Monitoring Series No. ME-12-MSTY-0698-1

CLOSEOUT MONITORING REPORT

SW SHORE WHITE LAKE PROTECTION (DEMO)
ME-12

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

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ABSTRACT

The SW Shore, White Lake Protection DEMO (ME-12) project area consists of approximately 25 ac (10 ha) of fresh and intermediate marsh located on the southwest shore of White Lake at the Vermilion/Cameron Parish line. This area is exposed to high wave energy and severe shoreline erosion. The objectives of this project were to determine the effectiveness of *Scirpus californicus* (California bullrush) as a wave damping technique along a 1 mi (1.6 km) section of the southwest shoreline of White Lake and to reduce shoreline erosion and prevent encroachment of White Lake into the interior fresh marsh vegetation and the shallow water areas of Deep Lake.

In June 1996, 2,650 transplants of *S. californicus* were installed. They were spaced on 6 ft (1.8 m) centers in three rows lakeward from the shoreline. The first, second, and third rows were spaced approximately 25 ft (7.6 m), 35-40 ft (10.7 - 12.2 m), and 50 ft (15.2 m) respectively from the shoreline. Markers consisting of treated 4 in x 4 in x 8 ft (10 cm x 10 cm x 2.4 m) wooden posts were placed at the beginning of each row in each sampling plot. Additional 4 x 4 markers were placed at the vegetated edge of the shoreline in the project and reference area.

The vegetation was monitored post-planting in July 1996 (1 month sampling period), December 1996 (6 month sampling period), and July 1997 (12 month sampling period). Plants in the 6 sampling plots were surviving and tillering after the 1 month and 6 month sampling periods, exhibiting a 98.8 and 76.6 percent survival, respectively. However, at the 12 month sampling period, the percent survival decreased to 0.17. Erosion rates for the project and reference areas, calculated through direct measurements from July 1996 to July 1997, were 11.7 ft/yr (3.6 m/yr) and 2.8 ft/yr (0.9 m/yr), respectively. Water depth combined with high wind generated wave energy were the likely causes of the plantings' lack of success. The results suggest that *S. californicus* has difficulty establishing itself in water depths of approximately 2 ft (0.6 m) in a high energy, wind-driven wave environment, and may not act as an effective wave damping technique.

INTRODUCTION

Shore erosion is a common problem in the bays, sounds, and estuaries of the coastal United States. A wide variety of structures have been developed and used to control this erosion. However, due to environmental objections and economic limitations it is often impractical to use even the most innovative of these structures. Low-cost, non-structural techniques are now available for controlling shore erosion in low wave energy salt and brackish water environments using native marsh plants. Vegetation, where feasible, is usually lower in cost than structures and may be more effective at controlling shore erosion (Knutson and Woodhouse 1983).

In coastal marshes along shorelines, herbaceous plant communities are periodically flooded by salt or brackish water. Vulnerability to wave attack during early stages of establishment prevents the natural invasion of marshes along many shorelines. Even mature natural marshes may suffer permanent damage from severe storms. A common form of damage is the formation of a scarp or bank on the seaward edge of the marsh. Once a scarp is formed it becomes a focal point of continued erosion (Knutson and Inskeep 1982).

To combat continued erosion, the large-scale use of vegetative planting as a restoration technique in Louisiana began through the Louisiana Geological Survey/Coastal Vegetation Section in 1986 when six pilot projects were implemented. These projects utilized various native plants and innovative techniques that have provided information valuable to the successful implementation of vegetative planting projects today. In 1988, the Louisiana Department of Natural Resources (DNR), the Natural Resources Conservation Service (NRCS, formally Soil Conservation Service), and the Soil and Water Conservation Committee (SWCC) agreed to work together to plant and monitor eight vegetation projects. It was through this agreement that agencies began a concerted effort to work together and share information on vegetation establishment (Bahlinger 1995).

Marsh plants perform two functions in abating erosion. First, their aerial parts form a flexible mass which dissipates wave energy. As wave energy is diminished, both the offshore transport and the longshore transport of sediment are reduced. Optimally, dense stands of marsh vegetation can create a depositional environment, causing accretion rather than erosion of the shore face. Second, many marsh plants form dense root-rhizome mats which add stability to the shore sediment. This protective mat is of particular importance during severe winter storms when the aerial stems provide only limited resistance to the impact of waves. Soils are believed to be more resistant to erosion where vegetation is healthier because soil strength is associated with live root biomass rather than dead roots or mineral sediments (McGinnis 1997). Vegetative plantings and seeding have been shown to retard conversion of marsh to open water, reduce erosion of lake shorelines, canal banks, dunes or other marsh-water interfaces, and promote reestablishment of emergent wetland vegetation (Knutson and Woodhouse 1983; Materne and Schexnayder 1993).

White Lake (29º 45' N. , 92º 30' W.) covers an area of 51,649 ac (20,902 ha) in the western portion of Vermilion Parish in Southwest Louisiana (Barrett 1970). White Lake lies within the Mermentau River Basin, which drains the area between the Calcasieu, Red, and Atchalafaya Rivers (Gunter and

Shell 1958). It is separated from the Gulf of Mexico by two cheniers, Grand Chenier and Pecan Island. White Lake is connected to Grand Lake by a canal, and the only outlets from these two lakes to the Gulf of Mexico are the Mermentau River and Schooner Bayou (Old Intracoastal Waterway). These outlets contain water-control structures that minimize saltwater intrusion and floods, and impound fresh water used by rice farmers and cattlemen for irrigation (Morton 1973).

High wave energy generated across the long fetch of White Lake is believed to be responsible for severe shoreline erosion in the project area. The shoreline erosion rate for the SW White Lake area averaged 11.9 ft/yr (3.6 m/yr) between 1974 and 1990 (Brown and Root 1992). This wave-induced erosion has led to the formation of a pronounced cutbank along the project area's vegetated marsh edge. Water depth immediately adjacent to the shoreline ranges from 2.0 to 3.0 ft (0.6 to 0.9 m); whereas the water depth within the planting area, 25 ft (7.6 m) lakeward of the shoreline, ranges from 1.0 to 1.5 ft (0.3 to 0.5 m). If wave erosion persists along the natural lake shoreline, the encroachment of White Lake into the Deep Lake wetlands is inevitable.

The SW Shore White Lake Shoreline Protection Demonstration (ME-12) project area consists of approximately 25 ac (10 ha) of fresh to intermediate marsh. The project is located in the Lake's sub-basin on the southwest shore of White Lake at the Vermilion/Cameron parish line north-west of Alligator Lake (figure 1). The shoreline plant community is comprised mainly of *Phragmites australis* (roseau cane), *Colocasia antiquorum* (elephant ear), *Scirpus californicus* (California bullrush), and *Sagittaria lancifolia* (bulltongue).

The objectives of the project are to determine the effectiveness of *S. californicus* plantings as a wave damping technique, and to prevent the encroachment of White Lake into the adjacent interior marsh by reducing the rate of shoreline erosion. The specific goal is to decrease the rate of shoreline erosion along the southwest shoreline of White Lake.

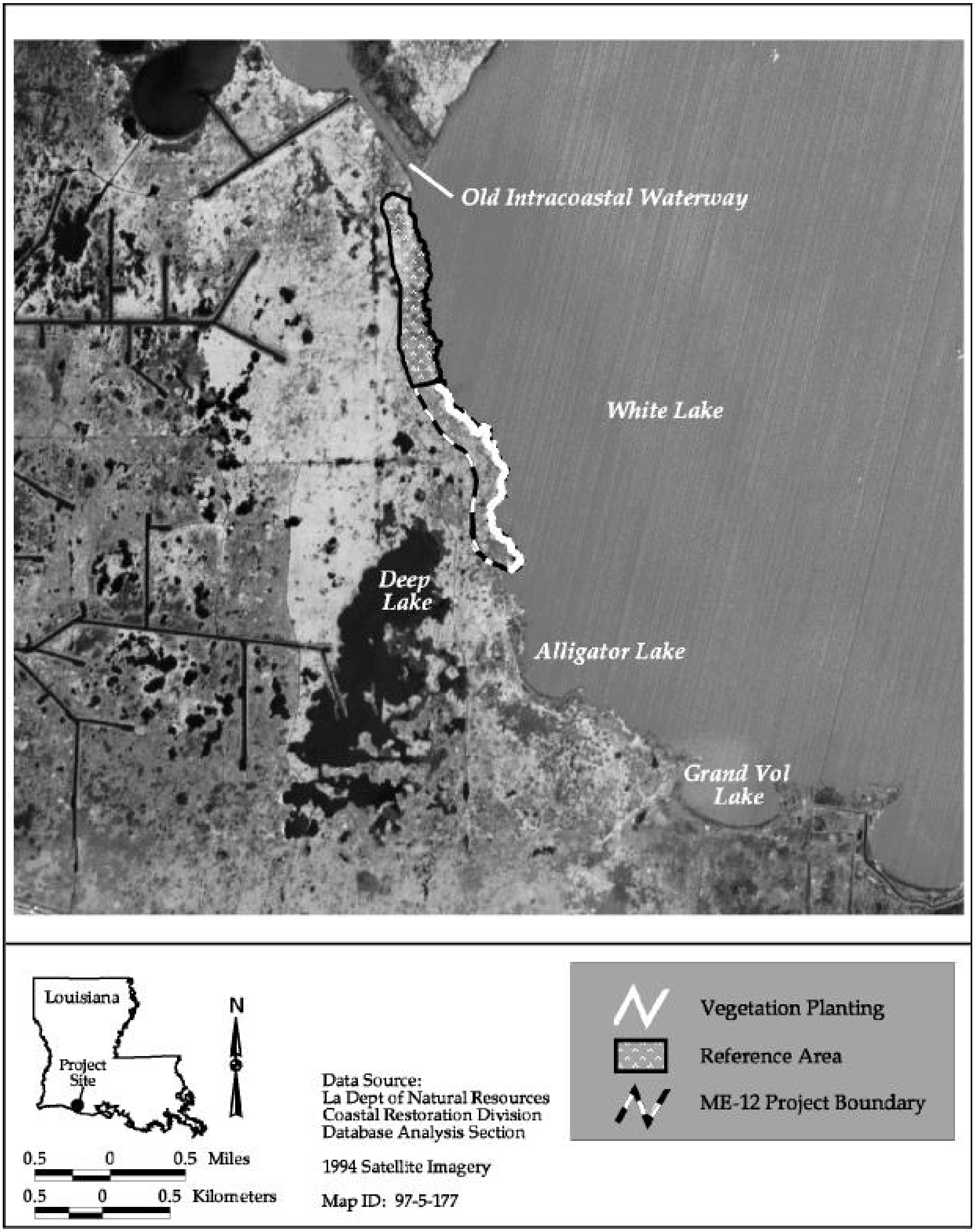


Figure 1. SW Shore White Lake Protection DEMO (ME-12) project and reference area boundaries and vegetation planting locations.

METHODS

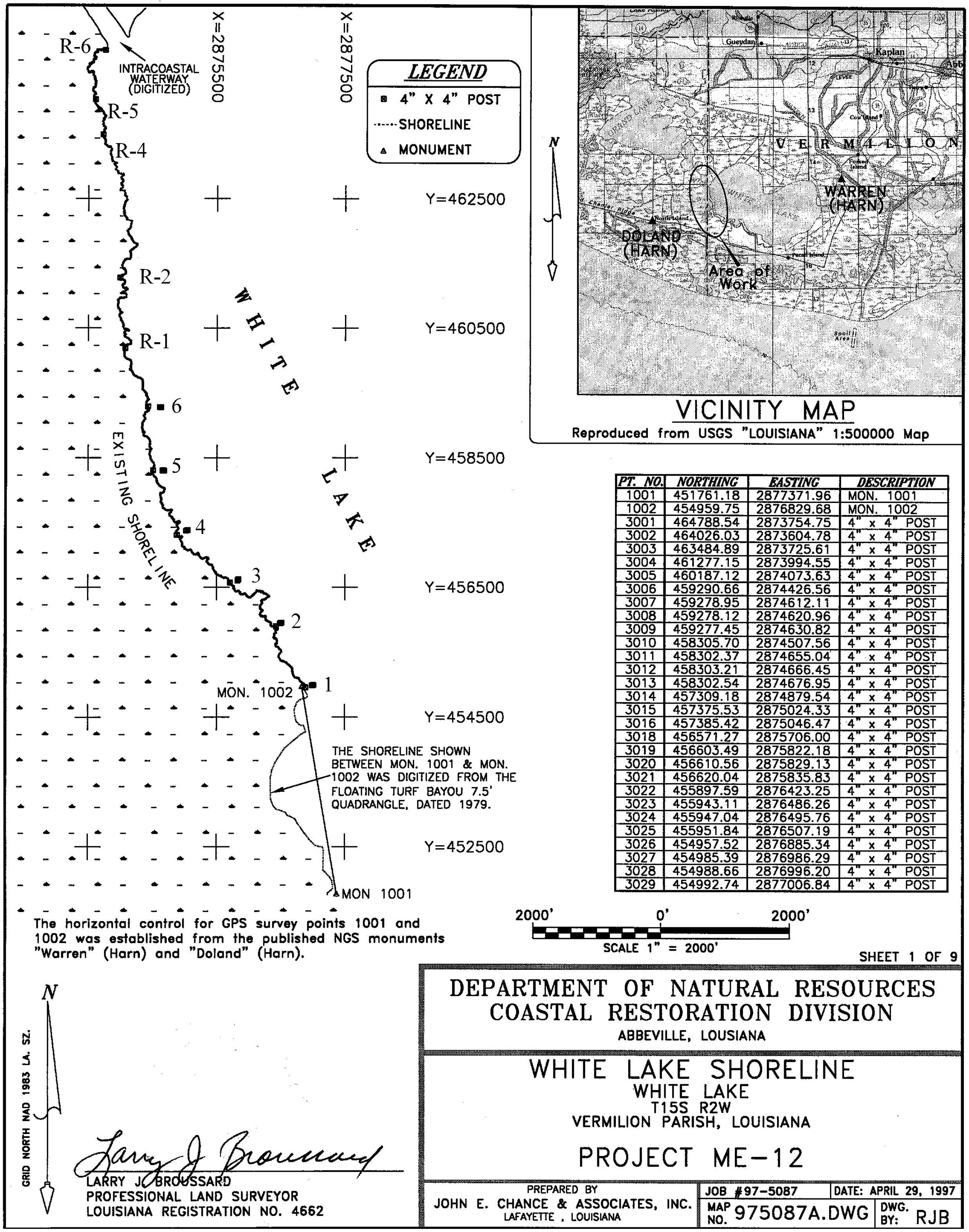
A detailed description of the monitoring design over the entire project life can be found in Miller (1998).

Aerial Photography: Near-vertical color-infrared aerial photography 1:12,000-scale was used to measure vegetated and non-vegetated areas for the project and reference sites. Aerial photography was scanned, mosaicked, and georectified by National Wetlands Research Center (NWRC) personnel according to the standard operating procedures described in the *Quality Management Plan for Coastal Wetlands Planning, Protection, and Restoration Act* (Steyer et al. 1995). Color-infrared aerial photography of the pre-construction project and reference areas was obtained on December 19, 1994. The photography was checked for flight accuracy, color correctness, and clarity. The duplicate photography was prepared for scanning and analysis, and the original film was archived. Using ERDAS Imagine, an image processing and geographic information system (GIS) software package, a digital file with 300 pixels-per-inch resolution was created from the photography. The photography was then mosaicked and used for basemap production (map ID 98-2-023). Global Positioning System (GPS) points were collected in August 1995 in the field to georectify the basemap to a Universal Transverse Mercator (UTM) coordinate system. The resulting preconstruction map was analyzed using ERDAS Imagine to determine land and water acreage (map ID 98-2-024). Postconstruction aerial photography will not be obtained for this project since the vegetative plantings were unsuccessful and monitoring was discontinued.

Shoreline change: Eighteen vegetation markers and twelve shoreline markers, consisting of single 4 in x 4 in x 8 ft (10 cm x 10 cm x 2.4 m) wooden posts, were placed at 1000 ft (305 m) intervals within each row of the plantings and adjacent to the shoreline at the vegetated marsh edge in the project and reference areas. The vegetation markers were used as reference points to determine lateral spread and percent survival of the plantings. The shoreline markers were designated as reference points to take direct measurements of shoreline position. The reference area, which contained six of the shoreline marker posts, was monitored for shoreline position only.

A shoreline location survey was conducted on April 29, 1997 (figure 2). This survey included 11 permanent marker locations, 6 in the project area and 5 in the reference area. One reference station (R-3) was missing at the time of the survey. Measurements were taken from the 4x4 shoreline marker to the existing shoreline. Vegetation marker posts in the project area were included in the survey.

To document shoreline movement, Department of Natural Resources (DNR) personnel used the shoreline markers within the project and reference areas to take direct measurements from the back side of the marker posts towards the vegetated marsh edge. Additional PVC marker poles were added 20 ft (6.1 m) west of the existing shoreline markers, and a compass bearing to the marker was recorded to assure that the original wooden shoreline marker posts could be reestablished if lost. Measurements were taken in July 1996, the 1 month sampling interval, to establish the distance from the 4x4 shoreline marker post to the existing shoreline. Shoreline retreat was determined by



PT. NO.	NORTHING	EASTING	DESCRIPTION
1001	451761.18	2877371.96	MON. 1001
1002	454959.75	2876829.68	MON. 1002
3001	464788.54	2873754.75	4" x 4" POST
3002	464026.03	2873604.78	4" x 4" POST
3003	463484.89	2873725.61	4" x 4" POST
3004	461277.15	2873994.55	4" x 4" POST
3005	460187.12	2874073.63	4" x 4" POST
3006	459290.66	2874426.56	4" x 4" POST
3007	459278.95	2874612.11	4" x 4" POST
3008	459278.12	2874620.96	4" x 4" POST
3009	459277.45	2874630.82	4" x 4" POST
3010	458305.70	2874507.56	4" x 4" POST
3011	458302.37	2874655.04	4" x 4" POST
3012	458303.21	2874666.45	4" x 4" POST
3013	458302.54	2874676.95	4" x 4" POST
3014	457309.18	2874879.54	4" x 4" POST
3015	457375.53	2875024.33	4" x 4" POST
3016	457385.42	2875046.47	4" x 4" POST
3018	456571.27	2875706.00	4" x 4" POST
3019	456603.49	2875822.18	4" x 4" POST
3020	456610.56	2875829.13	4" x 4" POST
3021	456620.04	2875835.83	4" x 4" POST
3022	455897.59	2876423.25	4" x 4" POST
3023	455943.11	2876486.26	4" x 4" POST
3024	455947.04	2876495.76	4" x 4" POST
3025	455951.84	2876507.19	4" x 4" POST
3026	454957.52	2876885.34	4" x 4" POST
3027	454985.39	2876986.29	4" x 4" POST
3028	454988.66	2876996.20	4" x 4" POST
3029	454992.74	2877006.84	4" x 4" POST

Figure 2. SW Shore White Lake Protection DEMO (ME-12) plan view showing the project and reference area.

subtracting retreat measurements taken in December 1996, the 6 month sampling period, and in July 1997, the 12 month sampling period, from the 1 month measurement. Means and standard deviation (SD) of shoreline retreat for both the project and reference area were calculated.

Vegetation: On June 7, 1996, approximately 2,650 *S. californicus* plantings were installed. The plantings were spaced on 6 ft (1.8 m) centers, in three rows approximately 10 ft (3.0 m) apart, within the 1.0 to 1.5 ft (0.3 to 0.5 m) contours. The first planting row is located approximately 25 ft (7.6 m) from the lake shoreline, the second row is located approximately 35 - 40 ft (10.7-12.2 m) from the lake shoreline, with the third planting row approximately 50 ft (15.2 m) from the lake shoreline. The general condition of the plantings was documented using a methodology similar to Mendelssohn and Hester (1988). Percent survival was expressed as the number of live plants divided by the number of plantings and multiplied by 100. Percent survival was determined at 6 randomly selected plots of 15 plants (5 plants on each of 3 rows), defined by the vegetation marker posts. This represents a 3 percent sub-sample of the entire planting. Percent survival from the six plots was used to determine the mean percent survival for the project area. Means and standard deviation (SD) on percent survival for both the project and reference area were calculated.

Measurements were taken east (lakeside) and west (shoreline) of the vegetation marker posts to determine lateral spread and amount of tillering of the transplanted vegetation (figure 3). Measurements from the six plots were averaged to obtain a mean and standard deviation (SD) for lateral spread for the 1 month, 6 month, and 12 month sampling period.

Planting survival was evaluated in terms of four variables (Harper 1977), which are defined and calculated as follows:

$$\text{survival frequency} = \text{number of live plants inside plot at timepoint } x$$

$$\text{mortality rate } (q_x) = \text{probability of a planting at age } x \text{ dying before the age of } x+1 = \frac{l_x - l_{x+1}}{l_x} = \frac{d_x}{l_x}$$

$$\text{mortality } (d_x) = \text{probability (at planting time) of dying during age interval } x, x+1 = l_x - l_{x+1}$$

$$\text{survivorship } (l_x) = \text{probability (at planting time) of surviving until age } x = \frac{\text{no. live plants inside plot at timepoint } x}{\text{original no. plants inside plot}}$$

Submersed aquatic vegetation (SAV) was identified and presence/absence of SAV was documented by ocular estimates every 1000 ft (305 m) between existing vegetation markers and corresponding shoreline marker.

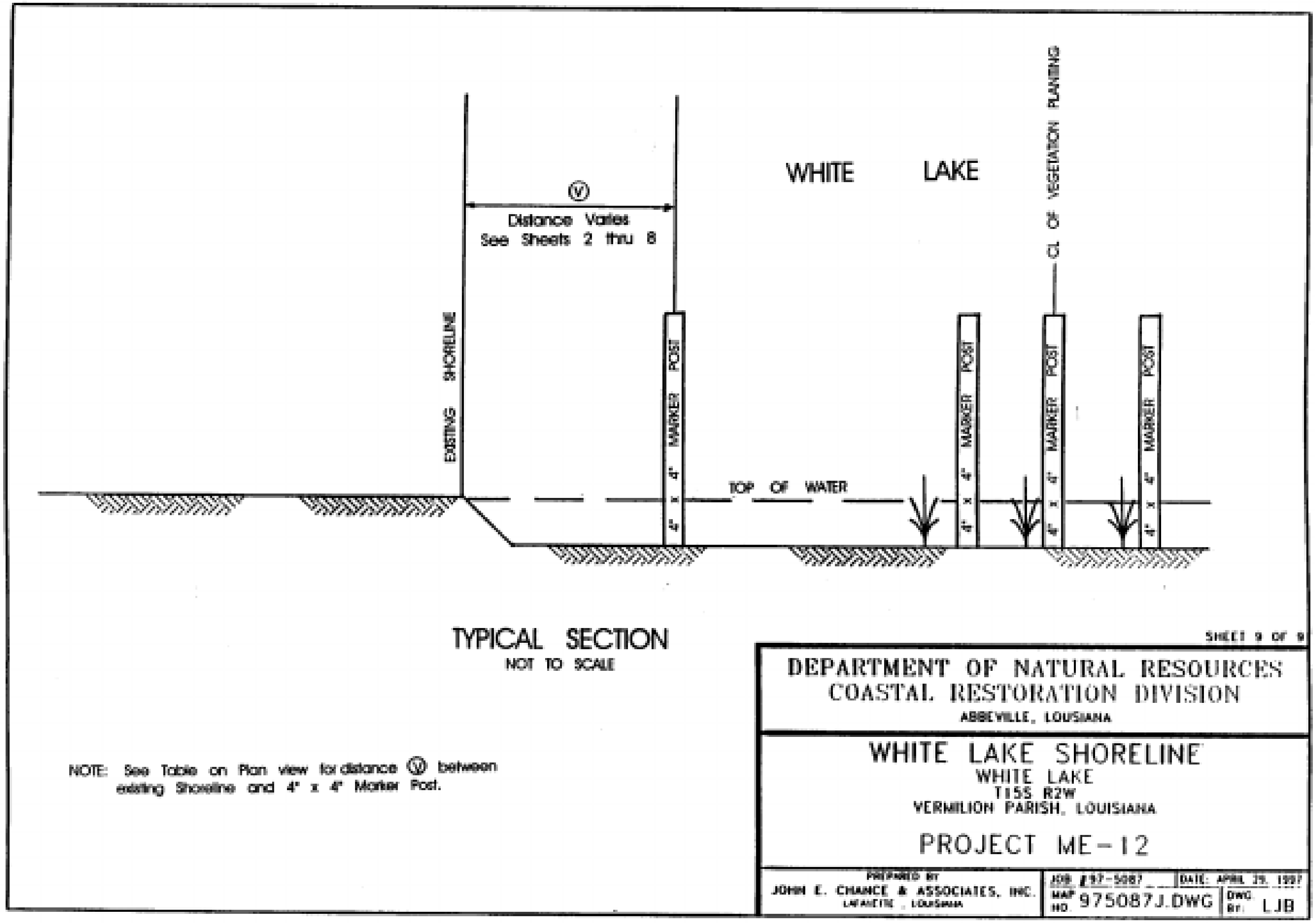


Figure 3. SW Shore White Lake Protection DEMO (ME-12) typical section showing existing shoreline, marker posts where direct measurements were taken, and location of plantings.

RESULTS

Aerial Photography: The GIS analysis showed that at the time of the flight, the project area consisted of 145.5 ac (58.2 ha) of land and 20.5 ac (8.2 ha) of water. The reference area contained 142.6 ac (57 ha) of land and 21.9 ac (8.8 ha) of water (figure 4). The GIS land-water classification analysis was conducted on the approved project boundaries, but after further discussion with monitoring managers and sponsoring agency personnel, a 75 ft (22.9 m) coastline buffer was added to the project and reference areas to further study any transgression or regression of the shoreline. This increase is reflected in the acreage results from the GIS analysis.

Shoreline change: Erosion was measured at all stations in the project area at the 12 month sampling period (table 1). Plot 6 showed the largest amount of erosion at 24.5 ft/yr (7.5 m/yr). Mean shoreline change within the project area was -1.9 ft $\pm$ 1.1 SD (-0.58 m $\pm$ 0.33), and -11.7 ft $\pm$ 3.3 (-3.57 m $\pm$ 1.0), at the 6 month and 12 month sampling period, respectively. In the reference area, R-1, R-2, R-4, and R-5 indicated erosion. R-3 had to be reestablished because the 4x4 shoreline marker post was missing. R-3 showed a 1.0 ft (0.3 m) gain while R-6 had no net loss. Mean shoreline change in the reference area was -0.6 ft $\pm$ 1.1 (-0.2 m $\pm$ 0.3), and -2.8 ft $\pm$ 1.3 (-0.9 m $\pm$ 0.4), at the 6 month and 12 month sampling period, respectively (figure 5).

Vegetation: Summary statistics from the vegetation surveys conducted at the 1, 6, and 12 month sampling period indicated that survivorship of *S. californicus* in the project area decreased from 0.99 at 1 month to 0.77 at 6 months with mortality increasing from 0.01 to 0.22 (table 2). At the 12 month sampling period survivorship decreased to 0.01 with mortality increasing to 0.76. Mean percent survival of the vegetative plantings was 98.8 $\pm$ 2.7 at the 1 month sampling period and decreased to 76.6 $\pm$ 34.7 at the 6 month sampling period. At the 12 month sampling period, percent survival decreased to 0.17 $\pm$ 0.4 (figure 6). Mean lateral spread of the vegetative plantings was 11.6 in $\pm$ 5.7 (29 cm $\pm$ 14.5) at the 1 month sampling period, and13.6 in $\pm$ 7.7 (35 cm $\pm$ 19.6) at the 6 month sampling period. The mean lateral spread of the vegetative plantings was 0.0 in (0.0 cm) at the 12 month sampling period (figure 7).

During the 1 month and 6 month sampling period there were no observed signs of submersed aquatic vegetation. During the 12 month sampling period, *Nelumbo lutea* (American lotus) was noted in plots 2 and 3 in the project area and in plots 5R and 6R in the reference area.

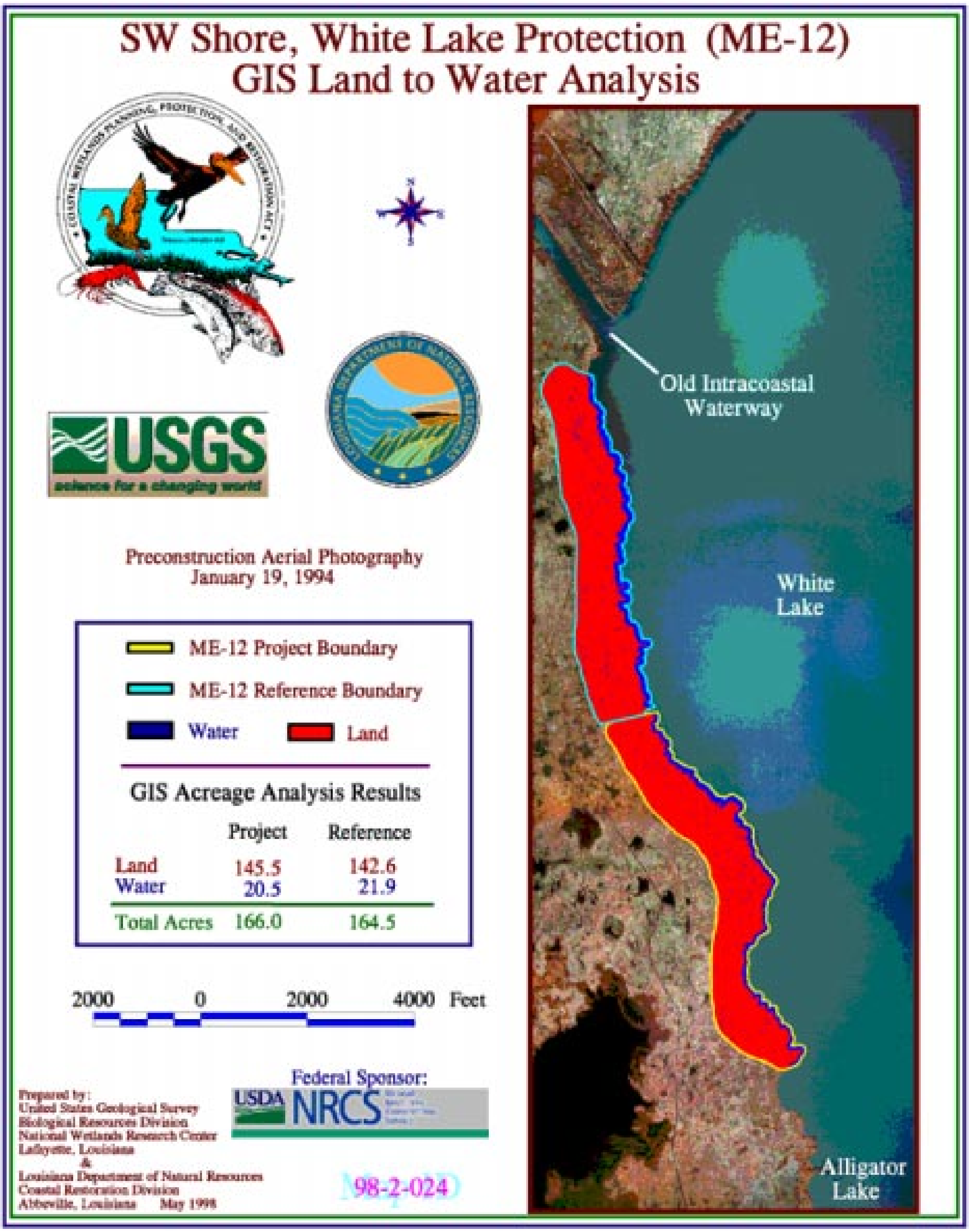


Figure 4. SW Shore White Lake Protection DEMO (ME-12) land/water acreage analysis.

Table 1. Shoreline changes calculated through direct measurements at the SW Shore White Lake Protection DEMO (ME-12) project and reference area monitoring sites from July 2, 1996 to July 23, 1997. Negative values represent shoreline retreat and positive values represent gain.

Plot Number		Shoreline Movement (ft)
1		-6.8
2		-12.8
3		-7.6
4		-9.6
5		-8.8
6		-24.5
	Mean:	-11.7
R-1		-0.5
R-2		-6.6
R-3[aa]		+1.0
R-4		-5.5
R-5		-5.4
R-6		0.0
	Mean:	-2.8

[aa]= Shoreline marker was missing and had to be reestablished using the hub.

Table 2. Partial life of *S. californicus* plantings in the SW Shore White Lake Protection DEMO (ME-12) project area, based on means of data collected from six 15-plant sampling plots, from July 2, 1996 to July 23, at 1, 6, and 12 month postplanting.

Age (mo)	Survival Frequency (n)	Survivorship	Mortality	Mortality Rate
0	15.00	1	0.00	0.01
1	14.83	0.99	0.01	0.22
6	11.50	0.77	0.22	0.99
12	0.17	0.01	0.76	___

n=mean # plants living per plot

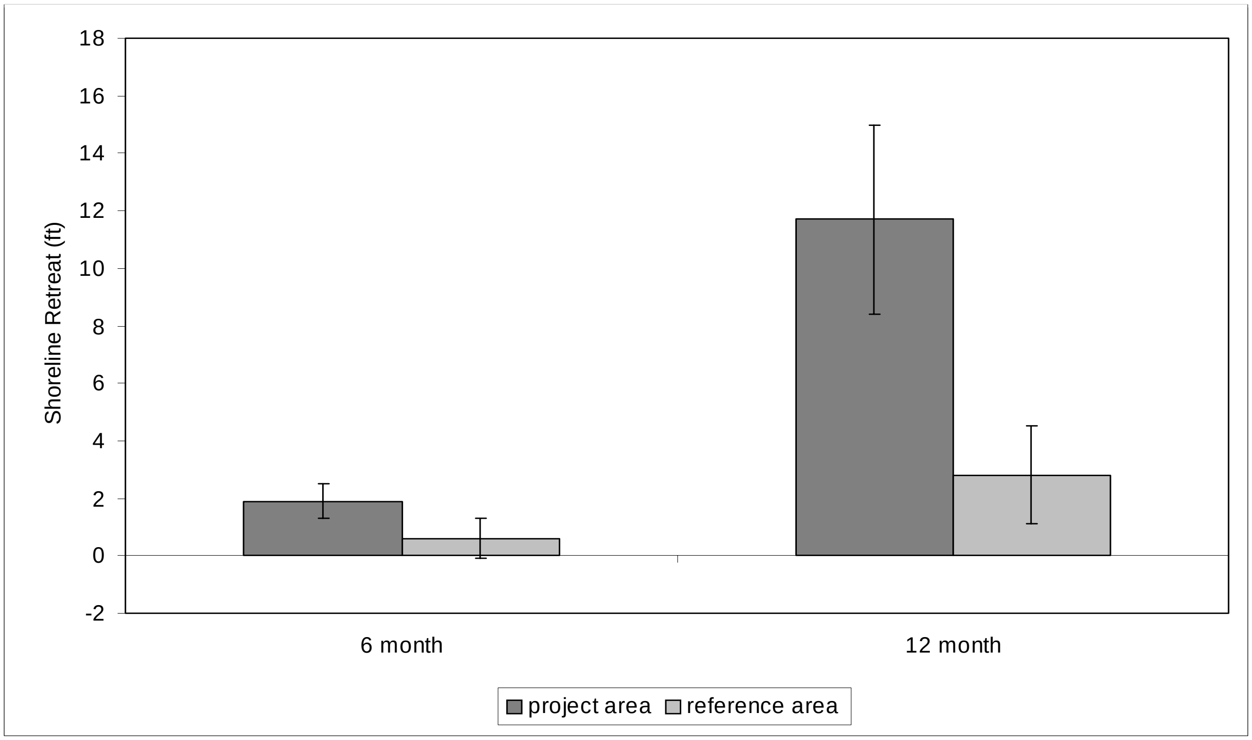


Figure 5. SW Shore White Lake Protection DEMO (ME-12) showing shoreline retreat (feet) in the project and reference area at the 6 and 12 month sampling period.

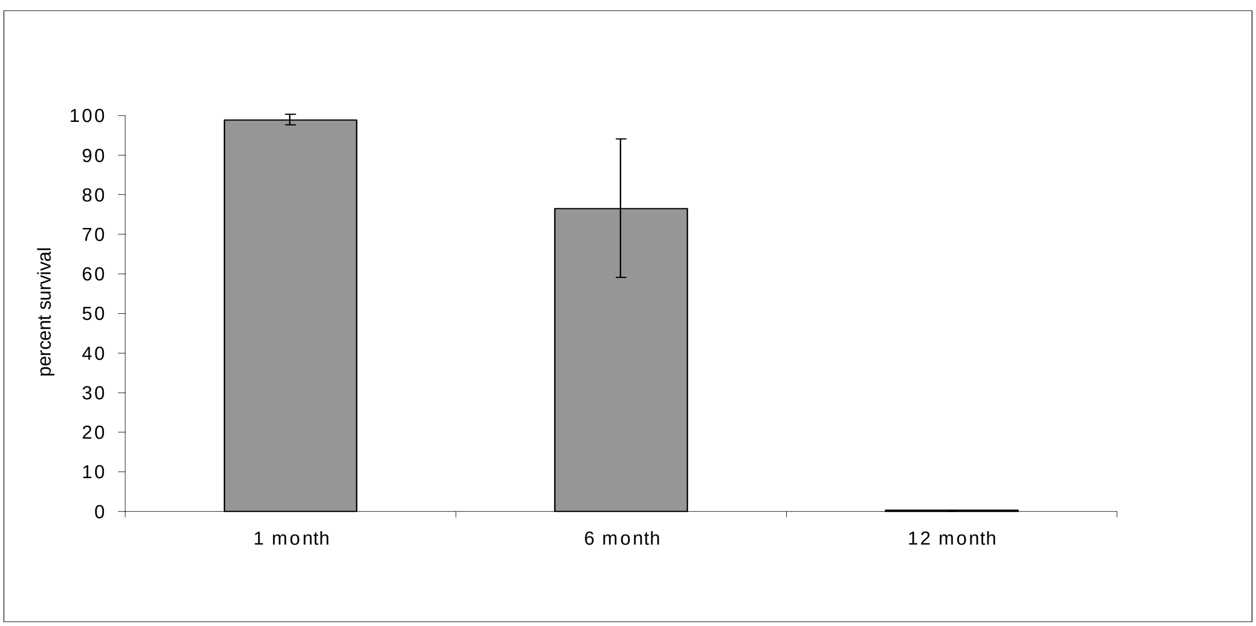


Figure 6. SW Shore White Lake Protection DEMO (ME-12) vegetative percent survival in the project area at the 1, 6, and 12 month sampling period.

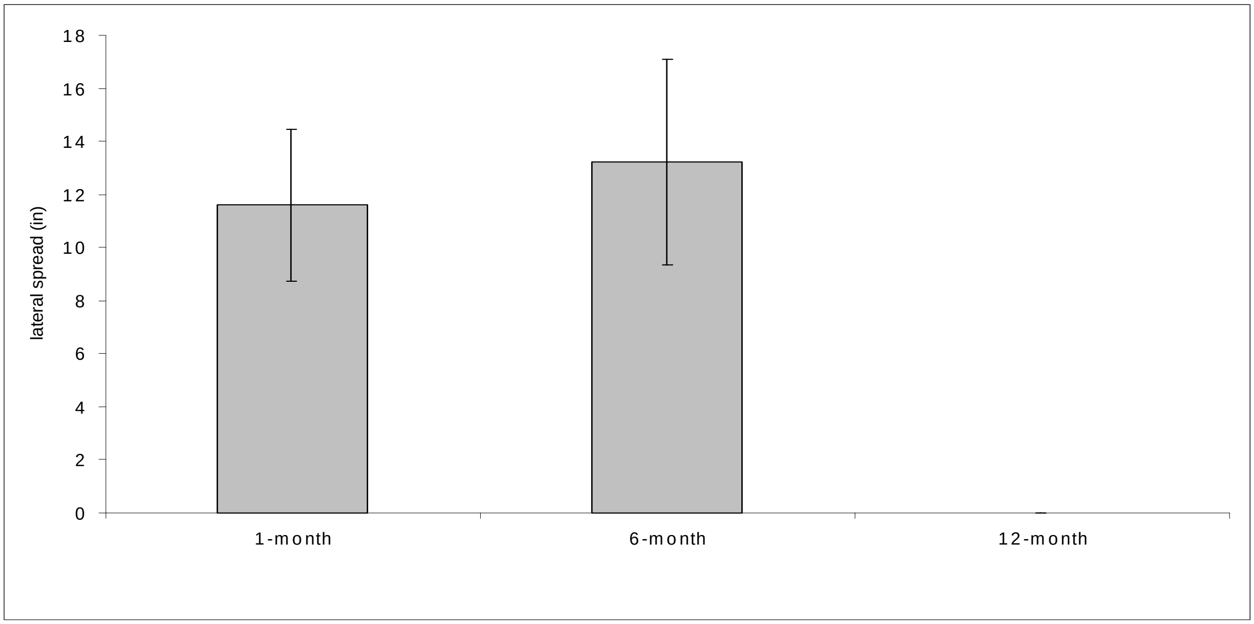


Figure 7. SW Shore White Lake Protection DEMO (ME-12) vegetative lateral spread (inches) in the project area at the 1, 6, and 12 month sampling period.

DISCUSSION

The shoreline erosion rate of 11.7 ft/yr (3.6 m/yr) in the project area is consistent when compared to 11.9 ft/yr (3.6 m/yr) between 1974 and 1990 (Brown and Root 1992). Shoreline location surveys were scheduled for 1999 and 2001. However, because this project has been deauthorized, future surveys will not be conducted. The plants were probably not a factor in decreasing the rate of shoreline erosion because they never became established.

The dominant soil type in the project and reference areas has been mapped as Larose mucky clay, which consists of very poorly drained soil in freshwater marshes. Many areas with Larose mucky clay soils are intermittently submerged and occur as small to large shallow lakes (U.S. Department of Agriculture, Natural Resources Conservation Service [USDA/NRCS] 1996). After physical inspection of the project and reference areas, the soil types in the project and reference area appear to be different than what is mapped by USDA/NRCS 1996. DNR personnel observed the bank vegetation in the project area and noted that plant species such as *P. australis*, *C. antiquorum*, and *Sagittaria latifolia* (arrowhead) were dominant, with a few small *Sapium sebiferum* (Chinese tallow tree) and *Salix nigra* (black willow). The area between the shoreline marker posts and the existing shoreline at the 12 month sampling period was a mud flat with approximately 1 ft (0.3 m) of water. Throughout this mud flat there were a series of deep pits about 3 ft (0.9 m) deep. At the bottom of these pits was a hard layer of sand and clay. In the reference area, *S. sebiferum* and *S. nigra* were dominant. The area between the shoreline marker posts and the existing shoreline was about 1 to 2 ft (0.3 to 0.6 m) deep with a firm layer of sand and clay. The project area appeared to be eroded marsh that had become part of the lake while the reference area appeared to be a historical ridge or spoil from the Old Intracoastal Waterway. Different types of vegetation and soil characteristics could be the factors contributing to the difference in erosion rates between the project and reference areas.

The project area showed a great deal of variance among the plots. The points along the shoreline were characterized by a sharp cutbank while the coves had gentle sloping banks. Plot 1 and 2 were both considered points but were very different in configuration. Plot 1 was a rounded wide point that tapered slightly. Plot 2 was a narrow point that once eroded exhibited a high erosion rate (figure 8). Plots 3 through 5 were similar coves with few defining characteristics such as an adjacent lobe or jagged shoreline. Plot 6 was a cove forming off of the side of a lobe jetting out into the lake with similar conditions to plot 2. In July 1996, the 1 month sampling period, DNR personnel noted the bank at plot 6 was sparsely vegetated with a few trees on the high areas of the lobe but in December, 1996, during the 6 month sampling period, the lobe was unvegetated. In July, 1997, during the 12 month sampling period, the lobe was approximately eighty-five percent eroded and the trees that remained were in standing water (figure 8). This situation was present throughout the entire project area shoreline where long thin points with traces of vegetation eroded leaving open water with uprooted trees and stumps scattered along the shoreline. All reference area sites were noted to be in coves without the extreme variance represented in the project area.

(A) July 1997

(B) July 1997

Figure 8. Photographs: (A) plot 2 showing an eroding lobe and the plot absent of *Scirpus californicus* plantings; (B) plot 6 showing another eroding lobe with trees in standing water with one *Scirpus californicus* planting present in the plot.

East to north-east winds were dominant in August, September, and October of 1996 (Louisiana Office of State Climatology [LOSC] 1996) and in January, February, April, and May of 1997 (LOSC 1997). These east to north-east winds may have caused greater erosion to the project than the reference area since the project area is positioned south of the reference area which is protected by tall trees on the north shore of White Lake.

In June and July 1996, the one month sampling period, the general wind direction was south to south-west (LOSC 1996). The plants were protected from wind generated waves for this sampling period, and survival was high. Throughout August, September, and October north-east to east winds were dominant. In November and December southerly winds dominated the area (LOSC 1996). At the December sampling period vegetation was noted to be less vigorous. Between the 1 month and 6 month sampling periods, plot 4 was smothered by a large raft of *Eichornia crassipes* (water hyacinth) which drastically lowered mean percent survival. In addition, this sampling period fell in the winter months when the vegetation was in a dormancy phase. The plants were on the decline with the most severe winter months ahead. The wave energy provided by the north-east to east winds may have weakened the plantings, exposing them to further stress. Had the plantings occurred earlier in the spring, the vegetation may have become better established and been able to survive the stresses of the fall and winter months. Average water depth in the plots, measured at the 12 month sampling period, was 2.0 ft (0.6 m). This water depth combined with east to north-east wind conditions may have produced waves that were too high for the plantings to tolerate. DNR personnel noted on July 23, 1997 that the plantings were in place with dead stems and retaining anchors still intact indicating that the plantings were not uprooted by the high wave energy generated through strong winds.

Salinity at the12 month sampling period in all six plots was 0.1 parts per thousand (ppt). Continuous hourly salinity data collected by DNR personnel in the eastern marsh of White Lake indicated a range of 0.0 ppt to 1.8 ppt from June 1996 to July 1997. Although most of the Calcasieu/Sabine Basin suffered a severe drought from February 1996 to July 1996, which led to several cases of plant stress due to high salinities, that was not the cause of this plantings' lack of success.

DNR and NRCS personnel investigated the entire project area noting that all six monitoring plots were devoid of *S. californicus* plantings except for station 6, which had one two-stemmed plant in the entire plot. Of the 2,650 *S. californicus* plants planted in the project area, only 30 to 40 were present after 12 months.

The only type of submersed aquatic vegetation present in stations 2, 3, R5, and R6 at the end of the 12 month sampling period was *N. lutea*. The stands of *N. lutea* that were present during the warmer months did provide some shore protection from southerly winds but were not very thick in the project or reference area. In areas near the project, *N. lutea* bordered the shoreline reaching out into the lake as much as 50 ft (15.2 m) (figure 9). In Grand Vol Lake, south of the project area (figure 1), DNR personnel observed at the 12 month sampling period that *N. lutea* covered approximately 75% of the lake. During the colder months *N. lutea* goes through a dormancy phase when most of the leaves and stems are not present. *N. lutea* does not protect the shoreline from the northern winds that are most common in the colder months. There were no other types of SAV observed in the vicinity of the project and reference areas, which may be a due to turbid waters that are common to this area.

July 1997

Figure 9. Photograph showing an area south of the project area where *Nelumbo lutea* is encroaching out lakeward providing some shore protection during the warmer months of the year.

CONCLUSION

The results presented in this report suggest that *S. californicus* was not effective as a wave damping technique along the 1 mi (1.6 km) section of the southwest shoreline of White Lake. Unsuccessful establishment of the *S. californicus* plantings contributed to not meeting the goal of decreasing the rate of shoreline erosion along the southwest shoreline of White Lake. We hypothesize that the plantings had difficulty establishing due to the combined effects of water depth and high wind-driven wave energy. This does not indicate that all vegetative planting projects would be a failure in this area. Perhaps a different type of vegetation, another location, an earlier planting time, or some type of structure to lower the wave energy would increase the chances of success.

Based on the monitoring results, the SW shore White Lake Protection Demonstration project was recommended for deauthorization on December 11, 1997, and officially deauthorized by the Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Task Force on October 21, 1998.

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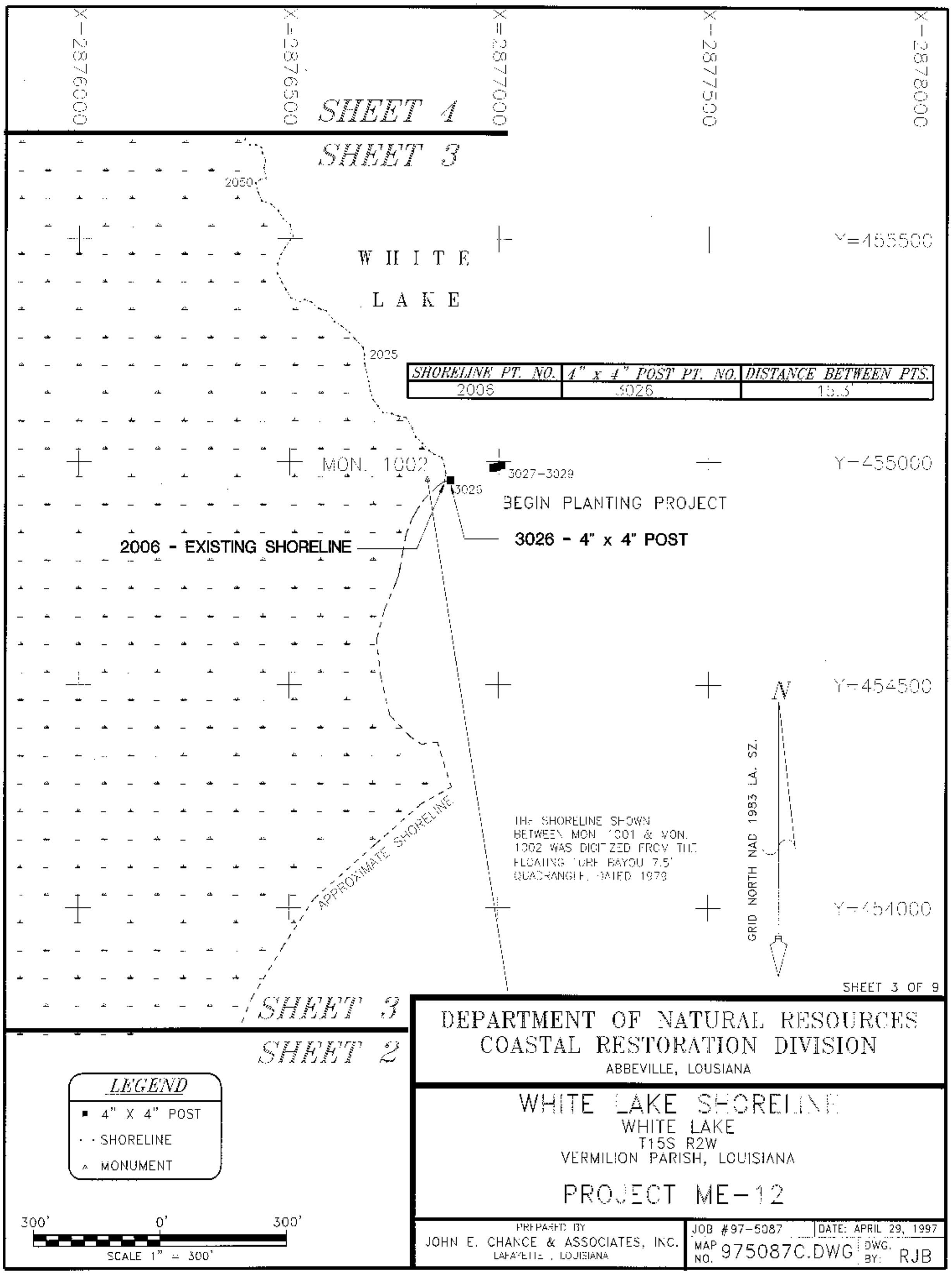
APPENDIX

Shoreline Profile Data



SHORELINE PT. NO.	4" x 4" POST PT. NO.	DISTANCE BETWEEN PTS.
2006	3026	15.5'

Figure A1. SW Shore White Lake Protection DEMO (ME-12) shoreline location survey showing station 1 (3026) in the project area, plant sampling location, and the distance from the shoreline marker to the existing shoreline.

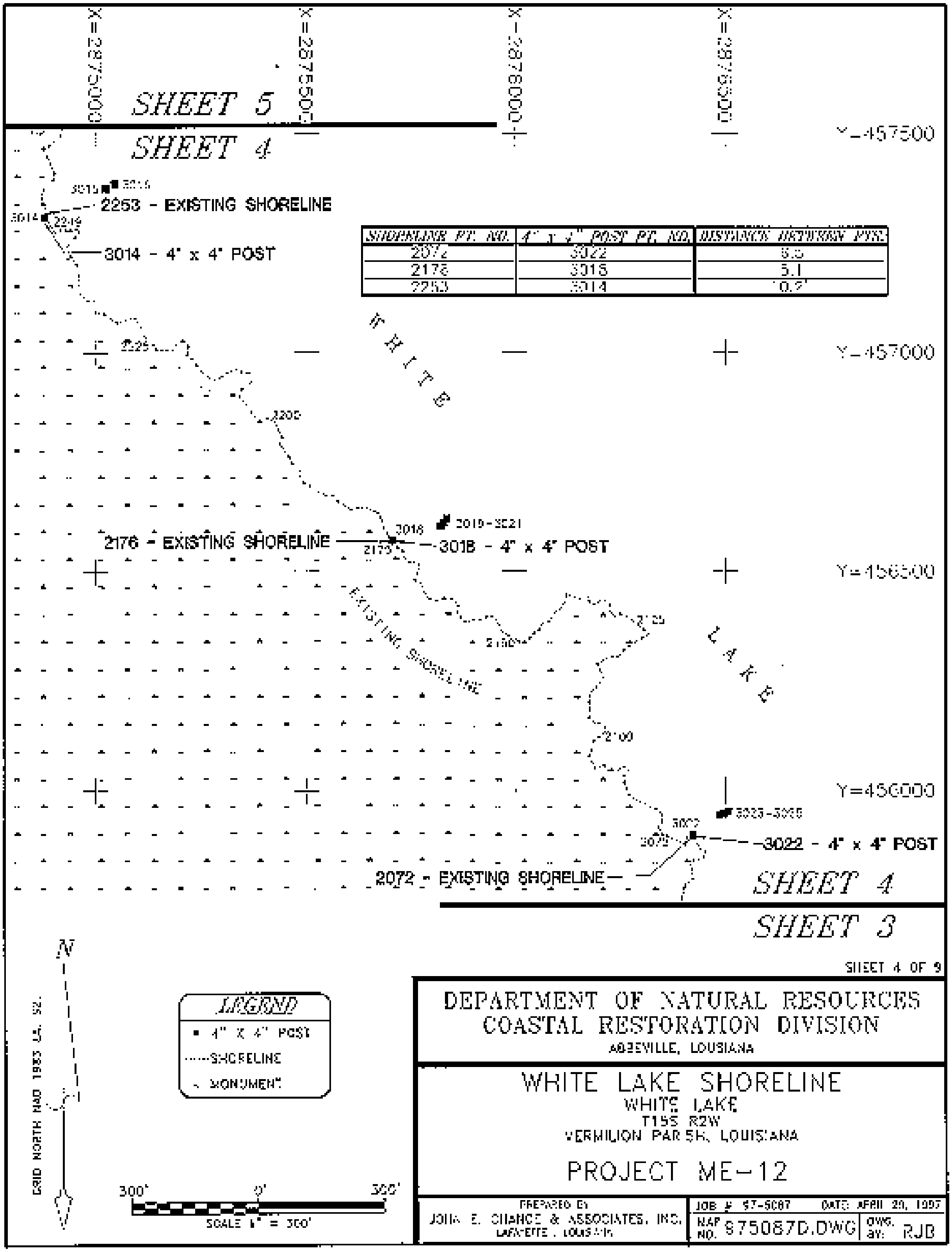


Figure A2. SW Shore White Lake Protection DEMO (ME-12) shoreline location survey showing station 2 (3022), 3 (3018), and 4 (3014) in the project area, plant sampling location, and the distance from the shoreline marker to the existing shoreline.

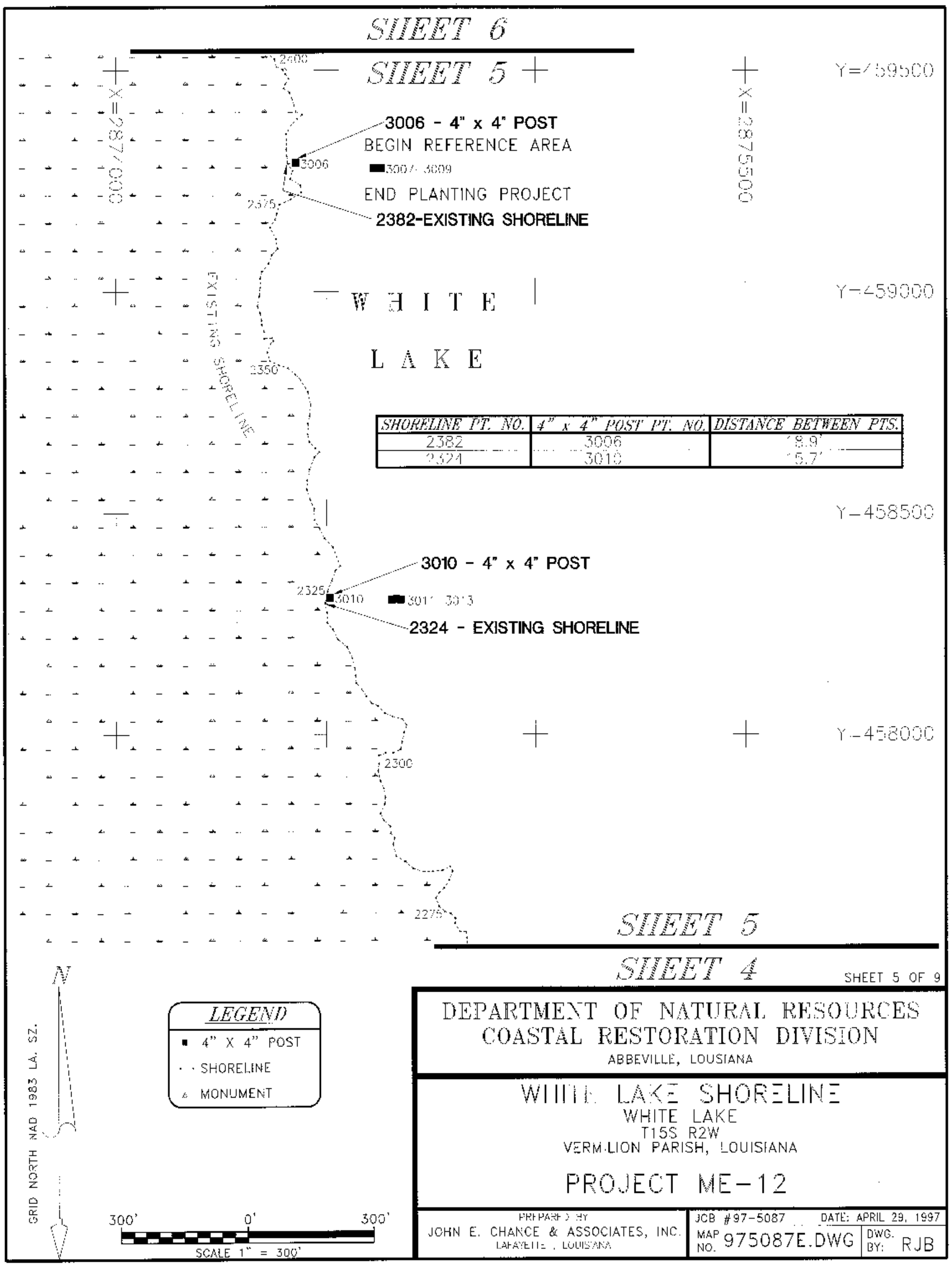


Figure A3. SW Shore White Lake Protection DEMO (ME-12) shoreline location survey showing station 5 (3010) and 6 (3006) in the project area, plant sampling location, and the distance from the shoreline marker to the existing shoreline.

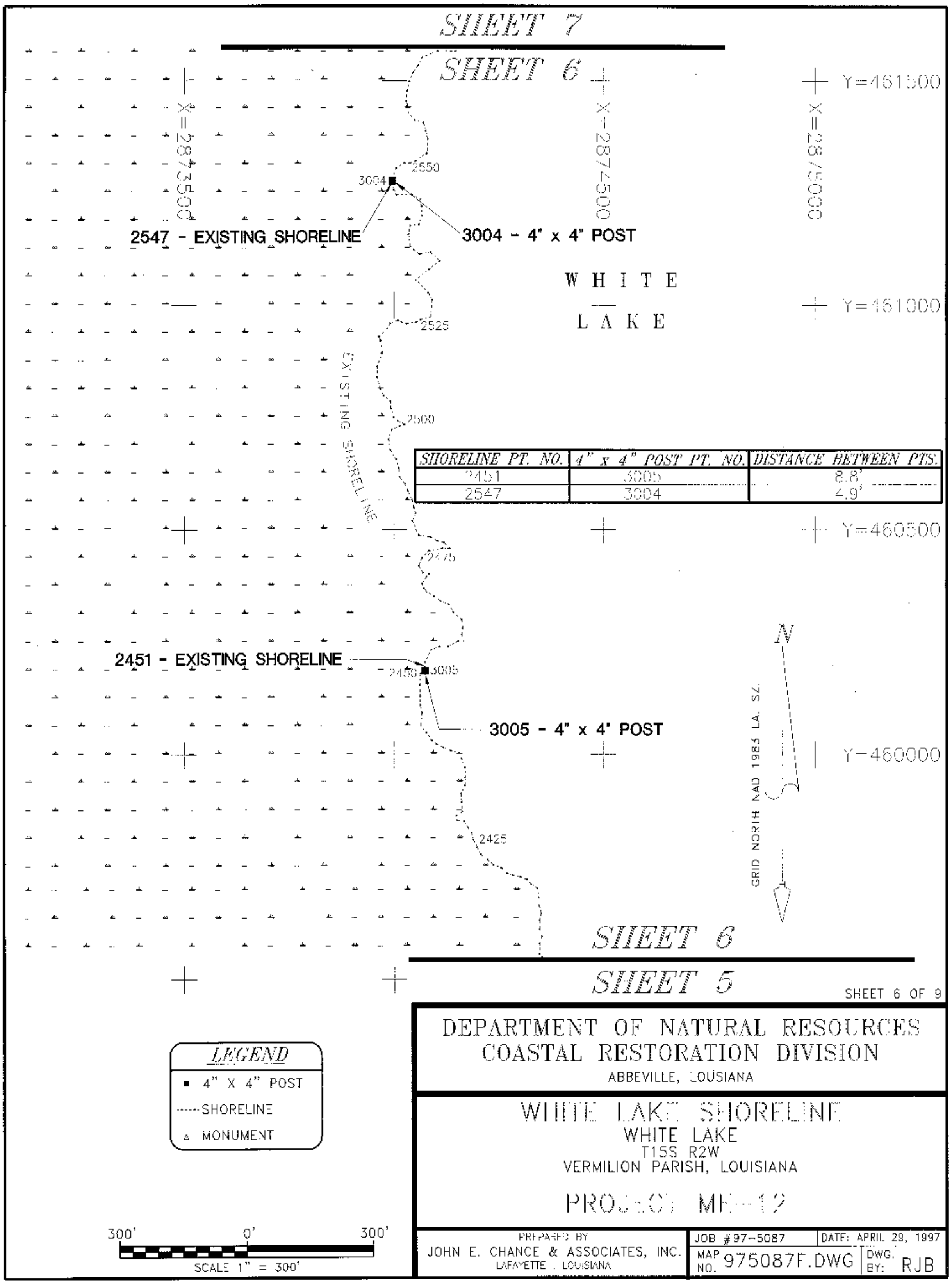


Figure A4. SW Shore White Lake Protection DEMO (ME-12) shoreline location survey showing station R-1 (3005) and R-2 (3004) in the reference area and the distance from the shoreline marker to the existing shoreline.

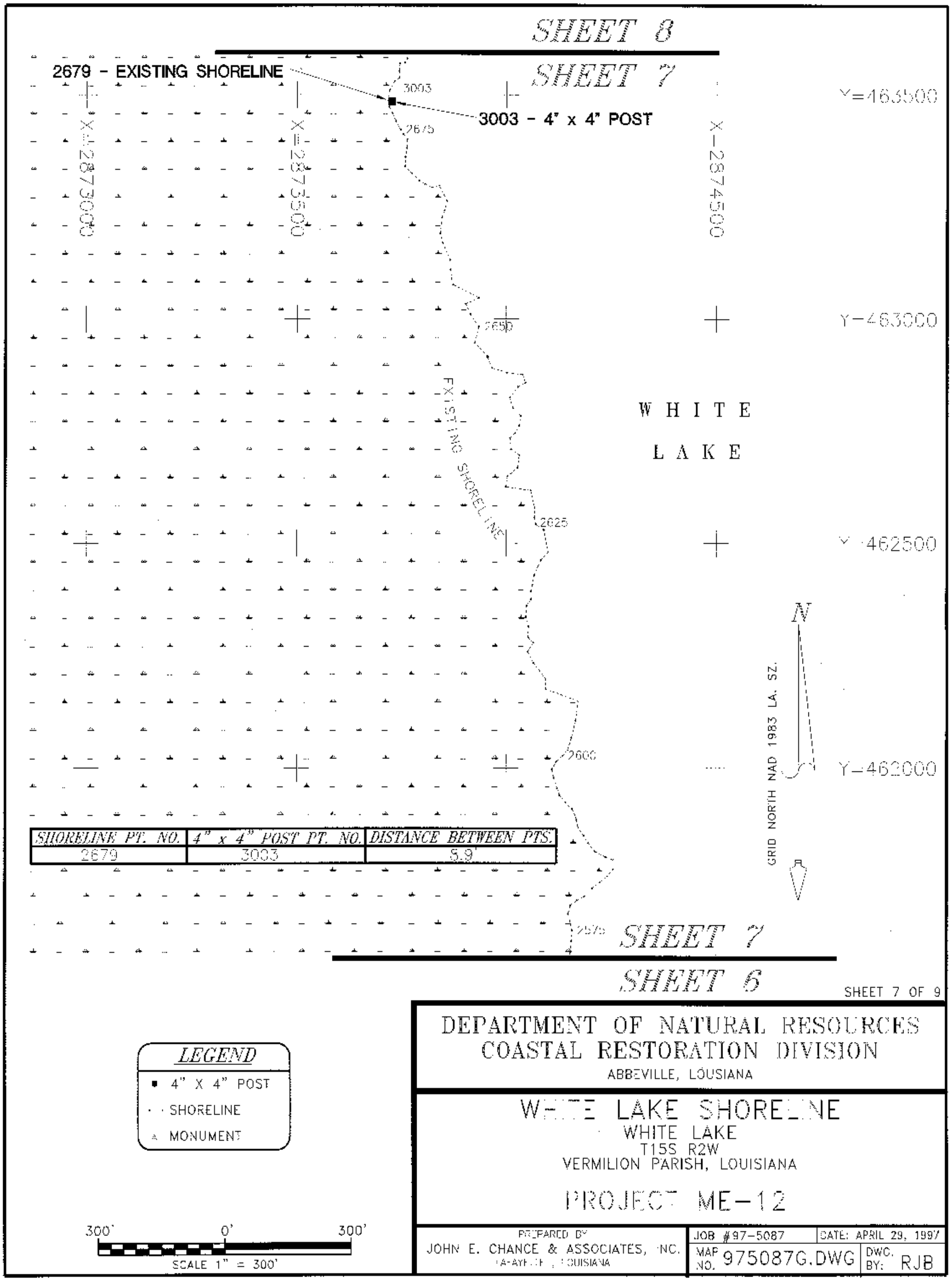


Figure A5. SW Shore White Lake Protection DEMO (ME-12) shoreline location survey showing station R-4 (3003) in the reference area and the distance from the shoreline marker to the existing shoreline. Station R-3 was missing at the time of the survey.

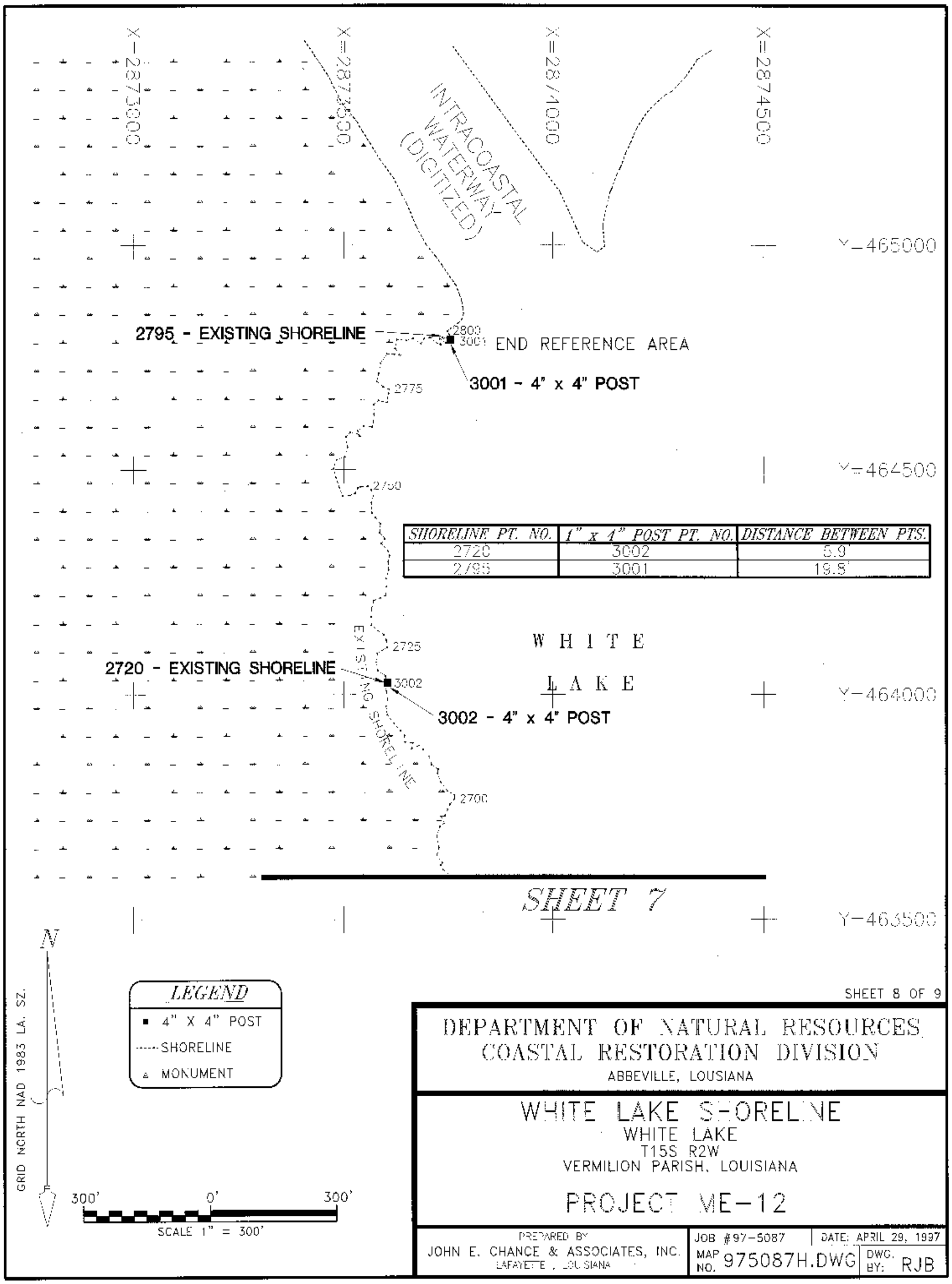


Figure A6. SW Shore White Lake Protection DEMO (ME-12) shoreline location survey showing station R-5 (3002) and R-6 (3001) in the reference area and the distance from the shoreline marker to the existing shoreline.