



State of Louisiana

**Coastal Protection and Restoration Authority of
Louisiana**

Monitoring Plan 2012

for

East Sabine Lake Hydrologic Restoration (CS-32)

State Project Number CS-32
Priority Project List 10



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Cameron Parish

Prepared by:

Thomas E. McGinnis
Operations Division
Lafayette Regional Office
635 Cajundome Boulevard
Lafayette, LA 70506

MONITORING PLAN

EAST SABINE LAKE HYDROLOGIC RESTORATION (CS-32)

ORIGINAL DATE: July 3, 2003

REVISED DATES: November 4, 2003; March 23, 2004; March 25, 2009; October 19, 2012

Project Description

The East Sabine Lake Hydrologic Restoration (CS-32) project area, federally cosponsored by U.S. Fish and Wildlife Service and USDA National Resource Conservation Service, is portioned throughout the Sabine National Wildlife Refuge (NWR) in southwestern Cameron Parish, Louisiana, which is bounded on the west by the east shoreline of Sabine Lake, on the north by the approximate northern boundary of Sabine NWR, on the east by the Burton-Sutton Canal, and on the south by Starks South Canal (figure 1). The project area is comprised of approximately 6,370 acres (2,579 ha) of primarily intermediate and brackish marsh (Chabreck and Linscombe 1978, 1988, 1997), the latter generally located along the shoreline of Sabine Lake and extending inland for 1 to 2 miles (1.6 to 3.2 km). Approximately 66% of the project area is now shallow open water habitat. The overall objectives of this project are to protect and restore intermediate and brackish marsh habitat within the project area (Balkum et al. 2003; Clark and Mazourek 2004).

Land loss within the project area has been attributed to saltwater intrusion from Sabine Lake and Calcasieu Ship Channel via Black Bayou, Green's Bayou, Willow Bayou, the Gulf Intracoastal Waterway (GIWW), and the construction of oilfield and boundary/drainage canals (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2002). The average land loss rate for the project area from 1983 to 1990 has been estimated at 0.2% per year (Dunbar et al. 1992) (figure 2). Coast 2050 analysis predicted continued land loss within the project area and identified Sabine Lake shoreline erosion, interior marsh loss along the edges of open water areas, and altered hydrologic regimes as the primary causes (Louisiana Coastal Wetlands Conservation and Restoration Task Force and the Wetlands Conservation and Restoration Authority [LCWCRTF & WCRA] 1999).

The East Sabine Lake Hydrologic Restoration (CS-32) project intends to address these causes of land loss by controlling channel-induced saltwater intrusion and water level fluctuations, by creating marsh in shallow open water areas, and by reducing and/or stopping erosion at a critical reach along the eastern Sabine Lake shoreline. These proposed approaches are consistent with the Coast-wide Common Strategies and Regional Ecosystem Strategies identified in Coast 2050 (LCWCRTF & WCRA 1998). The CS-32 project is from Project Priority List 10 of the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) and is federally co-sponsored by the US Fish and Wildlife Service and USDA – Natural Resource Conservation Service.

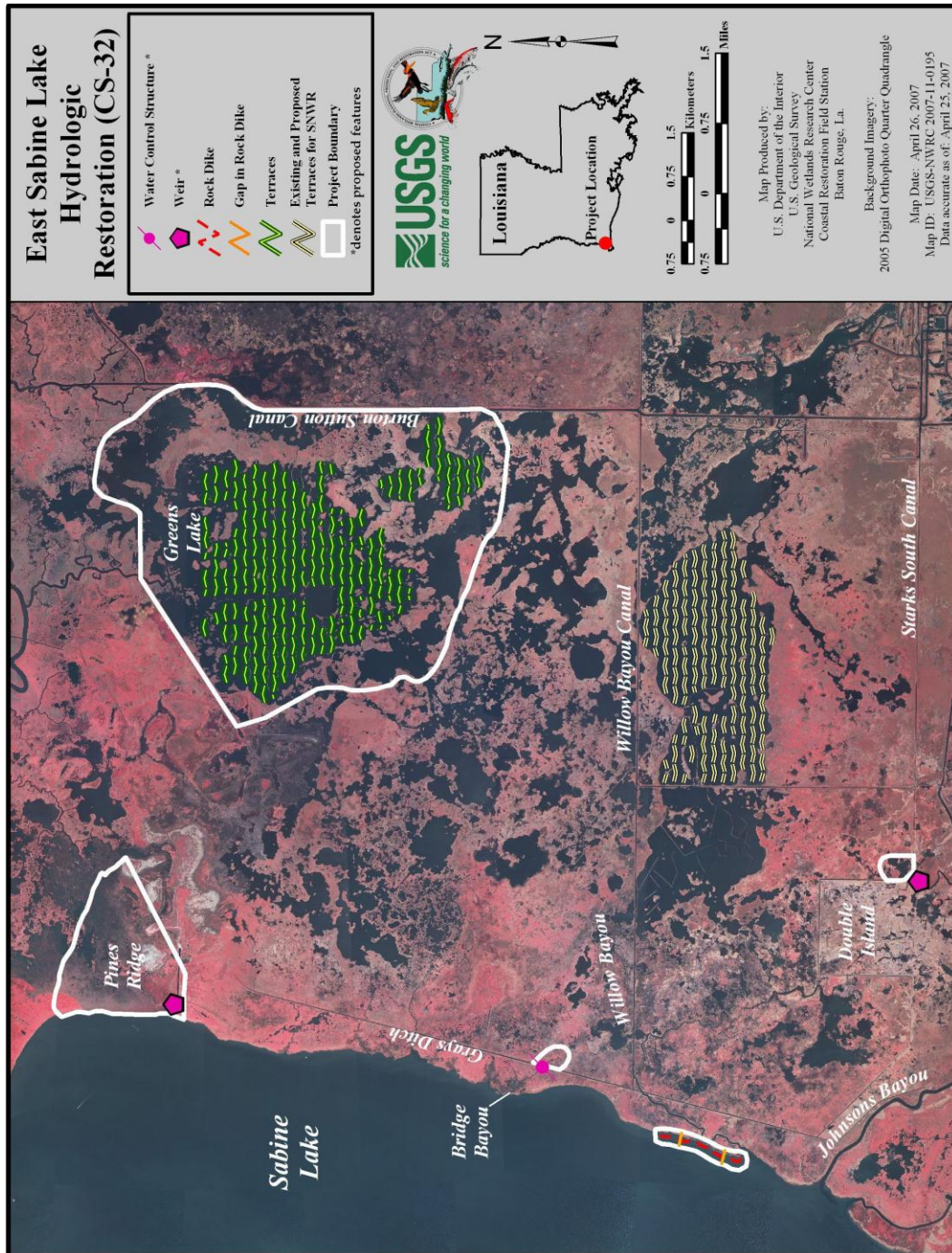


Figure 1. East Sabine Hydrologic Restoration (CS-32) project area showing project boundary and project features.

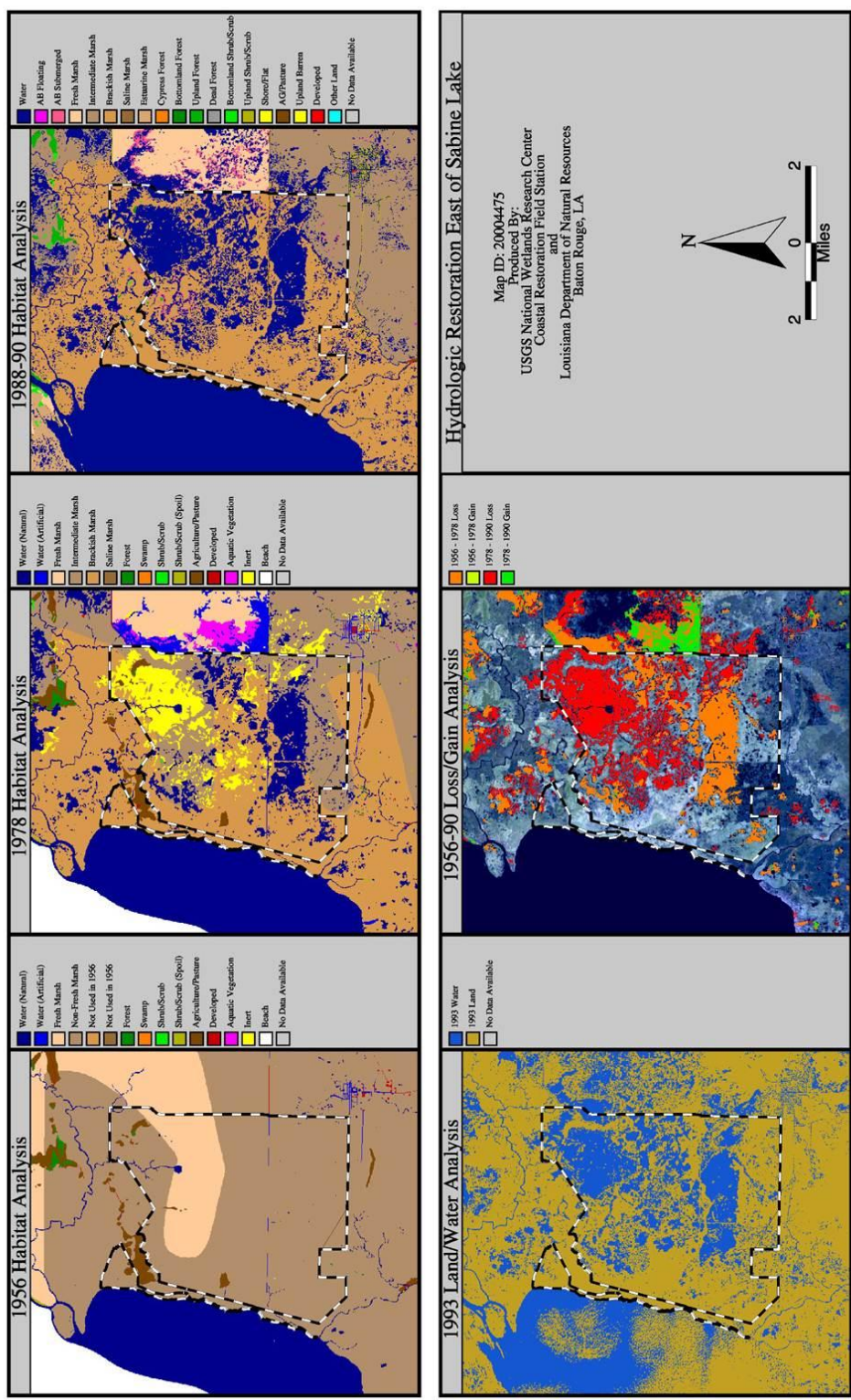


Figure2. Land loss in the project area from 1956 to 1990.

Project Goals and Strategies

Project Goals:

1. Reduce excessive elevated water salinity within portions of project area (Double Island Gully, Pines Ridge, and Greens Lake).
2. Reduce water level variability within portions of project area (Double Island Gully and Pines Ridge).
3. Stop erosion of a 3,000 ft length of Sabine Lake shoreline northward from Willow Bayou to prevent breach of Sabine Lake into Willow Bayou.
4. Create 127 acres (51.3 ha) of emergent marsh in shallow open water areas by the end of the 20-year project life.
5. Increase fisheries and estuarine organism access to the western portion of Sabine NWR.

Project Strategy:

1. Reduce salinity and water level variability through the construction of a rock weir at 1 ft below average water elevation (or 0.0 ft NAVD 88) in Pine Ridge Bayou at the intersection of an east-west oil and gas canal that connects Pine Ridge Bayou to Sabine Lake.
2. Reduce salinity and water level variability through the construction of a rock weir at 1 ft below average water elevation (or 0.0 feet NAVD 88) at Double Island Gully in the southeastern portion of Section 16 and Starks South Canal.
3. Stop Sabine Lake shoreline erosion through the construction of a 3,000 linear ft foreshore rock dike (3 ft NAVD 88 in elevation) north of the mouth of Willow Bayou at Sabine Lake.
4. Create 127 acres (51.3 ha) of emergent marsh and reduce area salinity through the construction of approximately 221,000 linear feet (69,062 m) of vegetated earthen terraces (15 ft wide crowns; 40 ft bases; 2 ft NAVD 88 elevation) in open water areas north and south of Green's Lake.
5. Increase opportunity for fisheries and estuarine organism access into the western portion of Sabine NWR and restore Bridge Bayou's hydrologic integrity through the installation of three 24-inch diameter culverts with stop logs and flapgates at the intersection of Bridge Bayou, the cattle walkway, and Grey's Ditch.

Project Features

Originally, features of the East Sabine Lake Hydrologic Restoration project were subdivided into two construction units (CU 1 and CU 2) which were to proceed independently toward construction authorization as planning and engineering warranted; however, CU 2 features were deleted from the project in 2006 because the hydrologic model indicated that those features would not significantly reduce salinities in the project area. CU 1 project features include:

- (1) a 40-ft wide, low-level (0.0 ft, NAVD88) rock weir in Pines Ridge Bayou was constructed in 2005 to attenuate water fluctuations from Sabine Lake.
- (2) 3000 linear feet, rock, dike along Sabine Lake shoreline north of the mouth of Willow Bayou was constructed in 2005 to prevent erosion and was segmented to allow for fish and wildlife access in 2007.
- (3) a low-level (0.0 ft, NAVD88) rock weir at the opening near the SE Section 16 and Starks South Canal was constructed in 2005, but it was removed by the Cameron Parish Drainage District in 2010.
- (4) approximately 221,000 feet of vegetated earthen terraces in large, shallow, open-water areas north and south of Green's Lake were constructed from 2005-2009 to increase marsh acreage, disrupt wind fetch waves, improve water quality, and reduce erosion of surrounding shorelines.
- (5) three, 24-inch diameter culverts with sluice gates in Bridge Bayou at Grey's Ditch were constructed in 2005 to improve fish and wildlife access.

The final length, acreage, and settled height of the rock dike and earthen terraces were documented by the CPRA Engineering Section in the Construction Completion Report and subsequent Operations and Maintenance (O&M) Reports to ensure that project features were achieved.

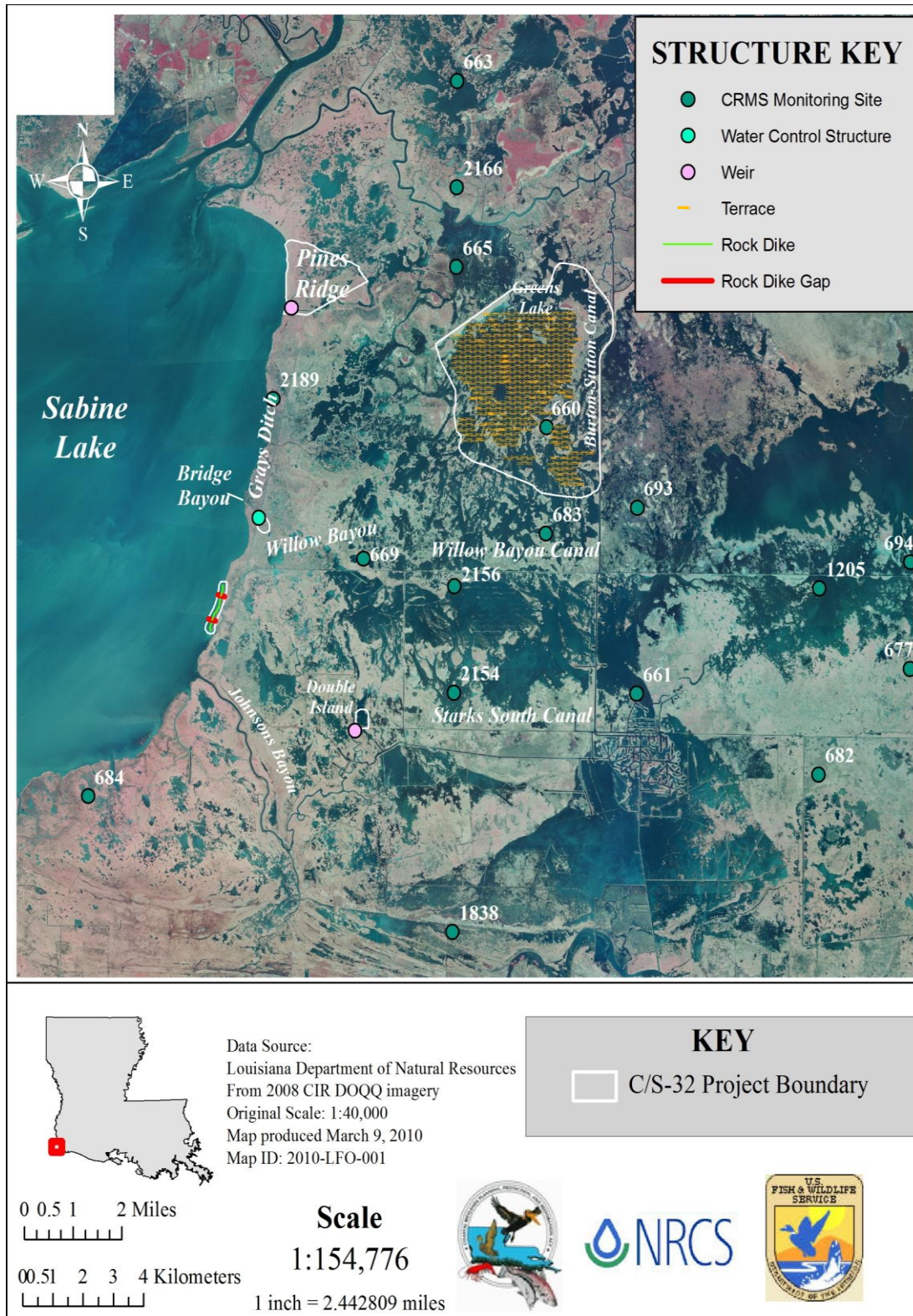


Figure 3. East Sabine Hydrologic Restoration (CS-32) project area showing project boundary, project features, and CRMS stations in or near the project area.

Monitoring Goals

The CWPPRA projects authorized for construction after August 14, 2003 are monitored with Coastwide Reference Monitoring System (CRMS) stations, other existing data collection, and any additional data collection specifically added to the project and funded separately from the normal monitoring. There is one CRMS site (CRMS0660) located within the terrace area, others in the surrounding marsh that serve as suitable references, and comparisons to CRMS sites at hydrologic basin and marsh type scales can be made (figure 3). No CRMS sites are within the small areas of impact around the weirs; therefore, project-specific sondes will be temporarily installed at the Pines Ridge structure to monitor salinity and water-level variability differences inside and outside of the affected area.

Priorities

The East Sabine Lake (CS-32) project is classified as a marsh restoration, hydrologic restoration, and shoreline protection project. Land area is expected to increase with the addition of terraces north and south of Green's Lake. Through the use of passive water control structures and terraces, a more beneficial hydrology is expected in the vicinity of Pines Ridge and Green's Lake. In the Pines Ridge area, the low-level weir is expected to attenuate rapid water fluctuations and salt water intrusion from Sabine Lake caused by artificial channel connections that unnaturally increase hydrologic exchange. And, erosion is expected to stop behind the rock dike along Sabine Lake.

Specific Monitoring Goals

1. Evaluate land area changes in project area, especially the terraced areas around Green's Lake.
2. Evaluate water-level variability within Pines Ridge area.
3. Evaluate water salinity within Pines Ridge area and Greens Lake.
4. Evaluate shoreline change along Sabine Lake behind the gapped, foreshore, rock dike.

Monitoring Strategies

1. Land/water ratio
Land/water ratio will be estimated for each project area (Green's Lake terraces, foreshore dike along Sabine Lake, and water control structures at Pine's Ridge, Double Island Gully, and Bridge Bayou) from available aerial photography provided by CRMS with a minimum of 1 m² resolution collected around years 1, 5, 10, and 20 post construction. The photography will be processed by National Wetlands Research Center (NWRC) personnel using standard operating procedures through GIS analysis (Steyer et al. 1995, revised 2000). Land change rates will be determined over time.

2. Water Level
Water level will be recorded hourly at a pair of sondes positioned on either side of the structure at Pines Ridge, one CRMS site within Green's Lake terrace area (CRMS0660), and other CRMS sites within the surrounding area. Daily water-level ranges will be calculated to compare water-level variability between the Pines Ridge sondes. In addition, frequency, depth, and duration of flooding will be analyzed at the Pines Ridge and CRMS sondes. The Pines Ridge sondes will be deployed temporarily from October 1, 2012 to September 30, 2013.
3. Salinity
Salinity will be recorded hourly at a pair of sondes positioned on either side of the structure at Pines Ridge, one CRMS site within Green's Lake terrace area, and other CRMS sites within the surrounding area. Interstitial water salinity of the adjacent marsh will be measured monthly when the sondes are serviced. The Pines Ridge sondes will be deployed temporarily from October 1, 2012 to September 30, 2013.
4. Vegetation
The condition of the natural and planted vegetation on the terraces will be evaluated by ocular estimates during O&M inspections.

Supplemental Project-Specific Information

The following monitoring elements do not address specific project goals, but will be collected from all project and reference CRMS stations to evaluate the condition of the marsh.

1. Soil Properties
Soil cores were collected at each CRMS site upon establishment. Analyzed soil properties include soil pH, salinity (EC), bulk density, moisture, percent organic matter, wet/dry volume, and texture (Particle Size Distribution).
2. Vegetation
Percent vegetation coverage, height, and species representation following the Braun-Blanquet methodology is sampled at ten replicate 2m x 2m stations located within the 200m x 200m site. Data will be collected annually in late summer.
3. RSET
Rod Surface Elevation Tables (RSET) will be used to measure precise changes in marsh surface elevation over time relative to a fixed datum. Data will be collected biannually in the spring and fall at each CRMS site.
4. Accretion
Accretion plots will be used to measure surface accretion (i.e., sedimentation) near the RSET at each CRMS site. Vertical accretion is to be used in conjunction with the RSET to provide information on below ground processes that influence surface

elevation change. Accretion data collection will be collected biannually in the spring and fall coinciding with the RSET.

Notes:

1. Implementation:

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| Start construction | April 2005 |
| End construction: terrace structure | June 2009 |
2. USFWS Project Manager: Darryl Clark (337) 291-3111
 NRCS Project Manager: Dale Garber (337) 783-1257 (ext 125)
3. CPRA Operations Engineer: Darrell Pontiff (337) 482-0683
 CPRA Monitoring Manager: Tommy McGinnis (337) 482-0662
 CPRA Project Manager: Andrew Beall (225) 342-6690
4. Comprehensive Operations, Maintenance, and Monitoring reports will be written every three years beginning in 2012.
5. Louisiana coastal marsh vegetation type maps (O'Neil 1949; Chabreck et al. 1968; Chabreck & Linscombe 1978, 1988, and 1997; and any subsequent publications) prepared by the Louisiana Department of Wildlife and Fisheries (LDWF) from field data collected approximately every ten years will be used as ancillary data to evaluate vegetation and habitat changes over time.
6. No funds are available to monitor fisheries goals.
7. References:

Balkum, K. F., J. L. W. Cowan, M. A. Stead, and K. Belhadjali. 2003. Ecological Review of East Sabine Lake Hydrologic Restoration, Construction Unit 1. Unpublished report. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

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- Clark., D. and J. Mazourek. 2004. East Sabine Lake Hydrologic Restoration Project Construction Unit 1 Environmental Assessment. U. S. Fish and Wildlife Service. Lafayette, LA. 34 pp plus appendices.
- Dunbar, J.B., L.D. Britsch, and E.R. Kemp III. 1992. Land loss rates. Report 3, Louisiana coastal plain. U.S. Army Engineer District, New Orleans, Louisiana.
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- Louisiana Coastal Wetlands Conservation and Restoration Task Force. 2002. Hydrologic Investigation of the Louisiana Chenier Plain. Baton Rouge, Louisiana: Louisiana Department of Natural Resources, Coastal Restoration Division. 135 pp plus appendices.
- 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 plan. Open-file series 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 112 pp plus appendices.
- Steyer, G. D., C. E. Sasser, J. M. Visser, E. M. Swenson, J. A. Nyman, and R. C. Raynie. 2001. A Proposed Coast-wide Reference Monitoring System For Evaluating Wetland Restoration Trajectories. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 112 pp plus appendices.