State of Louisiana
Department of Natural Resources
Coastal Restoration Division and
Coastal Engineering Division

2004 Operations, Maintenance, and Monitoring Report

for

Holly Beach Sand Management Project

State Project Number CS-31
Priority Project List 11

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Cameron Parish

Prepared by:

Mark Mouledous, Biological Monitoring Section (CRD)
and
Herb Juneau, P.E., Field Engineering Section (CED)
LDNR/Coastal Restoration and Management
Lafayette Field Office
635 Cajundome Boulevard
Lafayette, LA 70506

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2004 Operations, Maintenance, and Monitoring Report
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Holly Beach Sand Management Project (CS-31)

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I. Introduction

The Holly Beach Sand Management (CS-31) project area is located between the communities of Holly Beach and Constance Beach on the Gulf of Mexico shoreline of southwestern Louisiana, west of Calcasieu Pass in Cameron Parish (figure 1). The project area is comprised of approximately 10,849 acres (4,426 ha), of which 8,900 acres (3,603 ha) are classified as wetlands (U.S. Geological Service, National Wetlands Research Center [USGS-NWRC] 2001). The project area is divided into two areas separated by the Louisiana Highway 82 embankment. Area A includes approximately 8,600 acres (3,481 ha) of brackish and intermediate marsh located along the north side of the highway. Area B includes approximately 300 acres (121 ha) of beach dune and coastal chenier habitat located south of the highway along 8.0 miles (12.9 km) of beach between Holly Beach and Ocean View Beach.

Chronic erosion in this area is caused by a deficit of sand and sediment in the littoral transport system due to stabilization of the Mississippi River and regulation of the Atchafalaya River to the east (U.S. Department of Agriculture, Natural Resources Conservation Service and Louisiana Department of Natural Resources [USDA-NRCS and LDNR] 2001). In addition, the Calcasieu and Mermentau rivers are not supplying coarse grained sediment (sand) to the area, and the Cameron jetties associated with the Calcasieu Ship Channel deflect what little material that exists away from the project area (Byrnes et al. 1995, Byrnes and McBride 1995).

Today, this ridge is the only remaining hydrologic barrier separating thousands of acres of low energy, intermediate and brackish marsh along the southern boundary of Sabine National Wildlife Refuge (SNWR) from the high energy, saline waters of the Gulf of Mexico. The highway revetment has already been undermined and repaired in some sections, and the underlying chenier is in danger of being breached. A breach of this ridge would lead to direct wave erosion and saltwater intrusion into fragile, low energy wetlands to the north.

The intent of the project is to modify the design of 18 existing breakwaters on the west end of the breakwater field and remove 6 experimental breakwaters located landward of existing breakwaters 35 through 40, to enhance their sediment trapping capability. In addition, utilizing the beneficial placement of sand dredged from offshore, the beach will be widened and a sub-aerial beach profile will be re-established that will reduce the occurrence of wave over-wash of the chenier-beach ridge.

The breakwater modifications, which were funded by the state of Louisiana, were completed on June 19, 2002. The removal of the experimental breakwaters was completed on September 5, 2002. Approximately 1,750,000 cubic yards (1,600,200 cu meters) of coarse grained sand were pumped from a distance of 5 miles offshore between Holly Beach and Ocean View Beach. Construction of the sand-pumping portion of the project was initiated in July 2002 and was expected to be completed in November 2002. Inclement weather and equipment problems delayed completion until March 2003. Construction of 18,797 linear feet of sand fencing was completed in March, 2003, and installation of 18,400 gallons of *Panicum amarum* (Bitter Panicum) was completed in August 2003.

Figure 1. Holly Beach Sand Management (CS-31) project area boundaries.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Holly Beach Sand Management Project (CS-31) is to evaluate the constructed project features to identify any deficiencies and prepare a report detailing the condition of project features and recommended corrective actions needed. Should it be determined that corrective actions are needed, LDNR shall provide, in the report, a detailed cost estimate for engineering, design, supervision, inspection, and construction contingencies, and an assessment of the urgency of such repairs (LDNR 2003).

An inspection of the Holly Beach Sand Management Project (CS-31) was held on February 16, 2004 under clear skies and cool temperatures with a 10-15 mph N. wind. In attendance was Stan Aucoin and Herbert Juneau from LDNR. Representatives from NRCS were invited, but due to the last minute scheduling of this trip, were unable to attend. The annual inspection began at approximately 11:00 a.m. on the western boundary of the project area.

The field inspection included a complete visual inspection of all features. Staff gauge readings were used to determine approximate elevations of water, sand dunes, and sand fencing. Photographs were taken at each project feature and Field Inspection notes were completed in the field to record measurements and deficiencies.

b. Inspection Results

i. Beach Nourishment

The entire reach of the project was inspected and appears in excellent condition. Though scattered drift and debris in minor amounts were noted in vicinity of water's edge, beach fill appears to be as constructed except for some minor "adjustments" of the sandfill that was caused by the action of some significant high tidal events. Only some minor shallow depressions or shallow holes were noted in the beach; these being very infrequent and in vicinity of the gulf ward slope of the beach. Some sand has migrated, from wind generated action, towards the landside but this is considered minor and appears to have stabilized. No locations that would necessitate any maintenance were noted.

ii. Sand Fence

The sand fencing is considered in excellent condition at this time. Except but for one very short reach, the fencing is still intact and in great condition. In several short reaches, the four (4) foot tall fence has actually been covered by the drifting sand. Elsewhere, the fence is doing an excellent job in arresting the drifting of the sand as evidenced by the accumulated sand materials noted piled against the fence. It is estimated that sand drifts in those areas are approximately one (1) foot in thickness up from the original placement level of +5 NAVD'88. The gaps constructed in the sand fencing as pedestrian/vehicle gaps are almost non-functional however, as sand accumulations of one to two (1 to 2) feet are now existing in just about all of the gaps constructed. The sand materials there are fine and very dry making walking or driving through same very difficult. No maintenance is required at this time.

II. Maintenance Activity (continued)

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

None

ii. Programmatic/ Routine Repairs

None

III. Operation Activity

a. Operation Plan

There are no active operations associated with this project.

IV. Monitoring Activity

a. Monitoring Goals

The objective of the Holly Beach Sand Management Project is to protect approximately 8,600 acres (3,481 ha) of existing low energy, intermediate and brackish wetlands north of the chenier/beach ridge between Holly Beach and Constance Beach and to protect approximately 300 acres (121 ha) of beach dune and coastal chenier habitat along the shoreline from erosion and degradation caused by high energy wave action from the Gulf of Mexico.

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

1. Evaluate the beach response to sand nourishment and modification of 18 existing breakwaters after 2 years to facilitate re-evaluation of the existing breakwater design and the ability of the constructed beach profile to reduce predicted over-wash events.

2. Determine shoreline position to assess project-effectiveness at maintaining the shoreline (high water/rack line along beach ridge) seaward of its pre-nourishment position for the first 5 years (for breakwaters 10 thru 72).

3. Determine shoreline position to assess project-effectiveness at maintaining shoreline (high water/rack line along beach ridge) seaward of its pre-nourishment position for an additional 5 years should the beach need re-nourishment.

4. Evaluate water salinity in the project area north of the beach/ridge for effects of over-wash occurrences.

5. Evaluate maintenance of existing intermediate and brackish marsh vegetation in the project area north of chenier/beach ridge.

6. Evaluate condition of the *Panicum amarum* plantings along the project area shoreline.

b. Monitoring Elements

Aerial Photography:

To measure marsh and open water areas, near-vertical color-infrared aerial photography (1:12,000) was acquired pre-construction in December 2001 and December 2002 (since project completion was delayed). The original photography was checked for flight accuracy, color correctness, and clarity and was subsequently archived. Aerial photography was scanned, mosaicked, and georectified by USGS personnel according to standard procedures (Steyer et al. 1995, revised 2000). Photography will also be obtained in post-construction year 3 in 2006 and year 7 in 2010. Additional photography may be obtained in response to storm events.

Monitoring Activity (continued)

Bathymetry/Topography:

To document both horizontal and vertical change along the project area shoreline, transect lines used to measure elevation were established parallel and perpendicular to the breakwaters, and tied in to a known elevation datum by professional surveyors. These transect lines were surveyed incrementally pre-construction in 2002-2003, and immediately post-construction in March 2003 and will be surveyed in 2005.

Vegetation Plantings:

The general condition of the *Panicum amarum* (Bitter Panicum) plantings was documented using a generally accepted methodology similar to Mendelssohn and Hester (1988), Coastal Vegetation Project, Timbalier Island. Plots were chosen by randomly selecting numbers based on the coordinates within the project area to represent a 10 percent sample of the plantings. The GPS coordinates were used to mark one corner of a plot of 16 plants to determine % survival by counting live plants within each plot, dividing by the total number of plants, and multiplying by 100. Ocular estimates of percent canopy cover were recorded for each plot. The percent cover for each plot was broken down into the percent cover provided by the *P. amarum* plantings, by other wetland species and by upland species. These criteria were documented in the fall of 2003, and will be documented in the spring of 2004 and the fall of 2004 or until the original plants become indistinguishable. The possibility of herbivore damage is recognized and will be recorded if observed.

Shoreline Change:

To document shoreline movement between Holly Beach and Constance Beach, differential global positioning system (DGPS) surveys of unobstructed sections of the shoreline were conducted using the high water/rack line as the vegetative edge. DGPS shoreline positions were mapped and used to measure shoreline erosion/growth rates. Shoreline change rates were used to calculate the total acres gained/lost along the project area shoreline. Surveys were conducted immediately post-construction in 2003 and the fall of 2003, and will be conducted twice per year in the fall and spring of 2004, 2005, 2007, 2009, and 2011 post-construction.

Water Salinity:

To assist in determining the frequency that high salinity water enters the interior marsh from wave over-wash, three continuous recorders were installed to collect hourly salinity data, one at the southern end of Cowboy ditch, one adjacent to the low section of La. Hwy 82 with concrete block revetment between Peveto Beach and Holly Beach, and one in a marsh pond on the east side of the project area (figure 1). Data collected from these stations will be compared to hourly salinity data collected from the Sabine Refuge Structure Replacement (CS-23) project and the USGS realtime data recorder in Calcasieu Lake near Cameron, Louisiana to aid in determining the origin of high salinity water entering the project area. Hourly salinity data have been

collected at these three stations preconstruction, from September 2002 to February 2003, and 3 years post-construction from March 2003 to March 2006.

Emergent Vegetation:
To document the condition of the emergent vegetation in the project area over the life of the project, vegetation was monitored at 30 sampling stations established along 3 transect lines within the project area. Using the Braun-Blanquet methodology outlined in Steyer et al. 1995, revised 2000), percent cover, species composition, and dominant plant height were documented in replicate 2 m by 2 m sampling plots established at each station. A pole installed in one corner of each plot allows for locating and reevaluating established plots over time. Descriptive observations of SAV will be noted during monitoring of emergent vegetation. Vegetation was monitored once pre-construction in 2002 and postconstruction in the fall of 2003, and will be monitored in the fall of 2004, 2005, and 2009.

IV. Monitoring Activity
c. Preliminary Monitoring Results and Discussion

Aerial Photography:
Land to water analysis was completed for the pre-construction photography acquired in November 2001 and December 2002 (figures 2-4). Results indicated 82% land and 18% water within the project area in 2001 and 83% land and 17% water in 2002. The difference was due to the partial construction of the beach at the time of the 2002 photography.

Bathymetry/Topography:
The pre-construction survey was performed incrementally over the construction period and completed in January 2003. The post-construction survey was completed in March 2003. The contractor experienced problems controlling the fill and overpumped many sections. At completion of the work, it was determined that the contractor placed 22% additional fill above the design volume (Coastal Planning and Engineering, Inc., 2000). It is expected that the shoreline will degrade back to the design volume, washing away the overfill, soon after construction is complete (personal communication, Herbert Juneau). This was an anticipated loss that will appear on the shoreline surveys and will be taken into consideration when analyzing these data. Figures 5a and 5b represent cross-sections taken at eleven selected stations along the project indicating pre-construction conditions, as-built surveys, and the construction template.

Vegetation Plantings:
Construction of 18,797 linear ft of sand fencing was completed March 26, 2003. Installation of plantings of *Panicum amarum* was completed on August 7, 2003. The first survey of 115 plots was completed in October 2003 (figure 6). At 2 months postplanting, mean percent survival was 82.5% and mean percent cover was 13.1% (figure 7).

Shoreline Change:
Data were collected in March (immediately following construction) and October 2003. The data show a loss of approximately 21.6 acres between the surveys. Most of the loss occurred near the western end of the project (Figure 8). It was expected that the shoreline would degrade rapidly after construction due to the overfill of sand by the contractors. Future surveys should more accurately reflect the change along the shoreline.

Salinity:
Hourly salinity and water level have been collected at the following continuous recorder stations (figures 9 - 14). Water levels are not surveyed to NAVD 88:

Station	Data collection period
CS31-01	9/10/02 – present
CS31-02	2/18/03 – present
CS31-03	2/18/03 – present

It was reported by local residents that wave over-wash occurred at least twice in 2003 when Category 1 Hurricane Claudette (7/15/03) and Tropical Storm Grace (8/31/03) hit Texas. It is not certain exactly where the road was overwashed or for how long. The project recorders did not indicate salinity spikes during these two events. The rise in salinity at CS31-01 during the summer months mimics the pattern seen at Station CS23-01R and appears to be the result of a drop in water levels during August. Salinity levels did not rise above 4 ppt for the entire year at Station CS31-01 which is located near Highway 82. Therefore, the goal to maintain salinity within the intermediate to brackish target range of 3-12 ppt was met. The variability detected in other project stations is not evident in Station CS31-03 since it is located in a borrow ditch and is not hydrologically connected to any other water source. Further, the water level sensor at this station is out of the water during periods of low water. Figure 13 shows the 2003 hourly salinity and water level for Station CS23-01R in the Sabine Structure Replacement (CS-23) reference area, reflecting conditions in Calcasieu Lake.

Emergent Vegetation:
Data were collected in October 2002 and 2003 (table 1 & figure 15). A T-test comparing total cover in the year pre and post-construction showed that cover in 2003 was significantly lower than in 2002 ($p=0.0190$). However, though the data were statistically significant, they do not appear to be ecologically significant. The differences in cover could be related to seasonal changes or to herbivory damage from cattle grazing in the area of many of the vegetation stations. Two-thirds of the plots experiencing decreases in cover occurred at stations where the cattle are allowed access.

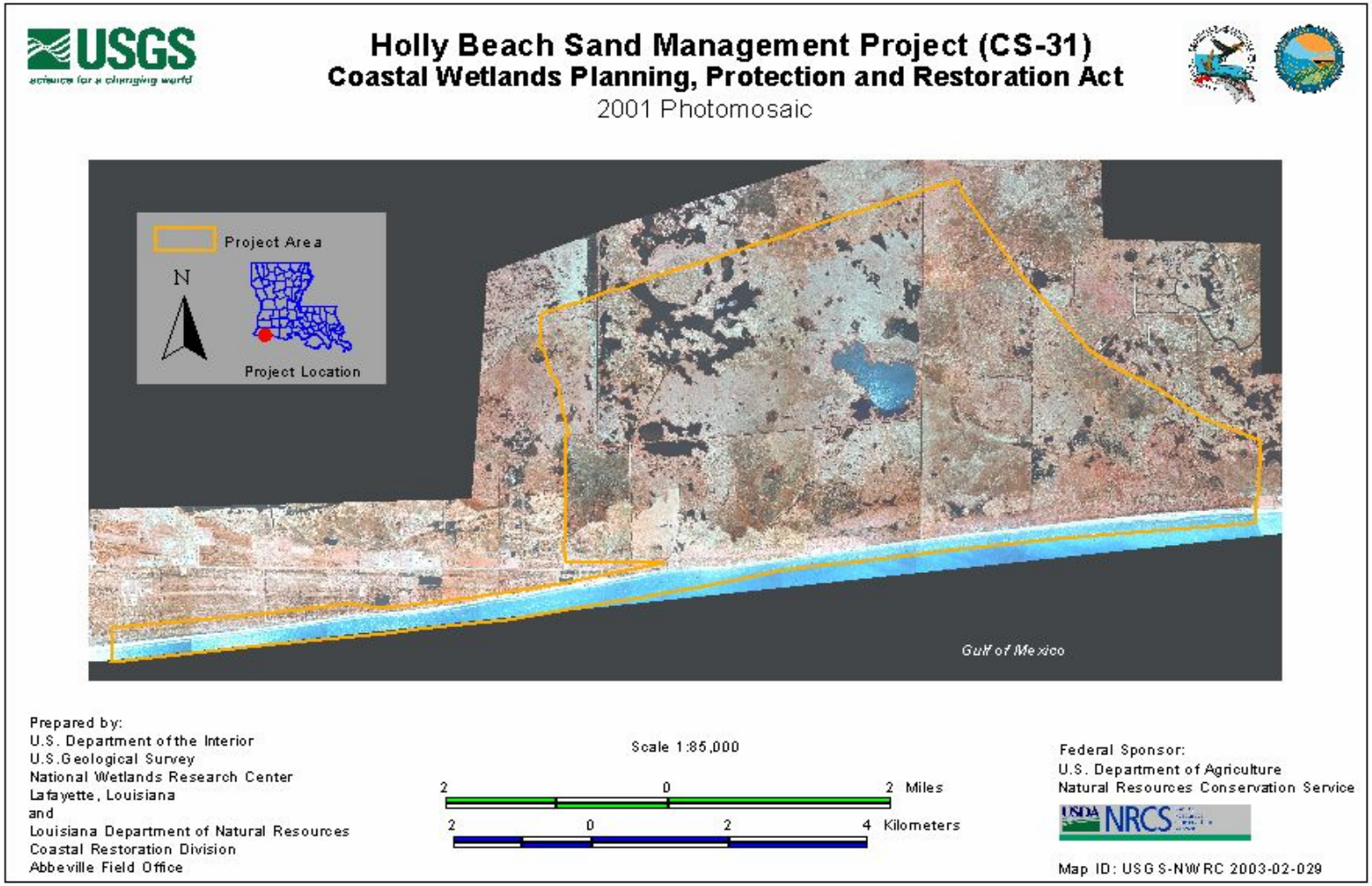

Figure 2. Photomosaic of the Holly Beach Sand Management (CS-31) project area from photography obtained November 17, 2001.

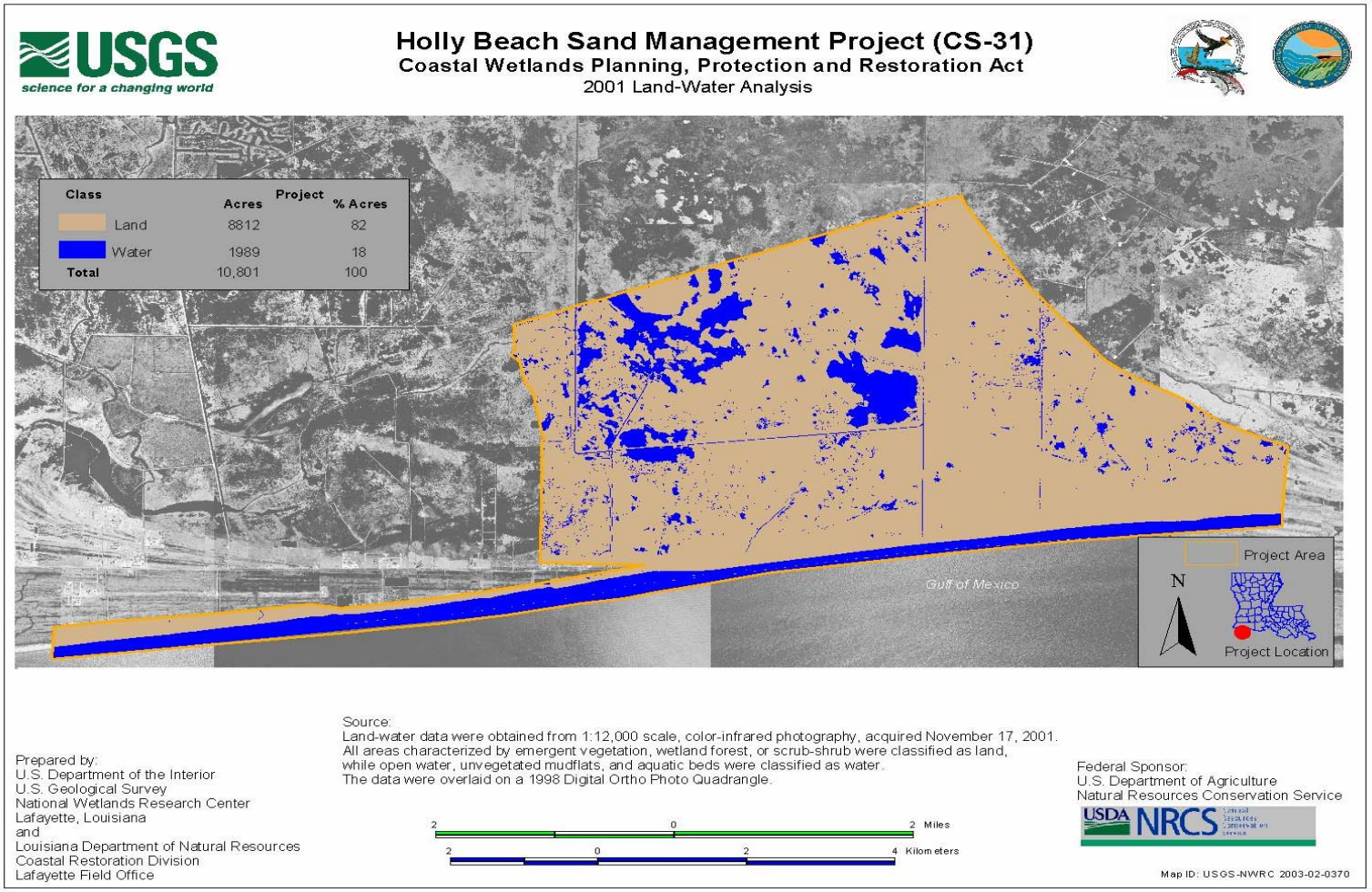

Figure 3. Land/Water analysis of the Holly Beach Sand Management (CS-31) project area from photography obtained November 17, 2001.

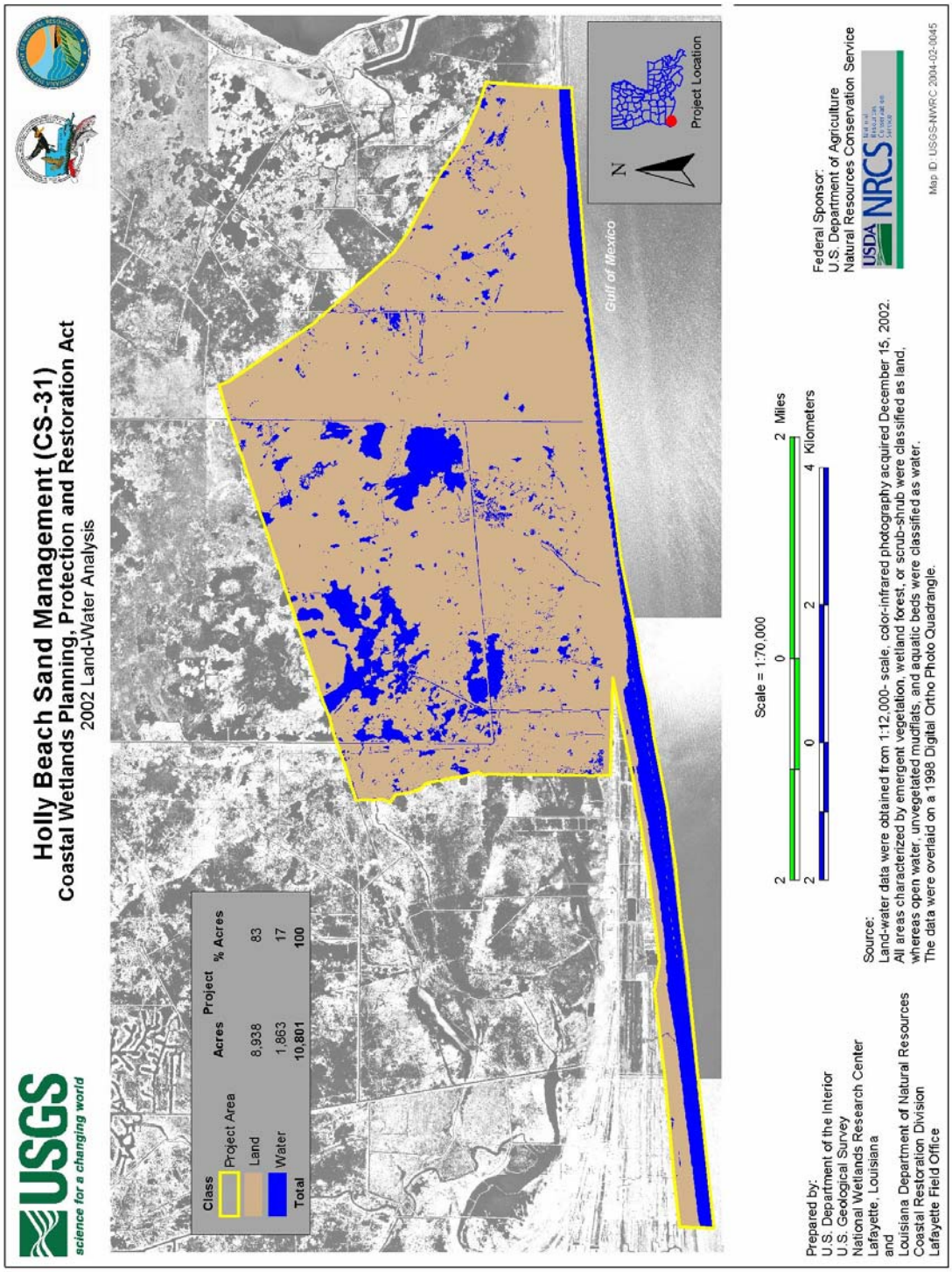

Figure 4. Land/Water analysis of the Holly Beach Sand Management (CS-31) project area from photography obtained December 15, 2002.

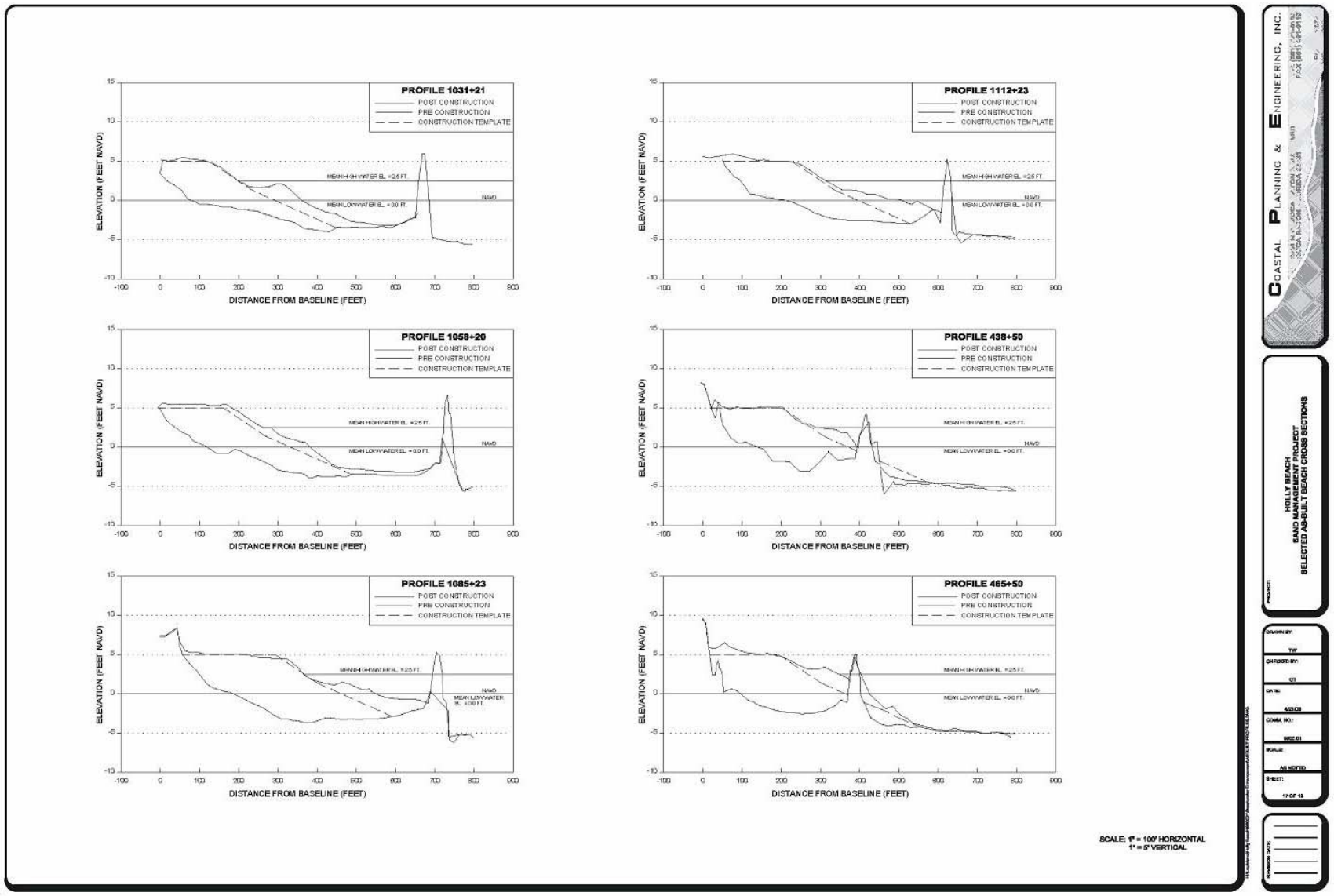

Figure 5a. Holly Beach sand Management selected pre-construction and as-built cross-sections.

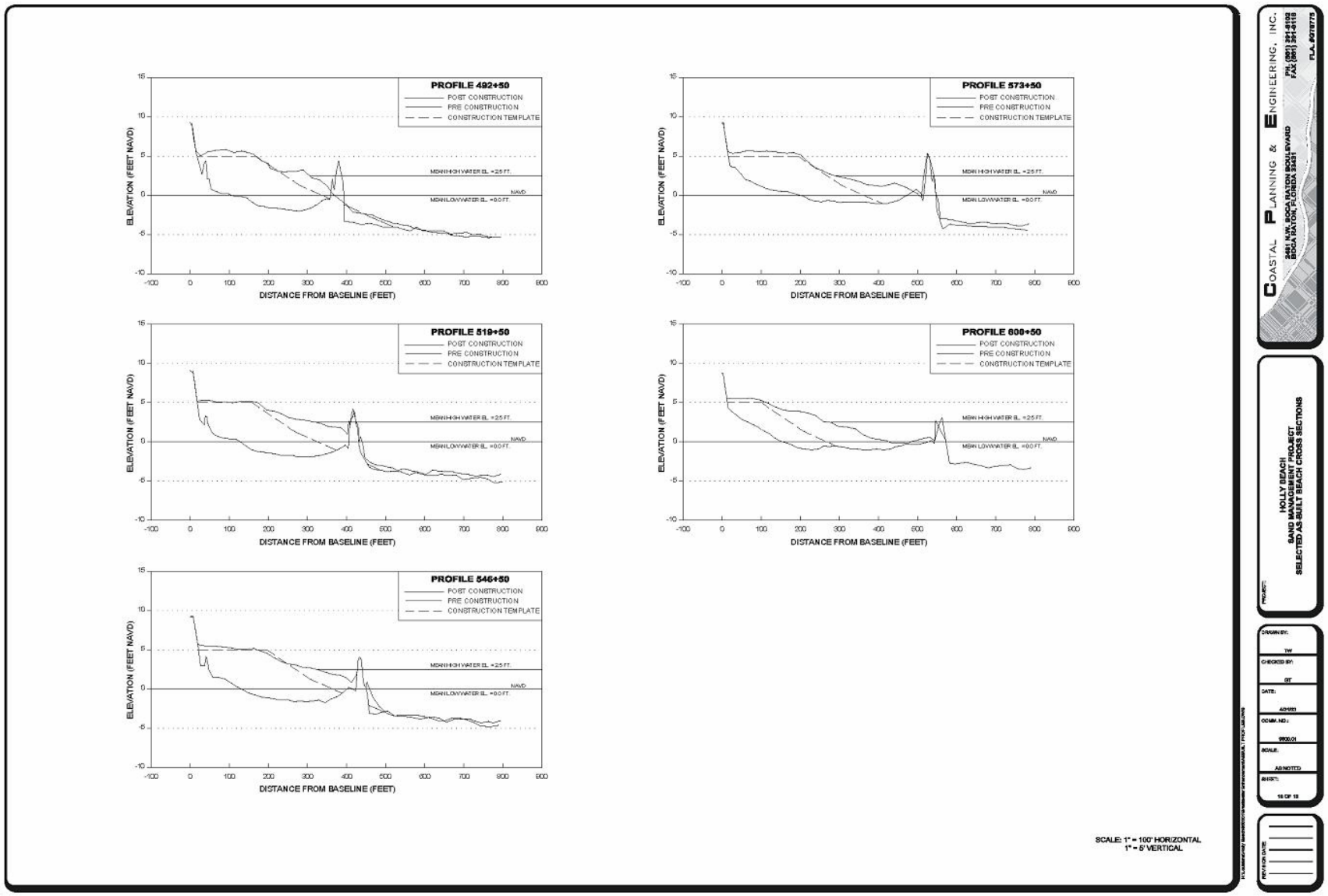

Figure 5b. Holly Beach sand management (CS-31) selected pre-construction and as-built cross-sections.

Figure 6a. View of the sand fencing and Vegetation Plantings at Station CS31-110 taken in October 2003. Note the dune formation already developing adjacent to the fences. The photograph is facing east.

Figure 6b. View of the Sand Fencing and Vegetation Plantings at Station CS31-208 taken in October 2003. Note the double rows of fencing constructed here near the end of the project. The photograph is facing east.

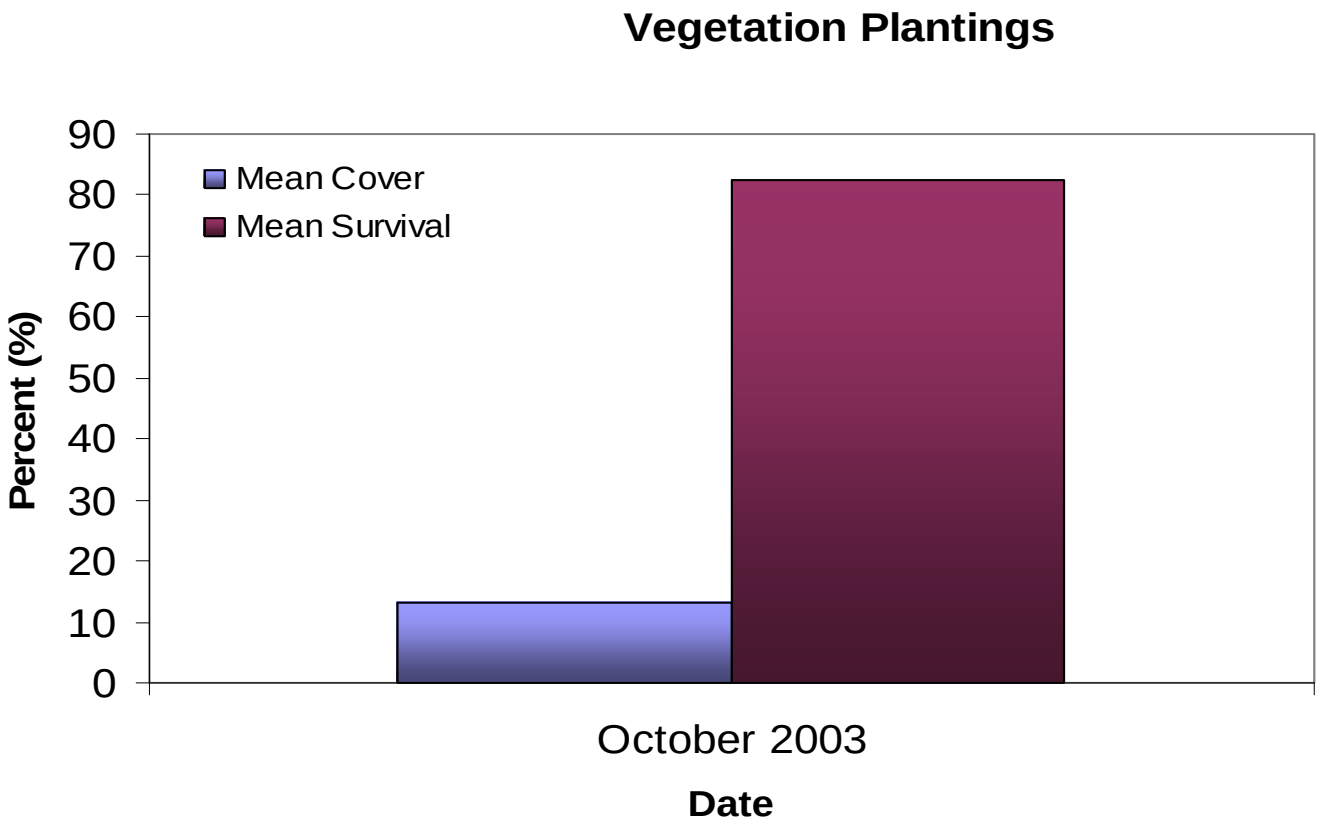

Figure 7. Mean percent cover and survival of the *Panicum amarum* plantings on the October 2003 survey.

Figure 8. Location of spring and fall 2003 shoreline surveys at Holly Beach Sand Management (CS-31) project.

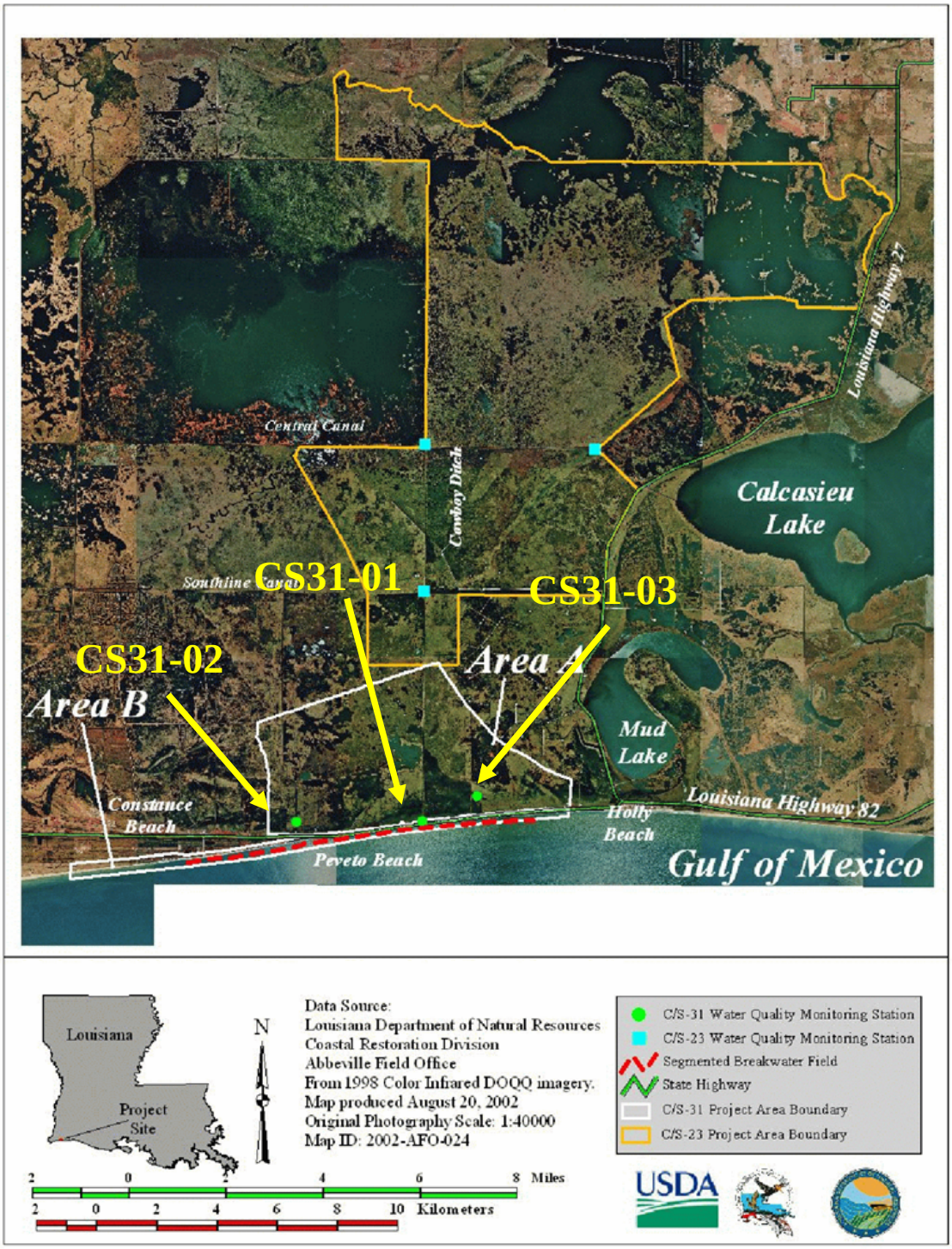

Figure 9. Location of continuous recorder stations at Holly Beach Sand Management (CS-31) project.

Holly Beach Sand Management (CS-31)

Station CS31-01 (1/1/03 – 12/31/03)

Salinity and Water Level Data

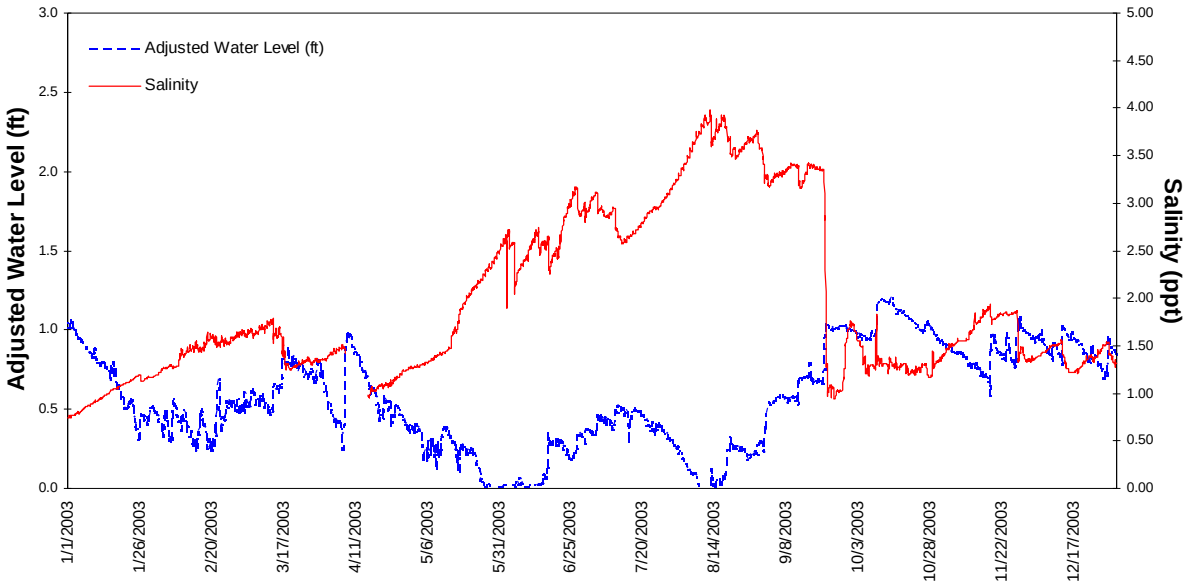

Figure 10a. Hourly salinity and water level at Station CS31-01 in the Holly Beach Sand Management (CS-31) project area during 2003. All water levels are relative. This station has not been surveyed to NAVD88 at this time.

Holly Beach Sand Management (CS-31)

Station CS31-02 (2/18/03 – 12/31/03)

Salinity and Water Level Data

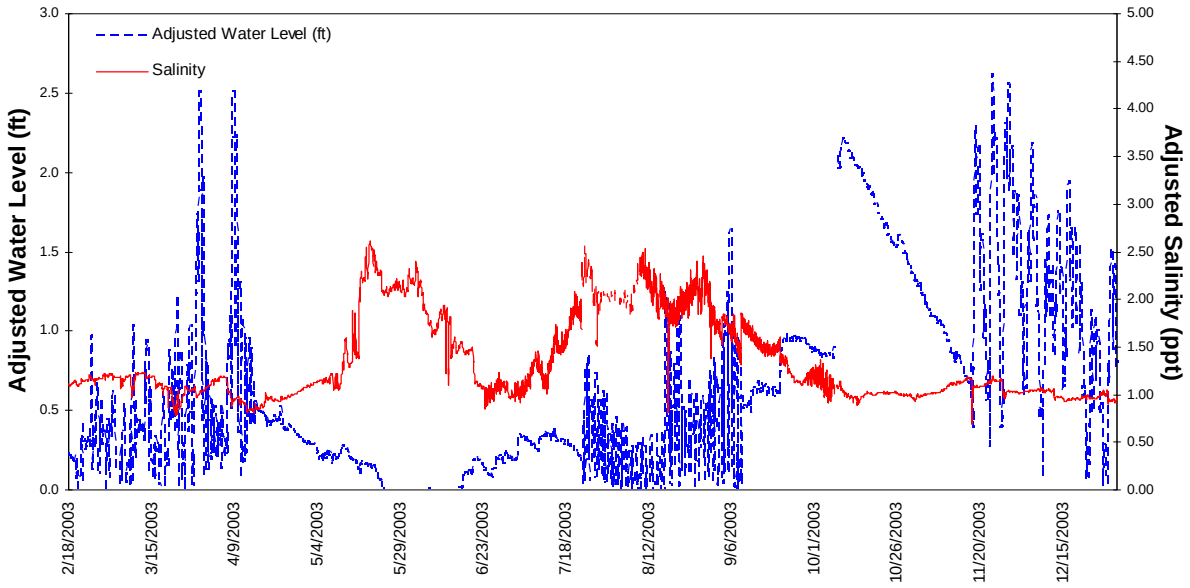

Figure 11a. Hourly salinity and water level at Station CS31-02 in the Holly Beach Sand Management (CS-31) project area during 2003. All water levels are relative. This station has not been surveyed to NAVD88 at this time.

Holly Beach Sand Management (CS-31)

Station CS31-03 (2/18/03 – 12/31/03)

Salinity and Water Level Data

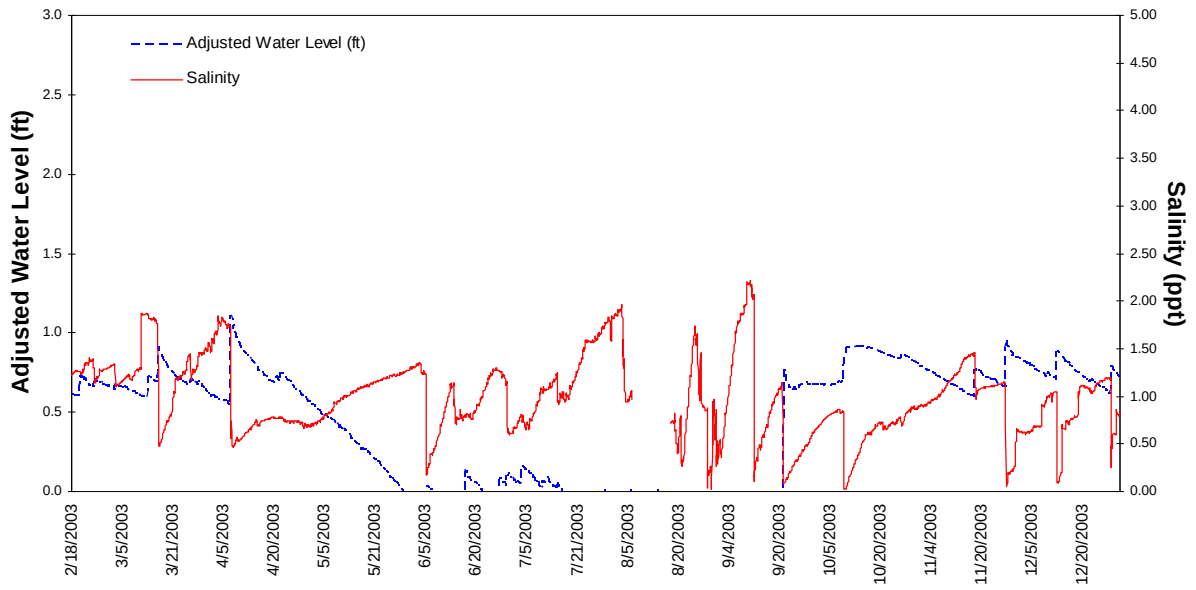

Figure 12a. Hourly salinity and water level at Station CS31-03 in the Holly Beach Sand Management (CS-31) project area during 2003. All water levels are relative. This station has not been surveyed to NAVD88 at this time.

Station CS23-01R (1/1/03 – 12/31/03)
Salinity and Water Level Data

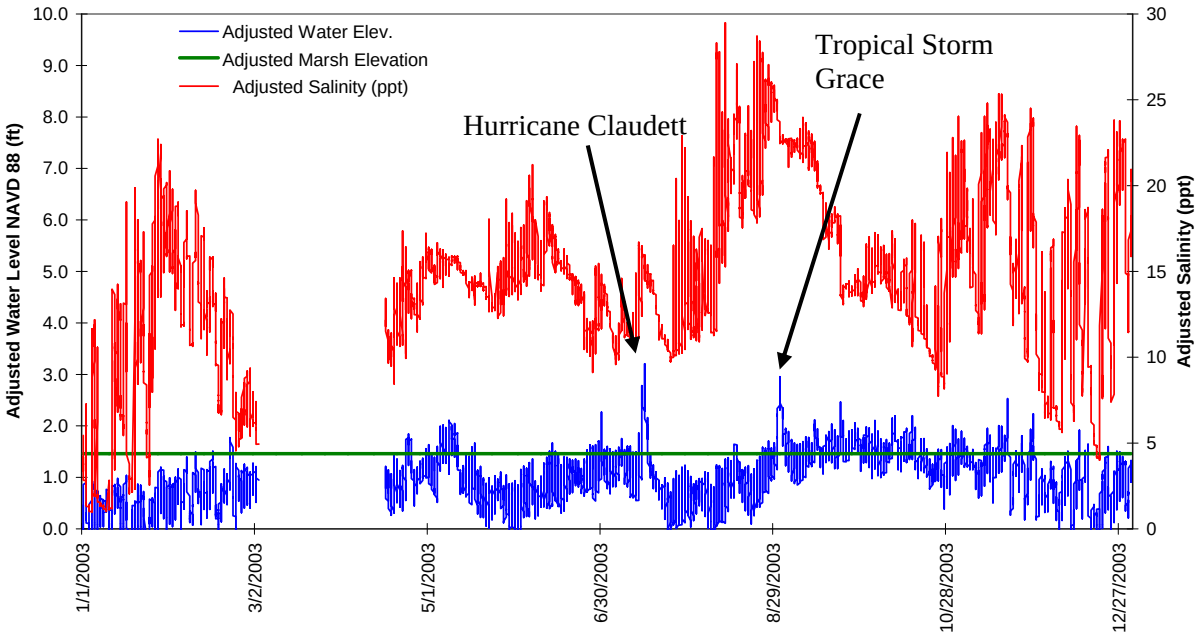

Figure 13. Hourly salinity and water level at station CS23-01R in the Sabine Structure Replacement (CS-23) reference area. A water level reading above marsh elevation indicates that the marsh is flooded.

Holly Beach Sand Management (CS-31)

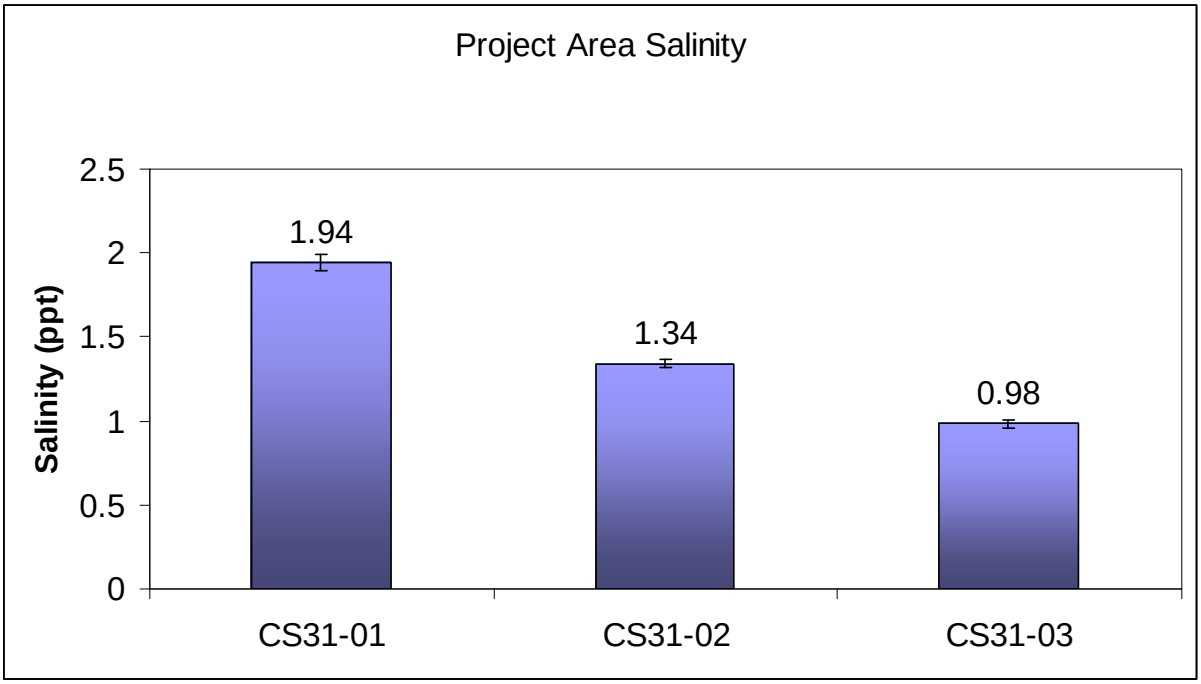

Figure 14. Yearly means derived from daily means of salinity (ppt) at 3 continuous recorders located in the Holly Beach Sand Management (CS-31) project area from period 1/1/03 – 12/31/03 for station CS31-01 and 2/18/03 – 12/31/03 for stations CS31-02 and CS31-03.

Holly Beach Sand Management (CS-31)
Emergent Vegetation

Table 1. Scientific and common names of plant species observed during the 2002 and 2003 vegetation surveys of the CS-31 project area.

Scientific Name	Common Name
Amaranthus australis	southern amaranth
Baccharis halimifolia	eastern baccharis
Borrichia frutescens	bushy seaoxeye
Cyperus odoratus	fragrant flatsedge
Distichlis spicata	seashore saltgrass
Echinochloa walteri	coast cockspur
Eclipta prostrata	false daisy
Iva annua	annual marshelder
Iva frutescens	Jesuit's bark
Mikania scandens	climbing hempvine
Paspalum vaginatum	seashore paspalum
Phragmites australis	common reed
Pluchea camphorata	camphor pluchea
Schoenoplectus americanus	Olney bullrush
Schoenoplectus californicus	California bulrush
Schoenoplectus maritimus	Cosmopolitan bulrush
Schoenoplectus robustus	sturdy bullrush
Sesbania herbacea	bigpod sesbania
Solidago sempervirens	seaside goldenrod
Spartina patens	marshhay cordgrass
Symphyotrichum tenuifolium	perennial saltmarsh aster
Typha	cattail
Vigna luteola	hairypod cowpea

Holly Beach Sand Management (CS-31)
Emergent Vegetation

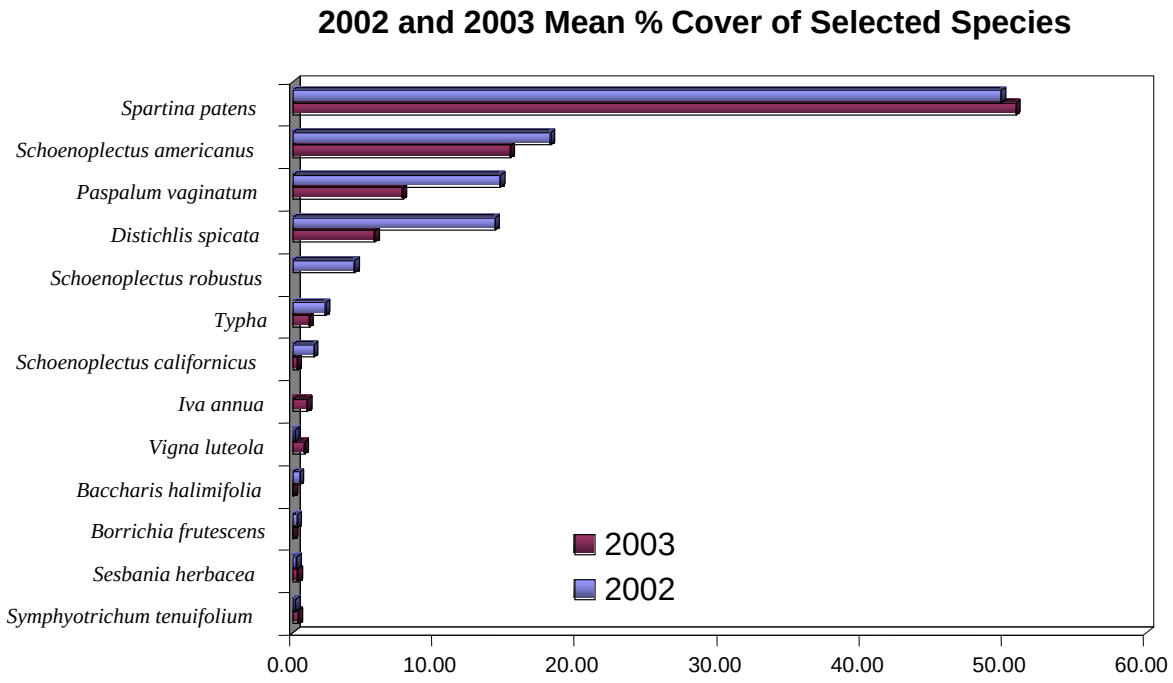

Figure 15. Mean % cover of selected species across all 4 m^2 plots within the CS-31 project area during October 2002 and 2003. Vegetation was sampled using the Braun Blanquet method.

V. Conclusions

a. Project Effectiveness

At least two tidal overwash events occurred during the year due to storms, however, data indicated that salinity spikes did not occur due to these events. Salinity levels were maintained within the intermediate to brackish target range and were below 4 ppt for the entire year at all project stations, while the reference station, which is directly linked hydrologically to the Calcasieu Ship Channel, experienced salinity levels of 15-25 ppt throughout much of the year. This indicates that the project area may not be influenced by salinity fluctuations in the CSC.

Differences in vegetative cover were detected between the pre- and post-construction emergent vegetation surveys. These differences, however, do not appear to be ecologically significant and may be due to seasonal changes or herbivory from cattle grazing in the project area.

The 1% gain in land between the 2001 and 2002 land:water analyses is attributed to the partial construction of the project when the 2002 photography was taken.

Percent survival of the *Panicum amarum* plantings was high at 82% after 2 months, despite two storm events. Percent cover was typically low at 13%, after planting. Because the plants appear vigorous and healthy, an increase in cover is expected this year. A dune has formed behind the sand fencing already and has begun to cover some of the plantings.

b. Recommended Improvements

Elevation surveys need to be completed for the three recorders to relate water levels to the NAVD ’88 Datum. This survey was scheduled to be accomplished with the surveys for the repair of the hurricane “LILI” damage, which have been delayed because of contractual and funding activities.

c. Lessons Learned

Construction of the beach fill, originally scheduled for November 2002, was completed in March 2003. Delays in construction were due to concurrent storm events requiring the contractor to remove the barges with the dredge equipment from the Gulf for protection. However, aerial photography that was to represent the final fill placement on “as built” photography was flown and obtained in December 2002 when construction of the beach fill was but partially completed. Flexibility in scheduling as built aerial photography should be considered.

Elevation surveys to establish vertical locations of monitoring instruments need to be coordinated more closely with personnel of DNR's Engineering Element so that surveys are accomplished in a more timely manner.

On future projects that are very similar to this project, the "sand fencing" should be a part of the original plans and specifications. For this project the "sand fencing" had to be accomplished by change order to the contract and probably cost significantly more than if the work had been a part of the original bidding process.

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