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PROGRESS REPORT NO. 4
For the period January 1, 1999 to December 31, 1999

Coast 2050 Region 4

EAST MUD LAKE MARSH MANAGEMENT
CS-20

Third Priority List Marsh Management Project
of the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA)
(Public Law 101-646)

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Introduction

Construction of the East Mud Lake Project was completed May 1,1996 and a comprehensive report was written analyzing the first 3 years of data collected (Weifenbach and Clark, 1999). This report discusses additional water quality and emergent vegetation data that has been collected and partially analyzed since the previous comprehensive report.

The East Mud Lake Marsh Management project area consists of 8,054 acres (3,222 ha) located in the Calcasieu/Sabine Basin in Cameron Parish, Louisiana. The project is bounded by the FINA Oil and Chemical Company property line to the south, La. Hwy. 27 to the west, the Sabine National Wildlife Refuge north of Magnolia Road, and an existing step levee and property line near Oyster Bayou to the east (figure 1). The Calcasieu/Sabine Basin suffers from anthropogenic hydrologic changes to the system (U.S. Department of Agriculture-Soil Conservation Service [USDA-SCS] 1993), which have led to the deterioration of the marsh since 1953. The Calcasieu Ship Channel (CSC) is 1 mi (1.6 km) east of the project area and provides an avenue for saline water (4–32 ppt) and rapid water movement into the East Mud Lake project area via West Cove, Oyster Bayou, and Mud Bayou (figure 1). The construction of La. Hwy 27 in 1936 reduced the input of freshwater from the west (USDA-SCS 1994). These connections facilitate increases in turbidity and scouring within the project area. In the 1950's, portions of the project area were impounded by construction of Magnolia Road and a levee system on the north, east, and south (figure 1). Analysis of aerial photos of the project area indicates a marsh loss rate of 76 ac/yr (30.4 ha/yr) from 1953 to 1983 (USDA-SCS 1992). Excluding Mud Lake, the land to open water ratio deteriorated from 99:1 in 1953 to 70:30 by 1983.

The project area has been divided into two hydrologically separate Conservation Treatment Units (CTUs) that are managed independently (figure 1). CTU 1 contains Mud Lake and is managed passively. Structures and features in CTU 1 consist of vegetative plantings, earthen plugs, culverts with flapgates and variable-crest culverts. The variable-crest culverts at stations 6, 7, and 8 are set at 6 in (15 cm) below marsh level with vertical slots open except when salinities exceed 15 ppt. The variable-crest culvert at station 13 is set at 6 in (15 cm) below marsh level (BML) with flapgates locked open except when salinities exceed 7 ppt.

CTU 2 is actively managed and has drawdown capabilities in order to encourage shallow water areas to revert to emergent vegetation. Two drawdown events were planned for the first five years of the project. Structures and features present in CTU 2 consist of vegetative plantings, variable crest culverts with flapgates, a gated culvert, and a variable-crest box structure (figure 1). Phase I emphasizes curtailing marsh erosion and reclaiming emergent marsh by implementing a partial drawdown from February 15-July 15. Phase II, the maintenance phase, emphasizes stabilization of salinity and water levels while ensuring ingress and egress of fisheries species.

The area east of CTU 2, south of Oyster Bayou and Mud Bayou (reference area 1, figure 1), was selected as the best reference area for the evaluation of the water level, salinity, and fisheries monitoring elements. The area north of Magnolia Road (reference area 2, figure 1) is a suitable reference area for the evaluation of the vegetative, accretion, water-level, salinity, fisheries, and soil

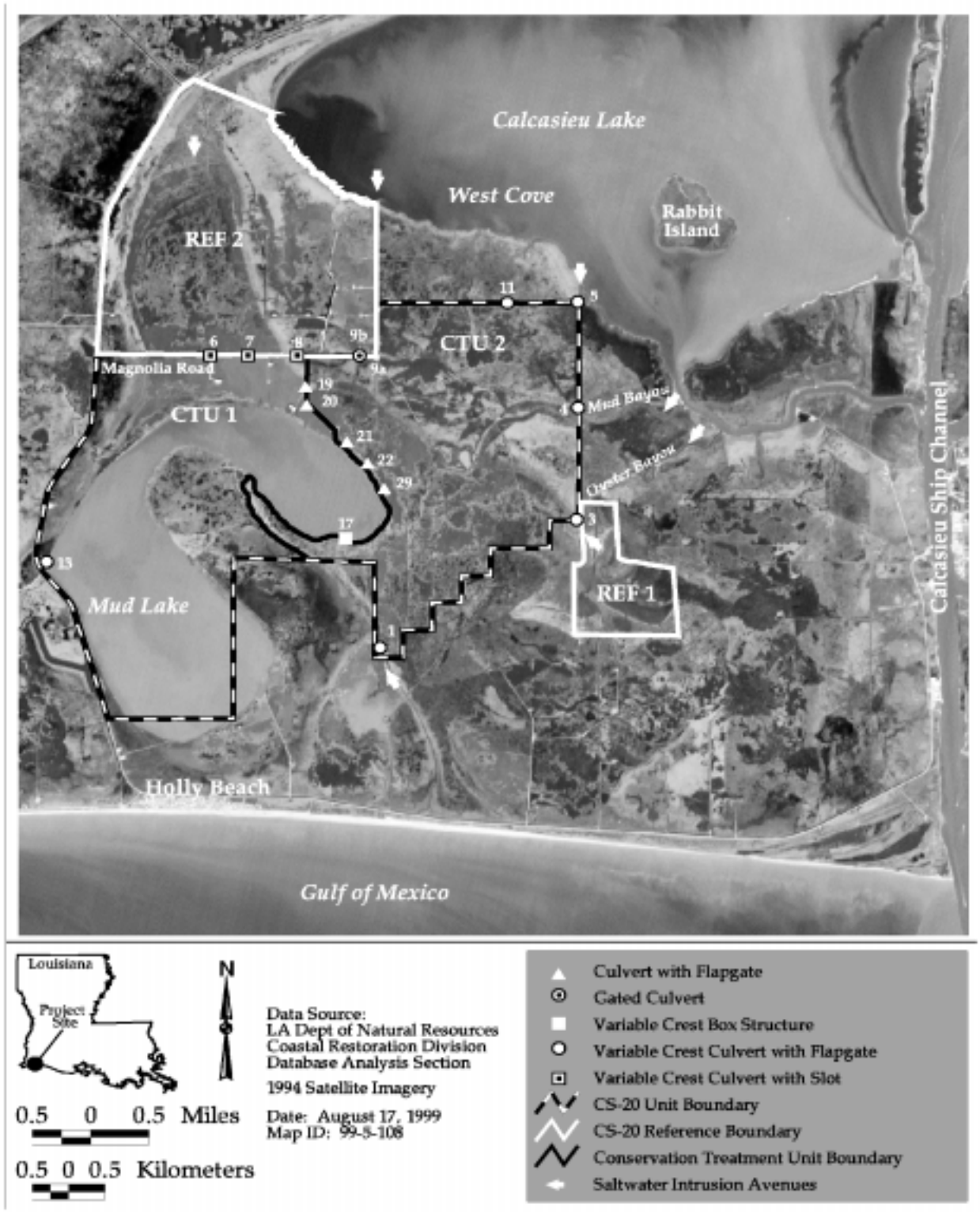

Figure 1. East Mud Lake (CS-20) project map depicting project boundaries, conservation treatment unit boundaries, reference area boundaries, project features, and saltwater intrusion avenues.

monitoring elements. The project area and both reference areas are classified as brackish marsh (Chabreck and Linscombe 1988) and contain mainly organic Bancker and Creole soils with ridges of Mermentau soils (U.S. Department of Agriculture-Natural Resource Conservation Service 1995). All are directly influenced hydrologically by the CSC and are dominated by *Spartina patens* (marshhay cordgrass).

Methods

Water quality: Water quality data were collected using seven (7) YSI 6000 continuous recorders at five stations inside the project area and 2 stations in the reference areas (figure 2). Water level (ft NAVD), salinity (ppt), temperature (C), and specific conductance ($\mu S /cm^2$) were recorded hourly at these stations. All continuous recorder data were shifted when necessary due to biofouling when error at time of retrieval exceeded 5%. Percent error due to biofouling was calculated at the time of retrieval by comparing dirty and clean discrete readings to those taken with a calibrated instrument. Missing data are usually due to instrument malfunction. Daily means for each continuous recorder were calculated.

Discrete monthly samples were taken at 27 stations, 15 located inside the project area, and 12 in the reference areas (figure 2). Monthly staff gauge readings were taken at 11 stations located inside the project area, and 10 in the reference areas.

Emergent vegetation: Sites to monitor existing vegetation were selected using a systematic transect pattern in which five transect lines were drawn in a northwest to southeast configuration from the Calcasieu Lake/West Cove shoreline in the project area and reference area 2. Five stations were chosen at equally spaced points along each transect line, for a total of 25 stations in the project area and 20 stations in reference area 2, to obtain an even distribution of stations throughout the marsh (figure 3). Percent cover, height of dominant plants, and species composition were monitored in two, 1.0-m^2 vegetation plots at each station. Emergent vegetation data were collected in July 1999 at the 3-yr postconstruction sampling period. Mean cover values of each species collected were calculated for the project and reference areas.

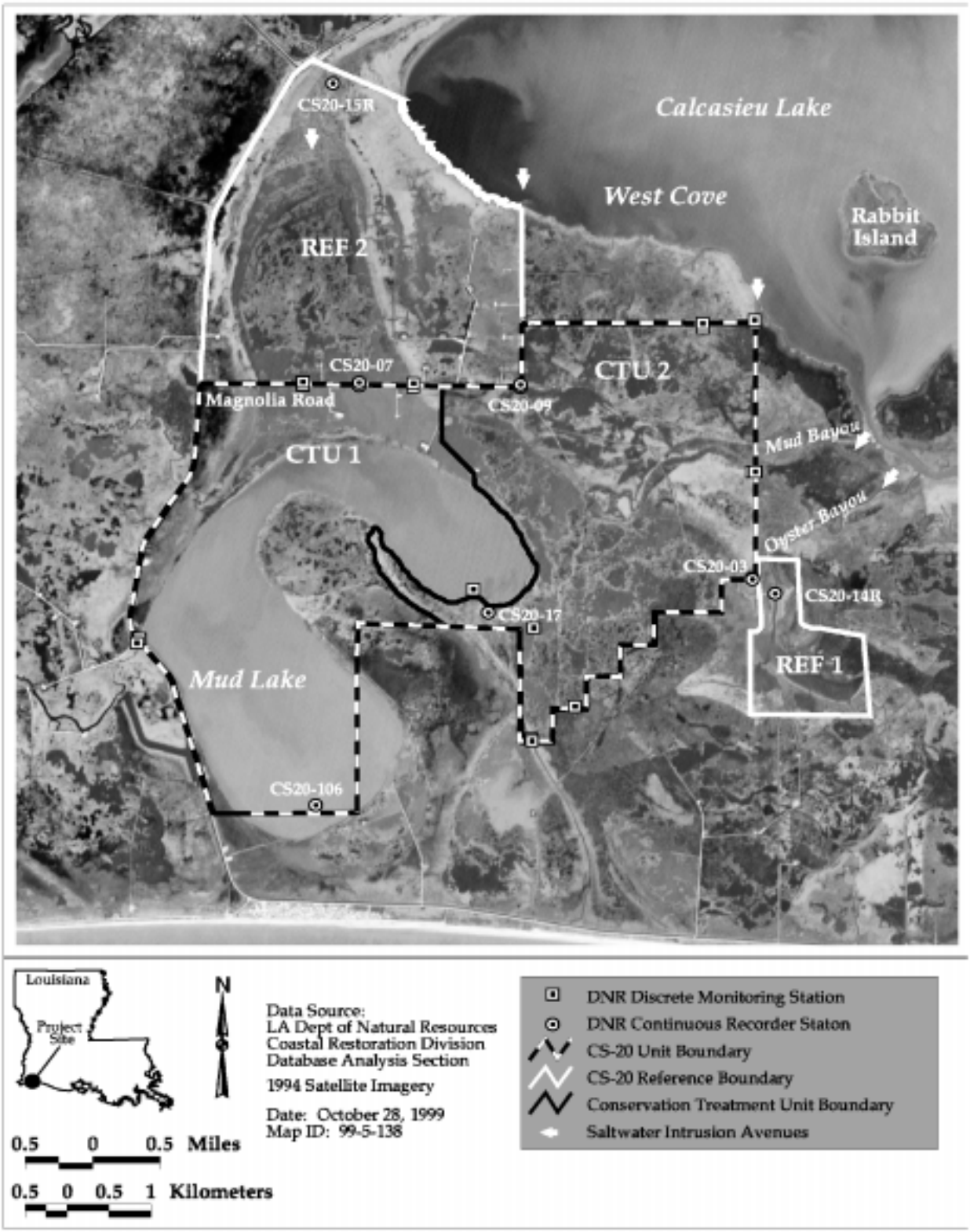

Figure 2. East Mud Lake (CS-20) project map depicting discrete monitoring stations, continuous recorder stations, and saltwater intrusion avenues.

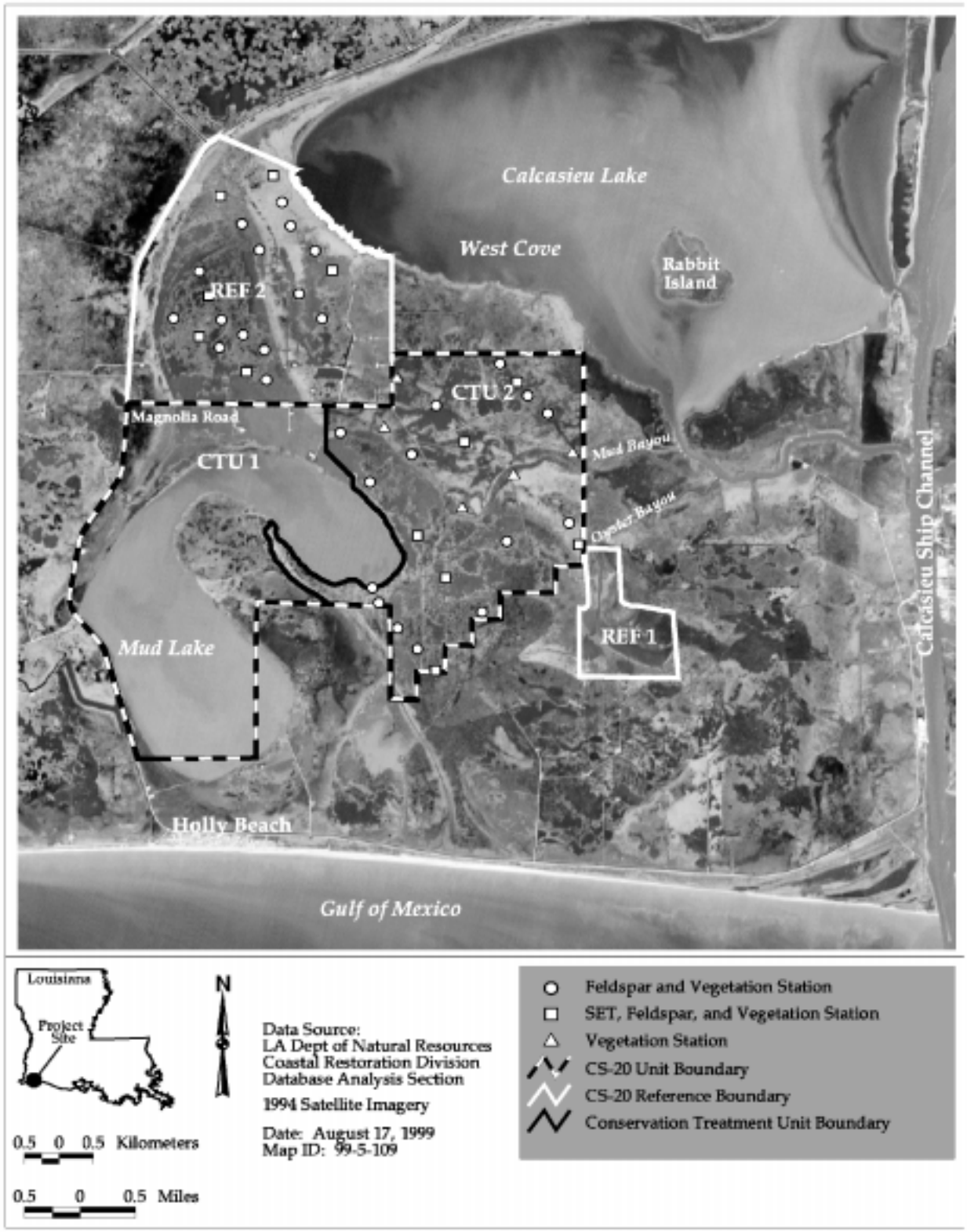

Figure 3. East Mud Lake (CS-20) project map depicting feldspar stations, emergent vegetation stations, *Spartina alterniflora* plantings, and SET stations.

Results

Water quality: Salinity remained within the target range of 15 parts per thousand for the majority of the first half of 1999 at all stations in the project area (figure 4). However, after August, salinity levels began to climb and remained at 15 ppt at stations 106 and 17 for the remainder of the year. At stations 3 and 9 inside the project area, and stations 14R and 15R outside the project area, salinities remained well above 15 ppt for the remainder of 1999. Water levels were maintained in the target range of 6 in below marsh level to 2 in above marsh level for the majority of 1999 (figure 5).

Emergent vegetation: Total cover values (figure 6) were higher in the reference area, at 76.7% than in the project area at 62.4% . Cover of the dominant species, *Spartina patens* (marshhay cordgrass) was much lower in the project area, at 26.2%, than in the reference area, at 68.9%. Species diversity was much higher in the project area than in the reference area. Only three species were recorded in the reference area compared to twelve species in the project area. *S. patens*, *Distichlis spicata* (saltgrass), and *Paspalum vaginatum* (jointgrass) comprise 100% of the species recorded in the reference area and over 95% of the species recorded in the project area along with *Scirpus robustus*, (leafy threesquare), and *Amaranthus australis* (gulf waterhemp). *Borrichia frutescens* (sea oxeye daisy), *Typha* spp. (cattail), *Iva frustescens* (saltmarsh elder), *Aster* spp. (saltmarsh aster) and *Scirpus americanus* (Olney's threesquare) comprise less than 5% of the emergent vegetation in the project area.

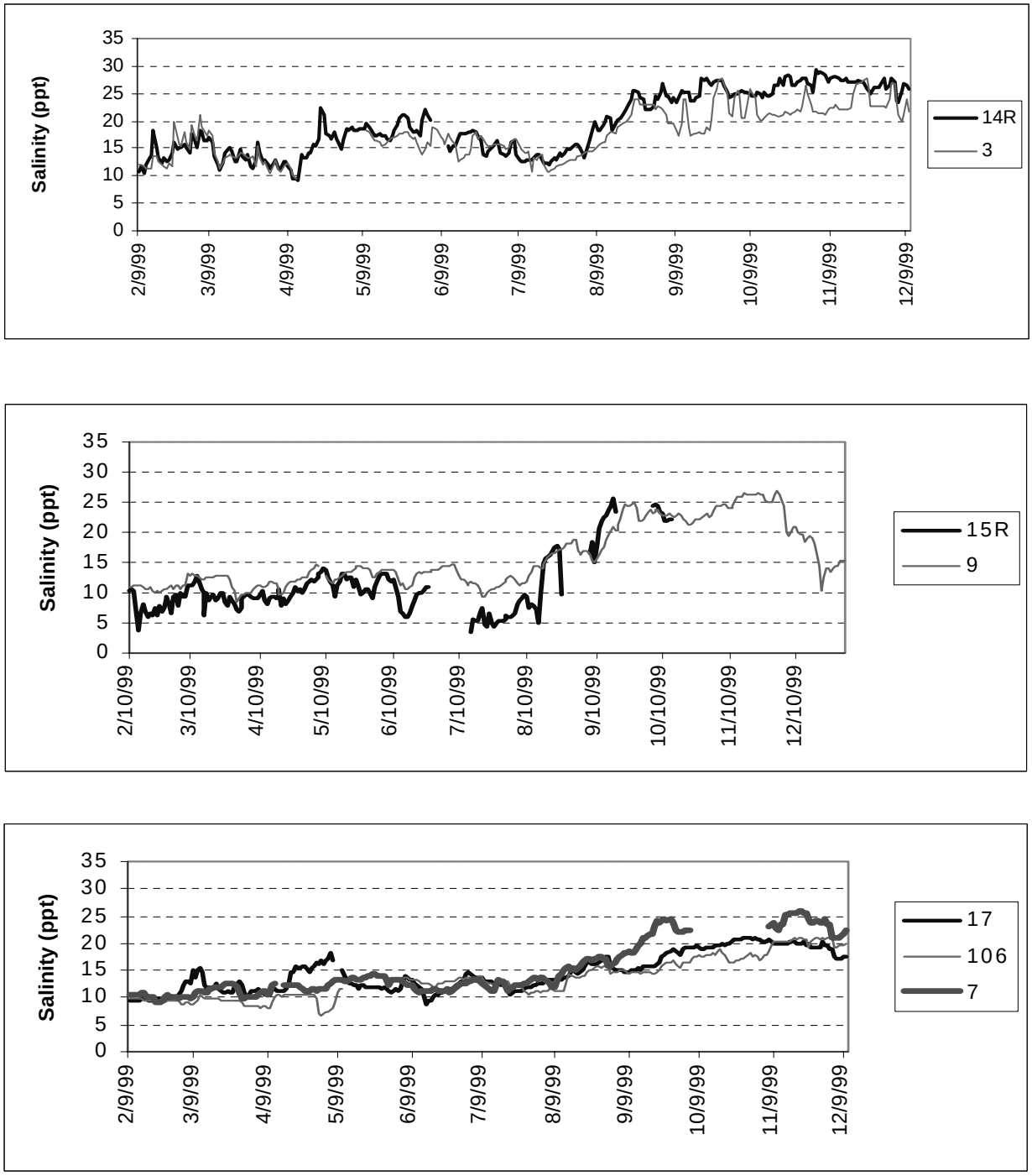

Figure 4. Mean daily salinity values for the southeast corner of CTU 2 (station 3) and reference 1 (station 14R), the northwest corner of CTU 2 (station 9) and reference 2 (station 15R), and the west central portion of CTU 2 (station 17), the southern end of CTU 1 (station 106), and the northern end of CTU 1 (station 7).

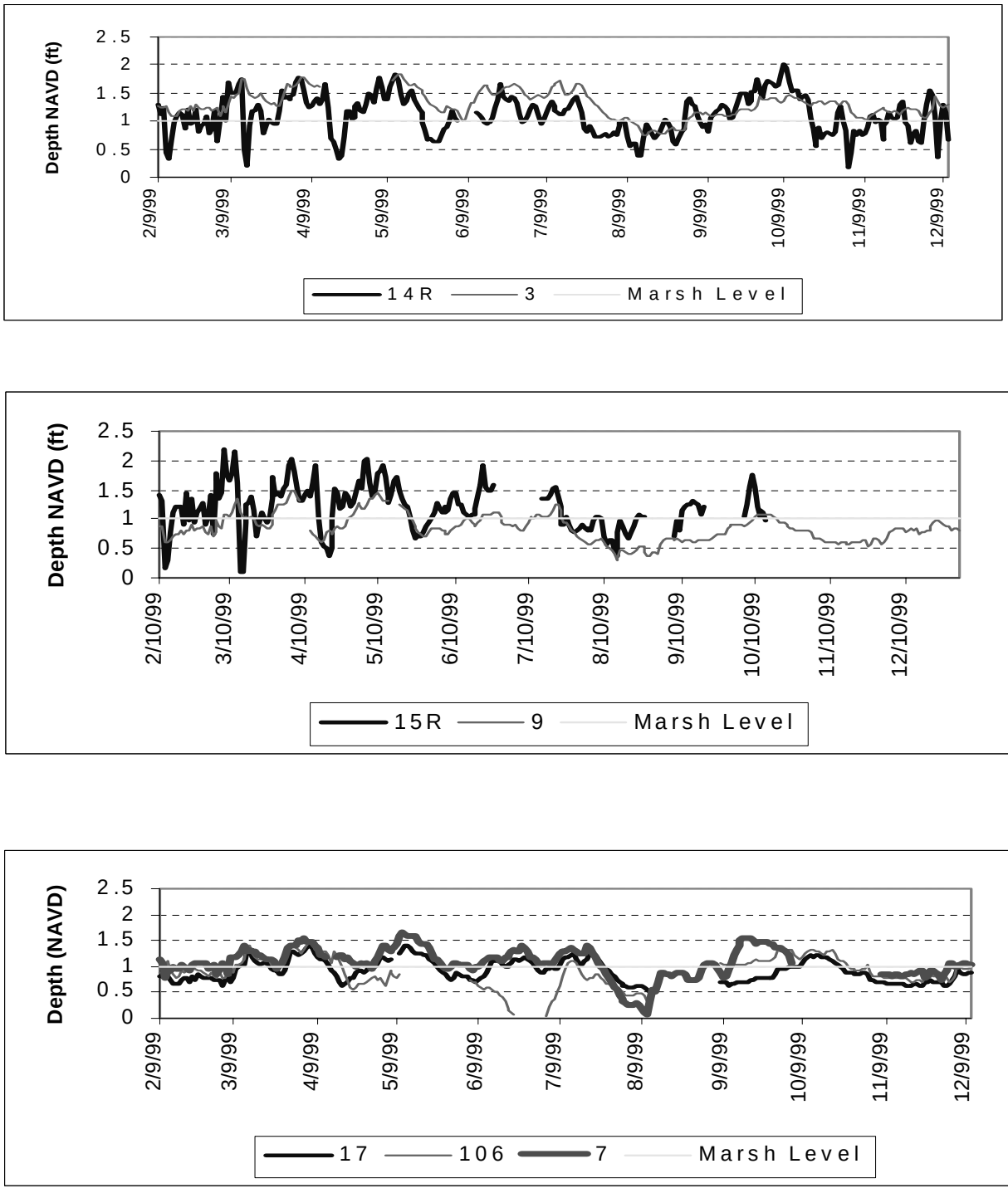

Figure 5. Mean daily depth values for the southeast corner of CTU 2 (station 3) and reference 1 (station 14R), the northwest corner of CTU 2 (station 9) and reference 2 (station 15R), and the west central portion of CTU 2 (station 17), the southern end of CTU 1 (station 106), and the northern end of CTU 1 (station 7).

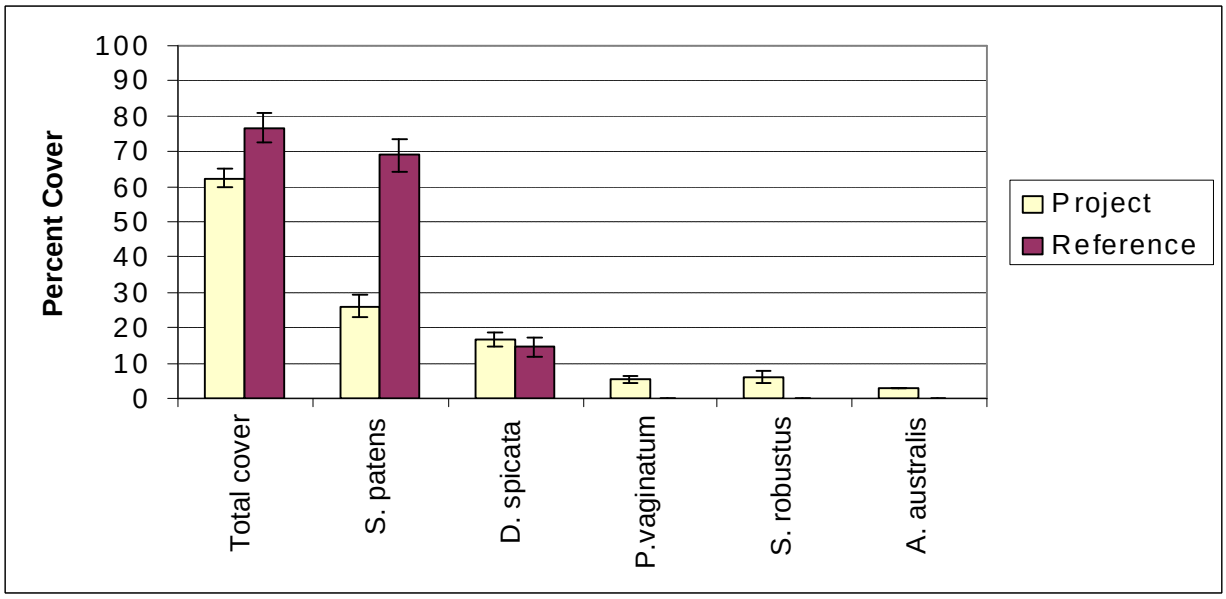

Figure 6. Mean percent cover values for total emergent vegetation and for dominant species in the project and reference areas in July 1999 (sum of percent cover for individual species may exceed 100%).

Discussion

Drought conditions were prevalent throughout 1999 in the southwestern portion of Louisiana as rainfall was below normal nine months of the year (Louisiana Office of State Climatology 1999). The annual rainfall deficit for the area was 13.97 inches. Frontal weather patterns in September caused southerly tides to deliver high salinity water from the Gulf of Mexico through the CSC and into the project area. Since construction in 1996 through December 1998, salinity in the project area was maintained within the 15 ppt threshold for the majority of the sampling period (Weifenbach and Clark, 1999). However, in the latter part of 1999, salinity in CTU 2 was well above15 ppt due, primarily, to the influx of high salinity water through a damaged culvert at structure 4 along the eastern boundary, during the operational phase when all other structures in CTU 2 were closed. Repair of the structure was completed in February 2000. In addition, Second Bayou has been silted in, hindering freshwater input into Mud lake when low water conditions prevail, and preventing closure of the flapgates.

Water levels remained within target ranges for the majority of 1999 at stations 3, 9, and 17 inside the project area despite tidal fluctuations in the reference areas. Water levels in Mud Lake were at or below marsh level for the majority of the year due, in part, to low rainfall.

The vegetation data shows the same trends as the 1997 postconstruction sampling period, indicating lower cover values of *S. patens* in the project area compared to the reference area, higher cover values of *D. spicata* in both project and reference areas, and higher species diversity in the project area than in the reference area. Further analysis on all data will be conducted and presented in the three year comprehensive report scheduled for publication in 2002.

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