State of Louisiana
Department of Natural Resources
Coastal Restoration Division

Monitoring Plan

for

Bayou Sauvage National Wildlife Refuge Hydrologic Restoration, Phase 2

State Project Number PO-18
Priority Project List 2

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Orleans Parish

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MONITORING PLAN

PROJECT NO. PO-18 BAYOU SAUVAGE (Phase II)

ORIGINAL DATE: June 19, 1995
REVISED DATES: 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, 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. As a the result of a joint meeting with DNR, USGS, and the federal sponsor, the recommendations for this Monitoring Plan were to change the remaining 2 habitat mapping analyses to land:water analyses and utilize CRMS-Wetlands data to evaluate changes within the project area. All other project-specific monitoring was discontinued. Although no CRMS stations fall within the PO-18 project area, this area will be evaluated using the CRMS land:water analyses based on basin-level satellite imagery and the 8 Chabreck and Linscombe vegetation stations within the project area. These recommendations have been incorporated into the Monitoring Elements section.

Project Description

The project area is located in the Bayou Sauvage National Wildlife Refuge 16 mi (25.8 km) east of New Orleans in Orleans Parish. The 6,900 ac (2,792 ha) site is west of Louisiana Highway 11, north of U.S. Highway 90, south of U.S. Interstate 10, and east of the Maxtent Canal (figure 1). The Bayou Sauvage refuge was established in 1986 to enhance overwintering waterfowl, shore bird, and wading bird populations in an urban setting. The area has important fishery resources, waterfowl concentrations, a state-ranked, coastal barrier island live oak forest, a state-ranked plant, an American eagle nest, and has important recreational fishing and canoeing potential. The main objective of this project is to reduce water levels in order to enhance fresh/intermediate marsh.

The project area has been effectively impounded by highways and canals. Elevated water levels have caused significant deterioration of the impounded marsh (USFWS 1994). According to USFWS (1994), the project area was over 90% non-fresh marsh (intermediate or brackish marsh) in 1956, 60% non-fresh marsh in 1978, and 14% non-fresh marsh in 1990. This was a 76% loss of

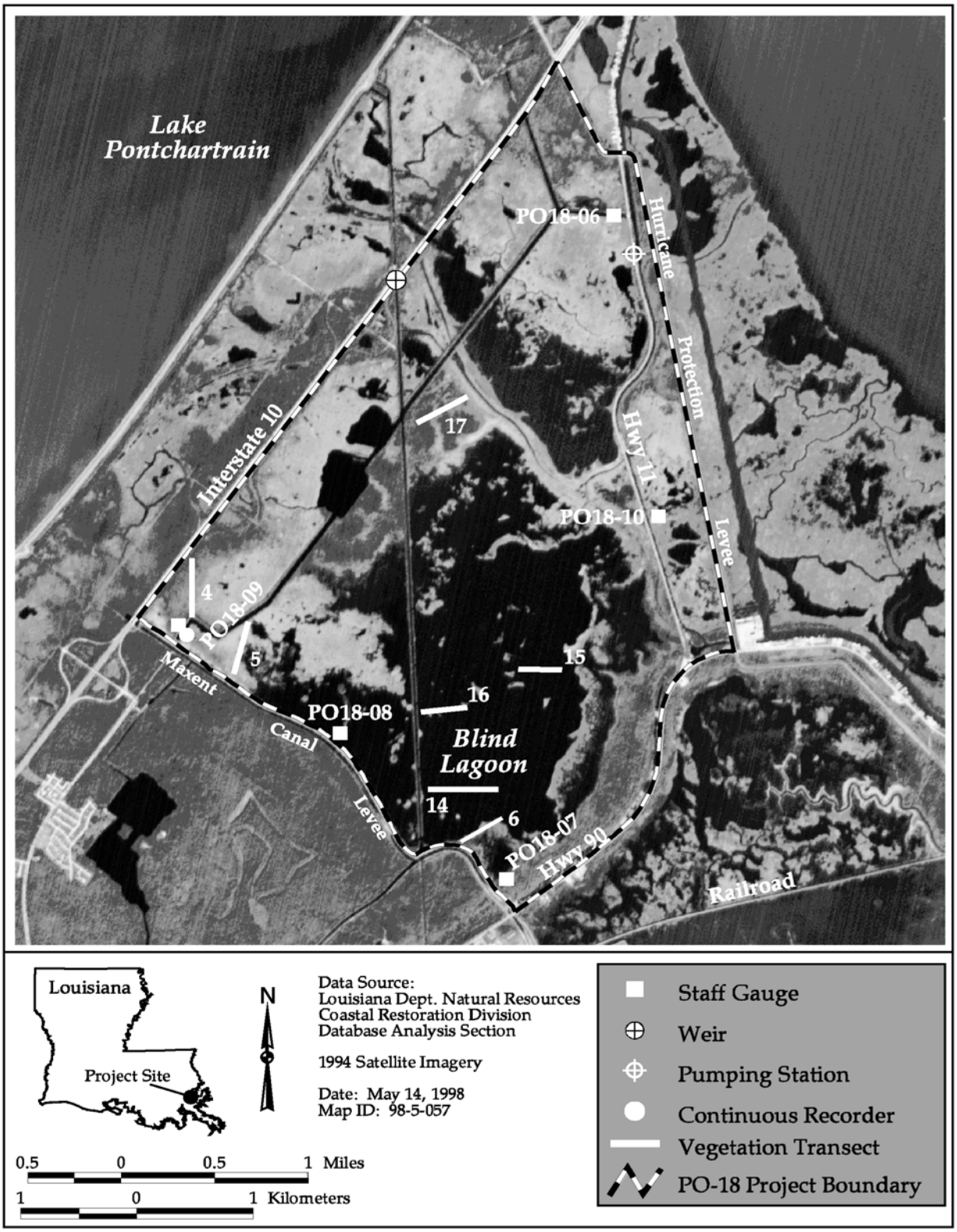

Figure 1. Bayou Sauvage Hydrologic Restoration (PO-18) project features.

non-fresh marsh. However, this non-fresh marsh loss was somewhat offset by an increase from 0% fresh marsh in 1956 to 30% fresh marsh in 1988. Probably the most dramatic indication of the project area deterioration due to impoundment was the increase in open-water area from 6.0 % in 1956 to 30% in 1988. The open-water ponds were about a third covered with submersed aquatics in 1978, but all of the submersed aquatic vegetation had disappeared by 1990. The loss of the non-fresh marsh and submersed aquatic vegetation has resulted in large open-water ponds, some over 1 mi (1.6 km) wide and approximately 1 ft (0.3 m) deep. The soils are mainly Lafitte, Clovelly and Gentilly mucks characterized by very fluid organic soils underlain by clay. The higher areas are Aquent soils, which are highly variable and slightly saline. The remnants of the Pine Island Beach Ridge, which cross the area, were more highly drained sands and silts, but were mined for material for Interstate 10. The large fetch-to-depth ratio results in high wave action, and fluid-fine particle size of the soils results in high turbidity, which together have accelerated the decline of the marsh and submersed aquatic habitats.

This project proposes to lower water levels to enhance revegetation. Two pumps will be installed in one pump house with a 42 in (1.07 m) discharge pipe on the northeast side of the area. The normal capacity of the pump station will be 68,000 GPM (257,380 LPM). Water levels will be drawn down approximately 1 ft (0.3 m) in the spring and summer to encourage submersed aquatic and emergent marsh colonization. Water levels will be maintained within 0.5 ft (0.15 m) of root mat levels during the fall and winter. The connection between the project area and the impounded marsh area north of Interstate 10 will be closed with a plug to ensure that the project area can be independently managed.

Project Objective

1. To enhance fresh marsh habitats in the project area.

Specific Goals

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

1. Lower water levels in the impounded areas to -0.5 ft to 0.0 ft of marsh sediment elevation in the spring and summer and to within +0.5 ft of marsh sediment elevation throughout the rest of the year via the installation of pumps.

2. Promote the reestablishment of emergent marsh.

Reference Area

The reference area will be monitored and evaluated in a similar fashion to provide a means to achieve statistically valid comparisons. Sites near the project area and across the Louisiana coast were considered based on the criteria that they be impounded with a similar water depth and

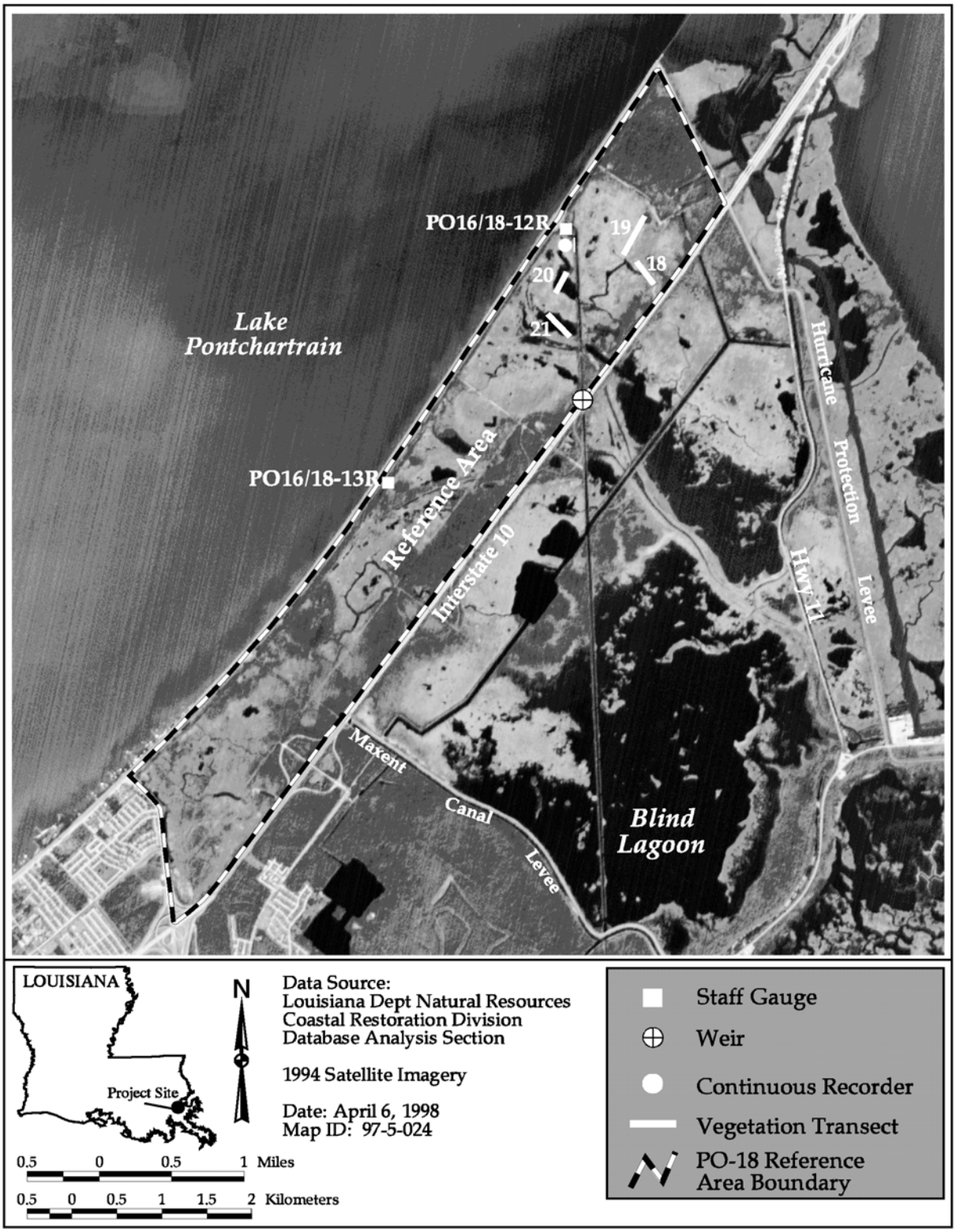

Figure 2. Bayou Sauvage Hydrologic Restoration (PO-18) reference area features.

hydroperiod (i.e., water level changes over time on a regular basis) and have similar vegetative communities and soil types. An area north and west of Interstate-10 and east of a levee along Paris Road was chosen since it was impounded, had open-water areas with and without submersed vegetation with water levels within 1 to 2 ft, had fresh/intermediate marsh, bottomland hardwood and willow habitat, and had Clovelly and Lafitte muck soils similar to the project area (figure 2). However, this reference area differs from the project area in that it has less open-water pond area and will have tidal influence during the spring via a gate located at the northeast corner of the area. Four vegetation transects established within the reference area have similar open-water and marsh habitats, correspond to the seven transects within the project area, and are representative of the major habitats within the area. Similarly, three staff gauges located within the reference area will be monitored by United States Fish and Wildlife Service (USFWS) on the same day as those within the project area. The reference area was flown for near-vertical, color-infrared photography for habitat mapping during the preconstruction project flight (November 1993 at 1:12,000) and will be flown simultaneously with the three post-construction flights. All monitoring elements will be evaluated identically for the project and 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 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 marsh to open water ratios in the project and reference areas, color infrared aerial photography (1:12,000 scale with ground controls) will be obtained. The photography will be georectified, photointerpreted, mapped, and analyzed with GIS by the National Wetland Research Center (NWRC) using standard operating procedures documented in Steyer et al. (1995). Photography was obtained prior to construction (1996) and will be taken post-construction in 2006 and 2012.

   However, based on the CRMS review, the 2006 and 2012 habitat mapping was changed to land:water.

2. Water Level — Will be measured using staff gauges at 5 locations within project area (three in the northern area, and two in the southern area) and at three locations within the reference area. The location and number of staff

gauges were determined by USFWS personnel using information gathered during field investigations of water flow throughout the areas. The staff gauges will be monitored weekly by USFWS personnel. The staff gauges' elevations will be surveyed relative to National Geodetic Survey Station H 374 (National Geodetic Survey 1993) at the intersection of Recovery Road and Highway 90. The staff gauges' elevations will be surveyed upon project completion, and in 2003. The target water level is in relation to marsh surface elevation which was determined by USFWS and SCS using techniques described in Steyer 1995.

Based on the CRMS review, water level will be monitored through 2004, after which, water level monitoring and elevation surveys of the gauges will be discontinued.

3. Vegetation

Species composition, percent cover, and relative abundance of plant species will be monitored along seven transects in the project area and four transects in the reference area, according to techniques described in Harris (1989) and Steyer and Stewart (1992). This area was formerly fresh/intermediate marsh, bottomland hardwood and open-water pond. The transects were chosen to be representative of fresh/intermediate marsh and the bordering bottomland hardwoods, open-water pond, and submersed aquatic habitats. Vegetation was monitored in 1996, 1997, and 2001.

Based on the CRMS review, vegetation sampling originally scheduled for 2003, 2006, 2009, 2012, and 2015 was eliminated. Vegetation data from the 8 Chabreck and Linscombe points within the project area will be used to evaluate project effects.

Anticipated Statistical Tests and Hypotheses

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

1. Descriptive and summary statistics on historical data and data collected during post-project implementation. Data from aerial photography and GIS interpretation will be used to determine trends in marsh- to open-water ratios.

Goal: Promote the reestablishment of emergent marsh.

A. *Hypothesis:*

H_0: Marsh:open-water ratio after project implementation at time i will not be

significantly higher than the marsh:open-water ratio before project implementation.

H_a: Marsh:open-water ratio after project implementation at time i will be significantly higher than the marsh:open-water ratio before project implementation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

B. *Hypothesis:*

H_0: Marsh:open-water ratio after project implementation at time i will not be significantly higher than the marsh:open-water ratio in the reference area.

H_a: Marsh:open-water ratio after project implementation at time i will be significantly higher than the marsh:open-water ratio in the reference area.

If we fail to reject the null hypothesis, we will investigate for negative effects.

2. The primary method will be to determine differences in water level as evaluated by an Analysis of Variance (ANOVA) that will consider spatial and temporal variation and interaction. The ANOVA approach may include terms in the model to adjust for station locations, proximity to structures, and seasonal fluctuations. Ancillary data (*i.e.*, precipitation, historical) will be used when available. This additional information may be evaluated through analyses such as correlation, trend, multiple comparisons, and interval estimation. These tests will allow for the analysis and long-term documentation of water level changes in the project area (goal 1). Data will be obtained from staff gauges within the project area.

Goal: Lower water levels in the impounded areas to -0.5 ft to 0.0 ft of marsh sediment elevation in the spring and summer and to within +0.5 ft of marsh sediment elevation throughout the rest of the year via the installation of pumps.

A. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i will not be significantly lower than water level before construction.

H_a: After construction, mean water level within the project area at time i will be significantly lower than water level before construction.

If we fail to reject the null hypothesis, we will investigate for negative effects.

B. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i will not be significantly lower than water level in the reference area.

H_a: After construction, mean water level within the project area at time i will be significantly lower than water level in the reference area.

If we fail to reject the null hypothesis, we will investigate for negative effects.

C. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i during the spring and summer will be significantly greater than or equal to -0.5 ft of the mean sediment elevation or less than or equal to 0.0 ft of the marsh sediment elevation.

H_a: After construction, mean water level within the project area at time i during the spring and summer will be significantly greater than 0.0 ft marsh sediment elevation or less than -0.5 ft marsh sediment elevation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

D. *Hypothesis:*

H_0: After construction, mean water level within the project area at time i during the fall and winter will be significantly less than or equal to +0.5 ft of marsh sediment elevation.

H_a: After construction, mean water level within the project area at time i during the fall and winter will be significantly greater than 0.5 ft marsh sediment elevation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

3. The primary approach will be to determine differences in vegetation, as evaluated by an ANOVA that will consider spatial and temporal variation and interaction. The ANOVA approach may include terms in the model to adjust for station/transect locations, location in relationship to the railroad, proximity to structures, and seasonal fluctuations. Ancillary data (*i.e.*, salinity, herbivory, historical data provided in Harris 1989) will be used when available. This additional information will be evaluated through analyses such as correlation, trend, multiple comparisons, and interval estimation. These tests will allow for the analysis and long-term documentation of changes in the occurrence of emergent marsh vegetation.

Goal: Promote the reestablishment of emergent marsh.

A. *Hypothesis:*

H_0: Mean occurrence of emergent marsh at time i will not be significantly greater after project implementation than occurrence of emergent marsh before project implementation.

H_a: Mean occurrence of emergent marsh at time i will be significantly greater after project implementation than occurrence of emergent marsh before project implementation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

B. More specifically, the wetland value assessment predicted the restoration of 700 ac (283 ha) of emergent wetland by yr 5 of the project.

Hypothesis:

H_0: Mean occurrence of emergent marsh vegetation at five yrs will not be 700 ac greater than occurrence of emergent marsh vegetation before project implementation.

H_a: Mean occurrence of emergent marsh vegetation at 5 yrs will be 700 ac greater than occurrence of emergent marsh vegetation before project implementation.

If we fail to reject the null hypothesis, we will investigate for negative effects.

NOTE: Available ecological data, both descriptive and quantitative, will be evaluated in concert with statistical analyses to determine overall project success.

Notes

1.	Implementation:	Start Construction:	March 30, 1996
		End Construction:	June 1, 1997
2.	USFWS Point of Contact:	Pondexter Dixson	(504) 646-7545.
3.	DNR Project Manager:	George Boddie	(504) 280-4067
	DNR Monitoring Manager:	Melissa Hymel	(504) 280-4065

4. The twenty year monitoring plan development and implementation budget for this project is $281,427. Pursuant to the CRMS review, it was authorized by the Task Force to maintain $218,665 with the project, and utilize $62,762 to support CRMS. A progress report will be available in 1998. Comprehensive reports on coastal restoration efforts in the Pontchartrain 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. DNR will conduct vegetative monitoring.

6. In November 1993, near-vertical, color-infrared aerial photography was flown at a scale of 1:18,000 by NBS.

7. USFWS will install and monitor staff gauges. Staff gauge readings taken for one year preconstruction (1994 - 1995) have shown that the spring and summer water level is approximately -0.2 ft and the fall and winter water level is from +1.0 to +1.5 ft. These relative readings will be converted to NGVD when the staff gauges are surveyed postconstruction and every five years thereafter.

8. USFWS will monitor wildlife (colonial wading bird rookery populations and waterfowl). This data will be provided by USFWS to DNR annually.

9. References, miscellaneous reports, and/or data available for this project:

Coastal Environments, Inc. 1986. A Wetland Management Program for the Bayou Chevee Marsh. Prepared by Coastal Environments Inc. for South Point Inc., Chicago, Illinois.

Harris, J. 1989. Floristic Survey of the (Proposed) Bayou Sauvage National Wildlife Refuge. Slidell, La.: U.S. Fish and Wildlife Service, Refuge Division. 50 pp.

Restoration Projects. Open File Report 93-01. Lafayette, La.: U.S. Fish and Wildlife Service, National Wetlands Research Center. 85 pp.

Steyer, G. D., and R. Stewart 1992. Monitoring Program for Coastal Wetlands Planning, Protection, and Restoration Projects. Open File Report 93-01. Lafayette, La.: U.S. Fish and Wildlife Service, National Wetlands Research Center. 85pp.

Steyer, G. D., R. C. Raynie, D. L. Steller, D. Fuller, and E. Swenson 1995. Quality management plan for Coastal Wetlands Planning, Protection, and Restoration Act monitoring program. Open-file series no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division.

U.S. Fish and Wildlife Service 1994. Final Environmental Impact Statement: Bayou Sauvage National Wildlife Refuge. Slidell, La. U.S. Fish and Wildlife Service.

U. S. Soil Conservation Service 1992. Conservation Plan for Bayou Sauvage National Wildlife Refuge, Louisiana.

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