine hydrologic basin will describe the status and effectiveness of the project as well as cumulative effects of restoration projects in the basin. | | |
| 5. | The marsh to open water ratio in the CS-30 project area will be compared with GIS interpretations of the pre- and post-construction aerial photography taken (at 1:24,000 scale) for the Perry Ridge Shore Protection (CS-24) project which exhibits similar shoreline protection mechanisms without terraces. GIS interpretations of these data sets, and of historical data sets available in digitized format for 1956, 1978, 1988, and for any subsequent years that become available during the life of this project, will be used in the analysis to document changes in the marsh to open water ratio within the CS-30 project area. | | |

6. References:

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