State of Louisiana
Department of Natural Resources
Coastal Restoration Division

Monitoring Plan

for

Lake Chapeau Sediment Input and Hydrologic Restoration, Point Au Fer Island

State Project Number TE-26
Priority Project List 3

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Terrebonne Parish

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LDNR/Coastal Restoration and Management

MONITORING PLAN

PROJECT NO. TE-26 LAKE CHAPEAU SEDIMENT INPUT and HYDROLOGIC RESTORATION, POINT AU FER ISLAND

ORIGINAL DATE: June 1, 1996
REVISED DATE: July 23, 1998, August 14, 2003

Preface

Pursuant to a CWPPRA Task Force decision on April 14, 1998, the original monitoring plan was reduced in scope due to budgetary constraints. Specifically, the frequency of vegetation monitoring was reduced from annual to every three years.

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. The recommendations for modifying this Monitoring Plan are the result of a joint meeting with DNR, USGS, and the federal sponsor. The recommendations have been incorporated into this revised Monitoring Plan and are described in the Monitoring Elements section. Specifically, the 2010 habitat mapping will be reduced to a land:water analysis.

Project Description

The Lake Chapeau project is located on Point au Fer Island between the Atchafalaya and Fourleague Bays. The project is centered at latitude 29° 15' 00" N and longitude 91° 15' 00" W, and is bounded by Fourleague Bay to the north, Atchafalaya Bay to the west, Locust Bayou to the south and Wildcat Bayou and an unnamed oil field canal to the east. The project incorporates a total of 13,549 ac (5,483 ha) of which approximately 9,006 ac (3,645 ha) are brackish to intermediate marsh and 4,543 ac (1,839 ha) are open water (NMFS n.d.). The wetland habitat within the project area has recently changed from 100% brackish marsh to a mixture of brackish and intermediate marsh (Chabreck and Linscombe 1988).

Approximately 8% of Louisiana's coastal marshes have been converted to open water canals and their associated spoil banks (Neill and Turner 1987). Canal construction likely alters wetland hydrology and contributes to wetland loss in coastal Louisiana (Turner et al. 1984). Similar alterations to the natural drainage pattern at Point au Fer Island have occurred from the dredging of oil and gas access canals through the interior of the island. Strong tidal flows occur between Locust Bayou in the southwest and Fourleague Bay in the northwest (NMFS n.d.). Point au Fer Island has experienced decreased salinities as sediments and fresh water from Atchafalaya Bay have circulated

through the islands' interior marshes. Increased fresh water flow and sediment input have not been effectively utilized due to changes in hydrologic patterns and the presence of artificial levees (NMFS n.d.).

Of the 9,006 ac (3,645 ha) of marsh habitat in the Lake Chapeau area, 56% of the area is brackish marsh and 44% of the area is intermediate marsh (NMFS n.d.). Vegetation in the brackish marsh is dominated by *Spartina patens* (marshhay cordgrass), *Scirpus olneyi* (olney three square), *Scirpus robustus* (leafy three square), and *Phragmites australis* (roseau cane). The vegetation of the intermediate marsh is dominated by *S. patens*, *S. olneyi*, *Echinochloa walteri* (walter's millet),*Scirpus californicus* (california bulrush), *Cladium jamaicense* (jamaica sawgrass), and *Sagittaria lancifolia* (bulltongue) (NMFS n.d.).

Marsh loss has occurred in the interior of Point au Fer Island since at least the 1930's. Marsh loss rates between 1932 and 1974 peaked at 45.45 ac/yr (18.4 ha/yr) and occurred as a direct result of oil exploration activities (NMFS n.d.). The rate of interior marsh loss has decreased since that time and

is currently estimated to be 20.14 ac/yr (8.15 ha/yr) (1983-1990). Shoreline erosion along Lake Chapeau is estimated to be 3 ft/yr (0.91 m/yr) (1932-1983; NMFS n.d.). Soils within the project area can be characterized as brackish marsh peat (Clovelly, Bd) to the south and brackish marsh clays and mucky clays (Bancker, Bb) to the north. The broken marshes immediately surrounding Lake Chapeau are dominated by a Bancker soil (SCS 1956).

The Lake Chapeau Marsh Creation project includes the following features:

- Sediment mined from Atchafalaya Bay, 300 yards (274 m) off the west central shoreline of Point au Fer Island, will be spray dredged over the broken marsh west of Lake Chapeau creating approximately 260 ac (105 ha) of marsh at a mean elevation 1.0 ft (0.3 m) NGVD (figure 1).

- Eight earthen plugs will be constructed in canals around the fringes of the project area (figure 1).

Project Objectives

1. Convert approximately 260 ac (105 ha) of open water to marsh west of Lake Chapeau between the Locust Bayou and Alligator Bayou watersheds using sediments mined from Atchafalaya Bay.

2. Restore natural sediment and hydrologic pathways by plugging canals in the project area.

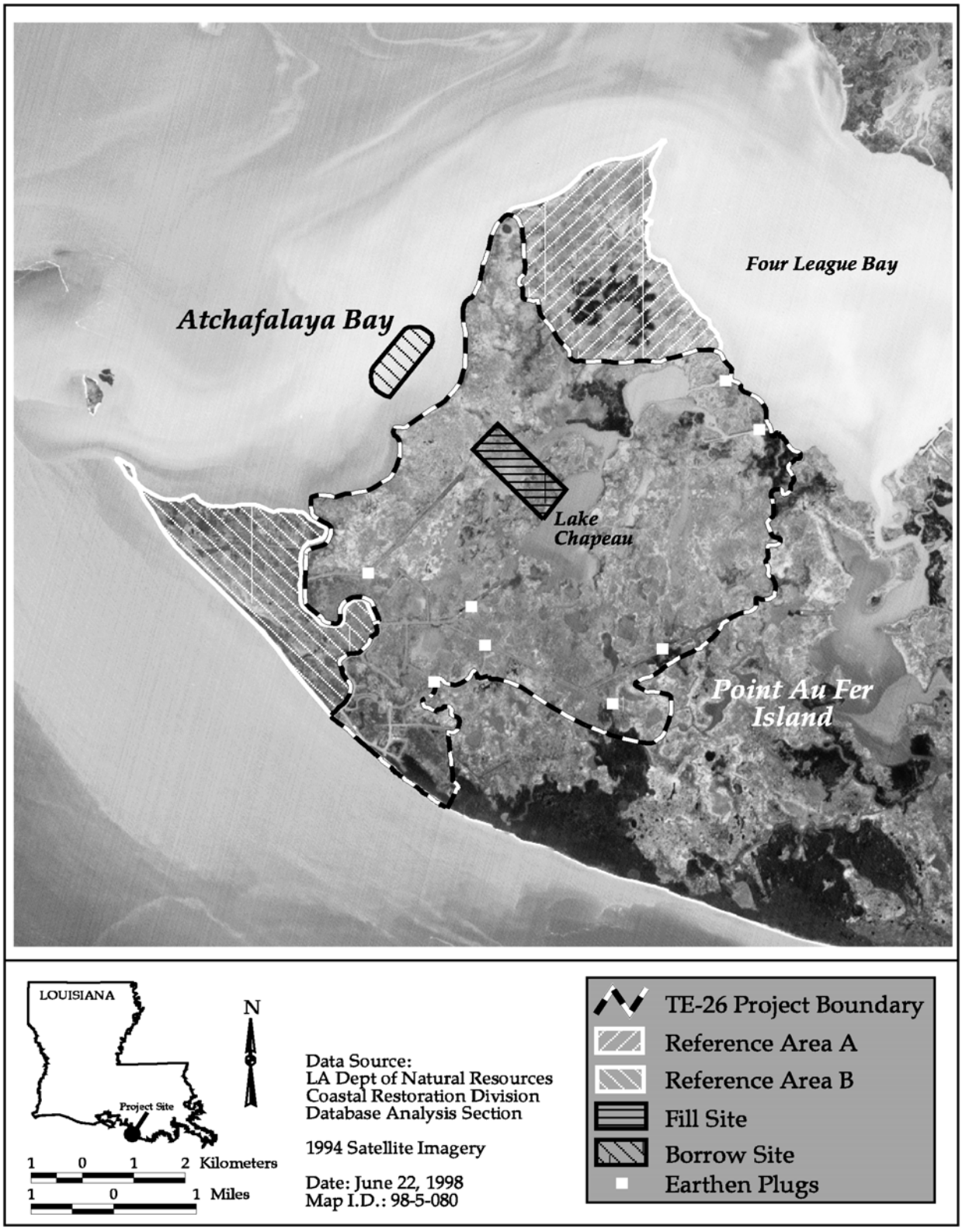

Figure 1. Lake Chapeau Sedimant Input and Hydrologic Restoration, Point Au Fer Island (TE-26) project area, reference areas, and features.

Specific Goals

The following goals will contribute to the evaluation of the above objectives:

1. Create approximately 260 ac (105 ha) of marsh west of Lake Chapeau.

2. Decrease the water level variability within the project area.

Reference Area

The importance of using appropriate reference areas cannot be overemphasized. Monitoring on both project and reference areas provides a means to achieve statistically valid comparisons, and is, therefore, the most effective means of evaluating project success. The evaluation of sites was based on the criteria that both project and reference areas have similar vegetative communities, soil types, salinity and hydrologic characteristics.

Two reference sites were chosen on Point au Fer Island. Reference site A (figure 1) is a marsh under natural conditions. No oil and gas access canals are present in the vicinity of Reference site A; tidal exchange only occurs through Alligator Bayou, a natural channel. Reference site B (figure 1) is located in the extreme southwest portion of Point au Fer Island between Dead Alligator Point and Raquet Pass. Reference site B will simulate the characteristics of a marsh in an impacted setting. This site is influenced by a large access canal, which is believed to impact tidal exchange. Both reference sites A and B have similar vegetation and soil types as the project area. After making a site visit to Point au Fer Island, it was determined that *S. patens* was the dominant plant species in both the project area and the reference sites. Soils within the project area and both reference sites are mainly mucky clays (Bancker, Bb).

Three other areas were considered as reference sites: Southeast Point au Fer Island, Marsh Island and the marshes between Mosquito Bay and Fourleague Bay. These potential reference sites could not be used because of impacts from future restoration projects, differences in vegetation communities, soil types and hydrology.

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 Elements

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

1. Habitat Mapping — To document vegetated and non-vegetated areas, changes in vegetative community type, and submerged aquatics (visual interpretation with ground truthing), color-infrared aerial photography (1:24,000 scale, with ground controls) will be obtained for both the project area and reference sites. The photography will be photointerpreted, scanned, mosaicked, georectified, and analyzed by National Wetlands Research Center (NWRC) personnel according to the standard operating procedure described in Steyer et al. (1995). The photography will be obtained twice pre-construction in 1994 and 1997, and post-construction in 2001 and 2010. Habitat mapping will be conducted on the 1994, 1997, and 2001 photography, however, based on the CRMS review, only a land:water analysis will be conducted on the 2010 photography. LDNR personnel will monitor the condition of earthen plugs, vegetation changes and elevation of dredge material coincident with aerial photography.

2. Water Level — To monitor water level variability, two continuous recorders will be located within the project area and one recorder located in each of the reference sites. Mean daily water level variability will be monitored continuously prior to construction in 1996-1998, and after construction in 1999-2016. In addition, flooding duration and frequency of flooding in the project area and reference sites will be evaluated. The location of sampling stations may be adjusted by DNR/CRD based on interpretation of preliminary data acquired from the area.

3. Vegetation — Relative abundance will be evaluated in the dredge disposal area using techniques described in Steyer et al. (1995). Ten (10) sampling stations will be randomly selected within the dredge disposal area. Relative abundance will be documented post-construction in 1998, 2001, 2004, 2007, 2010, 2013, and 2016. Each sampling station will be marked with 2 corner poles to allow revisiting over time. Relative abundance will be evaluated in the late summer or early fall, prior to plant senescence (from July 15 to September 15).

Anticipated Statistical Tests and Hypotheses

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

1. Descriptive and summary statistics will be used on both historical data and data from aerial photography and GIS interpretation collected during post-project implementation to assess changes in marsh loss/gain rates within the project area and reference sites. Also, historical values for the area as well as data available from other surveys (USACE, USFWS, LDNR, LSU) will be gathered to document and allow for statistical analysis of long term marsh loss/gain rates in the project area.

   Goal: Create 260 ac (105 ha) of marsh through the beneficial use of dredged material.

2. Analysis of variance (ANOVA) will be used determine differences in daily water level variability within the project area. The ANOVA approach may include terms in the model to adjust for station locations, proximity to structures, and seasonal fluctuations. Significant differences will be analyzed using post ANOVA comparisons. Ancillary data (i.e., precipitation, historical) will be included as covariables when available. This additional information may be evaluated through analysis such as correlation, trend, multiple comparisons, and interval estimation. Exploratory data analysis will be used to determine an appropriate variable for hypothesis testing (e.g., daily, weekly intervals). Descriptive and summary statistics will be used to analyze the difference in water level variability between the project area and the reference sites.

   Goal: Reduce the variability in water level within the project area.

   Hypothesis A:

   H_0: After project implementation at year i, water level variability will not be significantly less than before project implementation.

   H_a: After project implementation at year i, water level variability will be significantly less than before project implementation.

   If we fail to reject the null hypothesis, any possible negative effects will be investigated.

3. Descriptive and summary statistics will be used on vegetation data collected in the dredge disposal area during post project implementation to determine the species composition of the created marsh.

   Goal: Create vegetated marsh through the beneficial use of dredge material.

NOTE: Available ecological data, both descriptive and quantitative, will be evaluated in concert with all of the above data and with statistical analyses to aid in determination of overall project success.

Notes

1.	Implementation:	Start Construction:	September 14, 1998
		End Construction:	May 18, 1999
2.	NMFS Point of Contact:	John Foret	(337) 291-2107
3.	DNR Project Manager:	Brian Babin	(985) 447-0956
	DNR Monitoring Manager:	Elaine Lear	(985) 447-0990

4. The twenty year monitoring plan development and implementation budget for this project is $748,112. Pursuant to the CRMS review, it was authorized by the Task Force to maintain $703,539 with the project, and utilize $44,573 to support CRMS. Progress reports will be available in January 2000, January 2001. Periodic comprehensive reports on coastal restoration efforts in the Terrebonne hydrologic basin will describe the status and effectiveness of the project as well as cumulative effects of restoration projects in the basin.

5. Near-vertical color-infrared aerial photos (1:24,000 scale) were taken on December 24, 1994, and in 1997 and 2001.

6. Water levels and existing marsh levels will be evaluated and used to calculate duration and frequency of flooding (marsh elevation and NGVD will be established).

7. References:

Chabreck, R. H., and G. Linscombe 1988. Vegetative type map of the Louisiana coastal marshes. Louisiana Department of Wildlife and Fisheries, New Orleans.

National Marine Fisheries Service n.d. Coastal Wetlands Planning, Protection, and Restoration Act: Proposed Project Information Sheet. 9pp.

Neill, C., and R. E. Turner 1987. Backfilling canals to mitigate wetland dredging in Louisiana coastal marshes. Environmental Management 11:823-836.

Soil Conservation Service 1956. Soil survey of Terrebonne Parish, Louisiana. U.S. Department of Interior, Louisiana Agricultural Experiment Station, Series 1956, No. 1. Issued February 1960.

Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller and E. Swensen 1995. Quality management plan for the coastal wetlands planning, protection, and restoration act monitoring program. Open-file report no. 95-01. Baton Rouge, Louisiana: Louisiana Department of Natural Resources Coastal Restoration Division. 97 pp. plus appendices.

Turner, R. E., K. L. McKee, W. B. Sikora, J. P. Sikora, I. A. Mendelssohn, E. Swenson, C. Neill, S. G. Leivowitz, and F. Pedrazini 1984. The impact and mitigation of man-canals in coastal Louisiana. Water Science and Technology. 16:497-504.