State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Office of Coastal Protection and Restoration

2010 Operations, Maintenance, and Monitoring Plan

for

Holly Beach Sand Management

State Project Number CS-31
Priority Project List 11

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Cameron Parish

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2010 Operations, Maintenance, and Monitoring Report
For
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 Wetland Research Center [USGS-NWRC] 2001). The project area is divided into two areas separated by the Louisiana Highway 82 embankment, which is built on a chenier ridge. 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 in Area A to the north.

In Area B, 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 OceanView 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 on the eastern end of the project parallel to LA Hwy 82 was completed in March, 2003, and installation of 18,400 gallons of *Panicum amarum* (Bitter Panicum) was completed in August 2003. Shortly thereafter, another 11,000 linear feet of sand fencing was installed on the western portion of the project.

Hurricane Rita struck the coast of Louisiana on September 24, 2005 with maximum storm surge of 14-15 ft (4.3 – 4.6m) in the CS-31 project area. USGS calculated the amount of land that changed to water resulting from the storm to be 98 square miles in southwestern Louisiana, 22 square miles of land lost in the Cal/Sab basin (Barras, 2006). This land loss can be attributed to several patterns. Shearing, which is ripping and removal of marsh vegetation in historically healthy marshes was observed north of Johnson's Bayou and south of the Sabine National Wildlife Refuge. The removal of remnant marsh from areas with historical land loss from the surge was observed in the marsh just north of Johnson's bayou and north of Mud Lake.

Hurricane Ike struck near Galveston, Texas on September 13, 2008. A maximum storm surge of 15 – 16 ft (4.6 – 4.9m) was reported for the CS-31 project area (East et al. 2008).

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, OCPR 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. The annual inspection report also contains a summary of maintenance projects, if any, which were completed since completion of constructed project features and an estimated projected budget for the upcoming three (3) years for operation, maintenance and rehabilitation. The three (3) year projected operation and maintenance budget is shown in Appendix B.

An inspection of the Holly Beach Sand Management Project (CS-31) was held on October 20, 2009 under sunny skies and cool temperatures. In attendance were Darrell Pontiff and Dewey Billodeau from OCPR LFO, and Donald Taffi from NRCS. The annual inspection began at approximately 10:25 a.m. on the western boundary of the project area.

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

b. Inspection Results

<u>Beach Nourishment</u>

The sand beach nourishment area was fairly clean with some litter and debris from high tides. The sand plateau has suffered erosion from Hurricanes Rita and Ike over the last several years. Based on post storm surveys an estimated 415,000 CY of sand has been displaced. Also, there are several areas where the receding storm surge waters created cuts into the sand beach pushing the sand out into the Gulf towards the segmented rock breakwaters. Some of the sand from the beach has been pushed inland around the camps. Strong southeasterly winds were pushing the sand in a northwestern direction across Hwy 82 as well as across the beach plateau. (Photos: Appendix A, Photos 1 – 4).

Sand Fence

The sand fence has been completely destroyed with no visible signs of the sand fence material. There are some remaining 4x4 posts left standing, however the majority are broken off near the sand or leaning. There are no signs of any vegetation left that was planted along and adjacent to the sand fence alignment. (Photos: Appendix A, Photos 1 - 4).

II. Maintenance Activity (continued)

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

Replace sand fence and vegetative plants.

ii. Programmatic/ Routine Repairs

d. Maintenance History

General Maintenance: Below is a summary of completed maintenance projects and operation tasks performed since April 2003, the construction completion date of the Holly Beach Sand Management Project (CS-31).

April 2005 - The LA Dept. of Agriculture and Forestry along with the Cameron Parish Police Jury installed approximately an additional 18,800 linear feet of sand fencing along with approximately 4,000 plants in April 2005.

July 2006 – The LA Dept. of Agriculture and Forestry installed approximately 5,550 plants along the entire length of the beach project.

October 2006 – Sand Fence Replacement (FEMA Project) – A maintenance event is currently underway to replace 46,000 linear feet of sand fence destroyed by Hurricane RITA. The contractor is Landscape Management Services from Lake Charles, LA. Work began on October 9, 2006 and the contract time ends on March 12, 2007. The cost associated with the engineering, design and construction of the Holly Beach Sand Fence Maintenance Project is as follows:

Construction:	$ 218,473.50
Engineering & Design:	$ 10,000.00
Construction Admin./Oversight	$ 10,000.00
As builts:	$ 8,797.50

TOTAL CONSTRUCTION COST: $ 247,271.00

Note: This maintenance project was completed on November 27, 2006. The final quantity of sand fence installed was 46,239 linear feet.

III. Operation Activity

a. Operation Plan

There are no water control structures associated with this project, therefore no Structural Operation Plan is required.

b. Actual Operations

There are no water control structures associated with this project, therefore no required structural operations.

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, Area A, for effects of over-wash occurrences.

5. Evaluate maintenance of existing intermediate and brackish marsh vegetation in Area A, 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 (in Areas A and B), near-vertical color-infrared aerial photography (1:12,000) was acquired pre-construction in December 2001, December 2002 (since project completion was delayed) and October 2005. 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 7 in 2010. Additional photography may be obtained in response to storm events.

Aerial photography and satellite imagery will be collected for the entire coast through CRMS-*Wetlands*. The satellite imagery will be subset and used to qualitatively evaluate changes in land and water areas within the CS-31 project area at a coarse (25m) resolution. Photography and satellite imager for the Calcasieu/Sabine basin was collected in 2005, and will be analyzed for years 2005, 2008 and every 3 years thereafter.

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 were surveyed in August 2005 and post-hurricane Rita in January 2006.

Vegetation Plantings:

The general condition of the *Panicum amarum* (Bitter Panicum) plantings in Area B 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 in the spring and fall of 2004. The possibility of herbivore damage is recognized and was 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 average ft/yr gained/lost along the project area shoreline. Surveys were conducted immediately post-construction in 2003, the fall and spring of 2003, 2004, 2005, the fall of 2006, the fall and spring of 2007 and 2009, and will be conducted in the fall and spring of 2011.

Water Salinity:

To assist in determining the frequency that high salinity water enters the interior marsh in Area A 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). 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. Data collected from these stations was 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. The CS-23-01R data has been collected by personnel from Sabine National Wildlife Refuge and provided to OCPR since March 2004.

Salinity is monitored hourly utilizing one CRMS-*Wetlands* station (680) within the project area and selected reference site (2219). Continuous data was used to characterize average annual salinities throughout the project and reference areas.

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 Area A. Using the Braun-Blanquet methodology outlined in Steyer et al. (1995), 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 was noted during monitoring of emergent vegetation. Vegetation was monitored once pre-construction in 2002 and postconstruction in the fall of 2003, 2004, 2005 and 2009. Subsets of the vegetation transects were also collected in the fall of 2006, 2007, 2008 to document the effects of Hurricane Rita.

Vegetation composition and cover were also estimated from 10 permanent 2x2 plots that are randomly distributed along a transect in the emergent marsh within each of the 1 km^2 CRMS-*Wetlands* sites. Data were collected in the late summer to early fall of 2006, 2007, 2008 and 2009 using the Braun Blanquet method.

Floristic Quality Indices (FQIs) have been developed for several regions to determine the quality of a wetland based on its species composition (Cohen et al. 2004; Bourbaghs et al. 2006). A Floristic Quality Index (FQI) was developed by Jenneke Visser and an expert panel for Louisiana as part of CRMS. A list of plants occurring in Louisiana's coastal wetlands (~500 species) was provided to all known Louisiana coastal vegetation experts and their input on scoring was requested. The panel then provided an agreed upon group score (Coefficient of Conservatism or CC Score) for each species. CC scores are weighed based on cover in the FQI for Louisiana coastal wetlands. All species known to occur in the coastal zone were given a floristic quality score on a scale of 0 to 10. Species that scored lowest were considered by the panel to indicate disturbance or unstable marsh environments. CRMS sites inside (608) and outside (2219) the project area were used for this report.

Porewater Salinity:

At each project-specific emergent vegetation station, we attempted to obtain soil porewater salinity data, utilizing the sipper method, down to 10 cm below the soil surface. Data were collected pre-construction in 2002 and postconstruction in the fall of 2003, 2004, 2005 and 2009. Subsets of the data were also collected in the fall of 2006, 2007, 2008 to document the effects of Hurricanes Rita and Ike.

At each servicing of the CRMS-*Wetlands* station recorders, a measurement of the interstitial water salinity is collected adjacent to the boardwalk. Interstitial water salinity is also determined at 5 of the vegetation plots, when vegetation is surveyed.

CRMS Supplemental

In addition to the project specific monitoring elements listed above, a variety of other data is collected at CRMS-*Wetlands* stations which can be used as supporting or contextual information. Data types collected at CRMS sites include hydrologic from continuous recorder (mentioned above), vegetative, physical soil characteristics, discrete porewater salinity, surface elevation change, vertical accretion and land:water analysis of 1 km^2 area encompassing the station (Folse et al. 2008). For this report, hydrologic, vegetation, porewater and soil characteristic data were used to provide contextual information for the project. Data from CRMS site 680 within the project area is compared to data from CRMS site 2219 outside the project area in a traditional project versus reference manner. In the future, data collected from the CRMS network over a sufficient amount of time to develop valid trends will be used to develop integrated data indices at different spatial scales (local, basin, coastal) to which we can compare project performance.

IV. Monitoring Activity (continued)

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 and postconstruction acquired in October 2005 (figures 2-5). Results are presented in Table 1. The difference between the 2001 and 2002 analyses was due to the partial construction of the beach at the time of the 2002 photography. The 2005 analysis followed Hurricane Rita and showed approximately 30 acres of land lost, mostly along the shoreline. The 2005 land to water analysis for CRMS0680 showed approximately 98% land and 2% water (Figure 6).

Table 1. Land:Water acreages from 2001, 2002 (pre construction) and 2005 (post construction) in the project area.

		Project		
Year		Acres	Hectares	%
2001	Land	8812	3566	82
2001	Water	1989	805	18
2002	Land	8938	3617	83
2002	Water	1863	754	17
2005	Land	8897	3601	82
2005	Water	1894	767	18

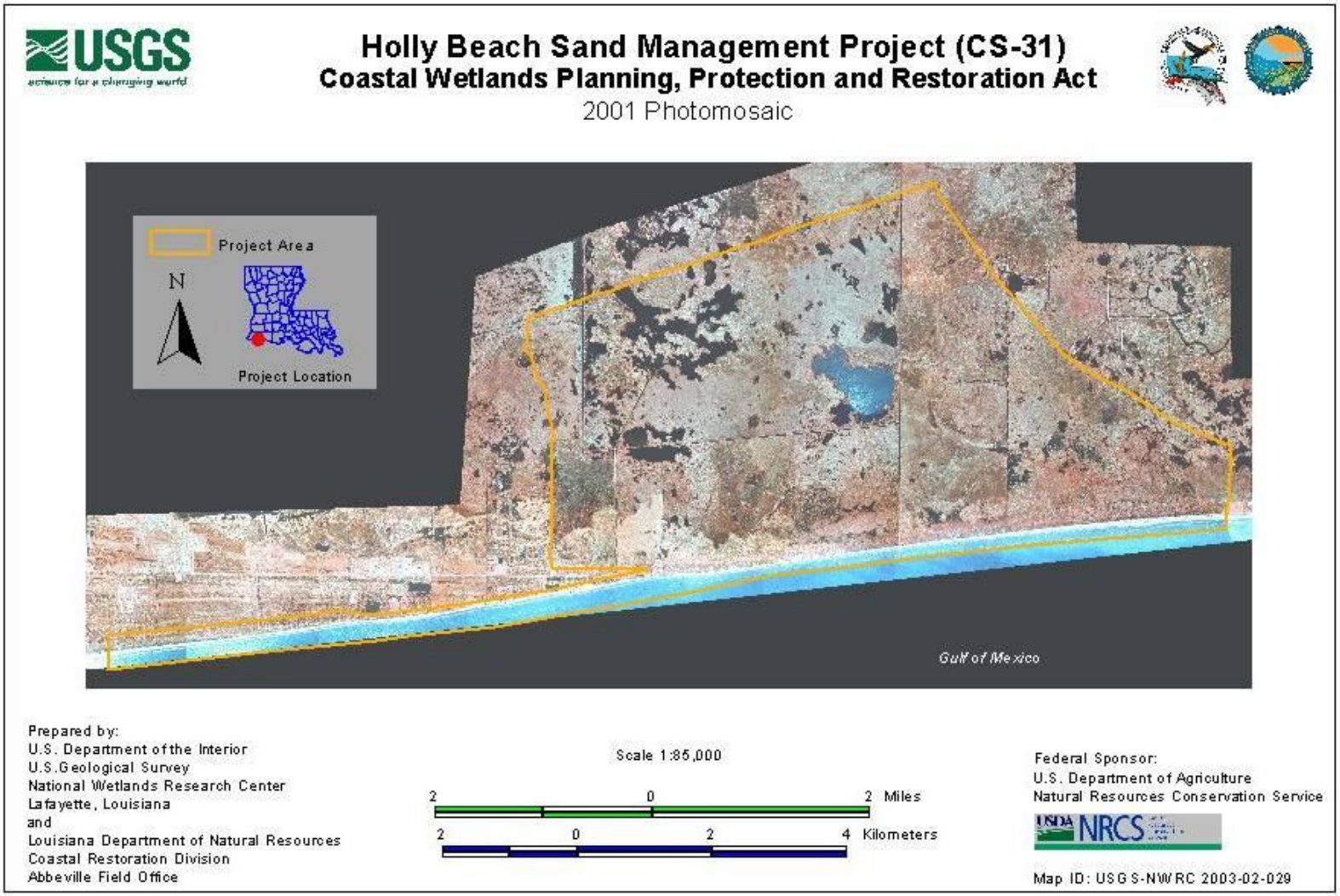


Figure 2. Photomosaic of the Holly Beach Sand Management (CS-31) project area from photography obtained November 17, 2001.

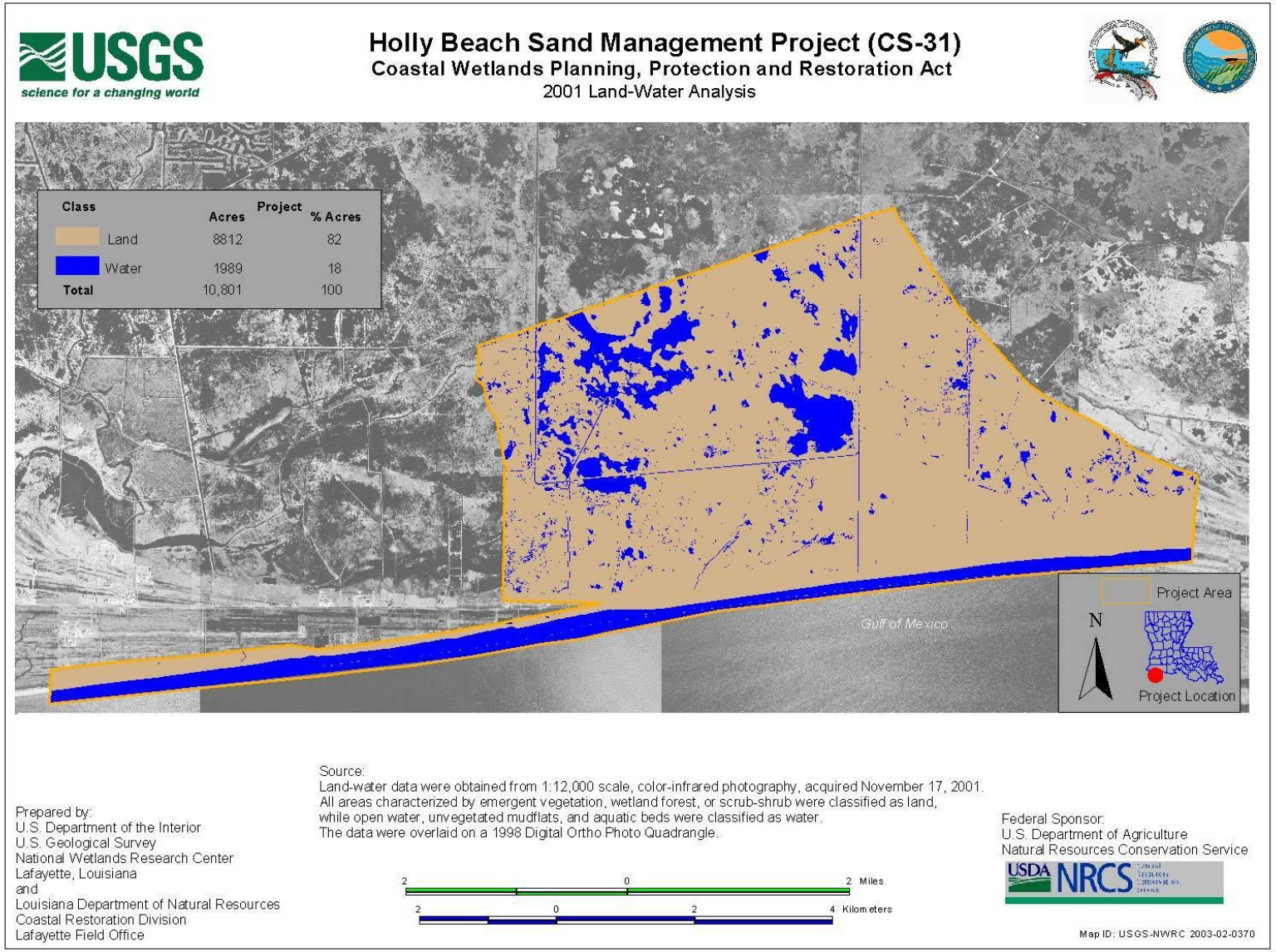


Figure 3. Land/Water analysis of the Holly Beach Sand Management (CS-31) project area from photography obtained November 17, 2001.

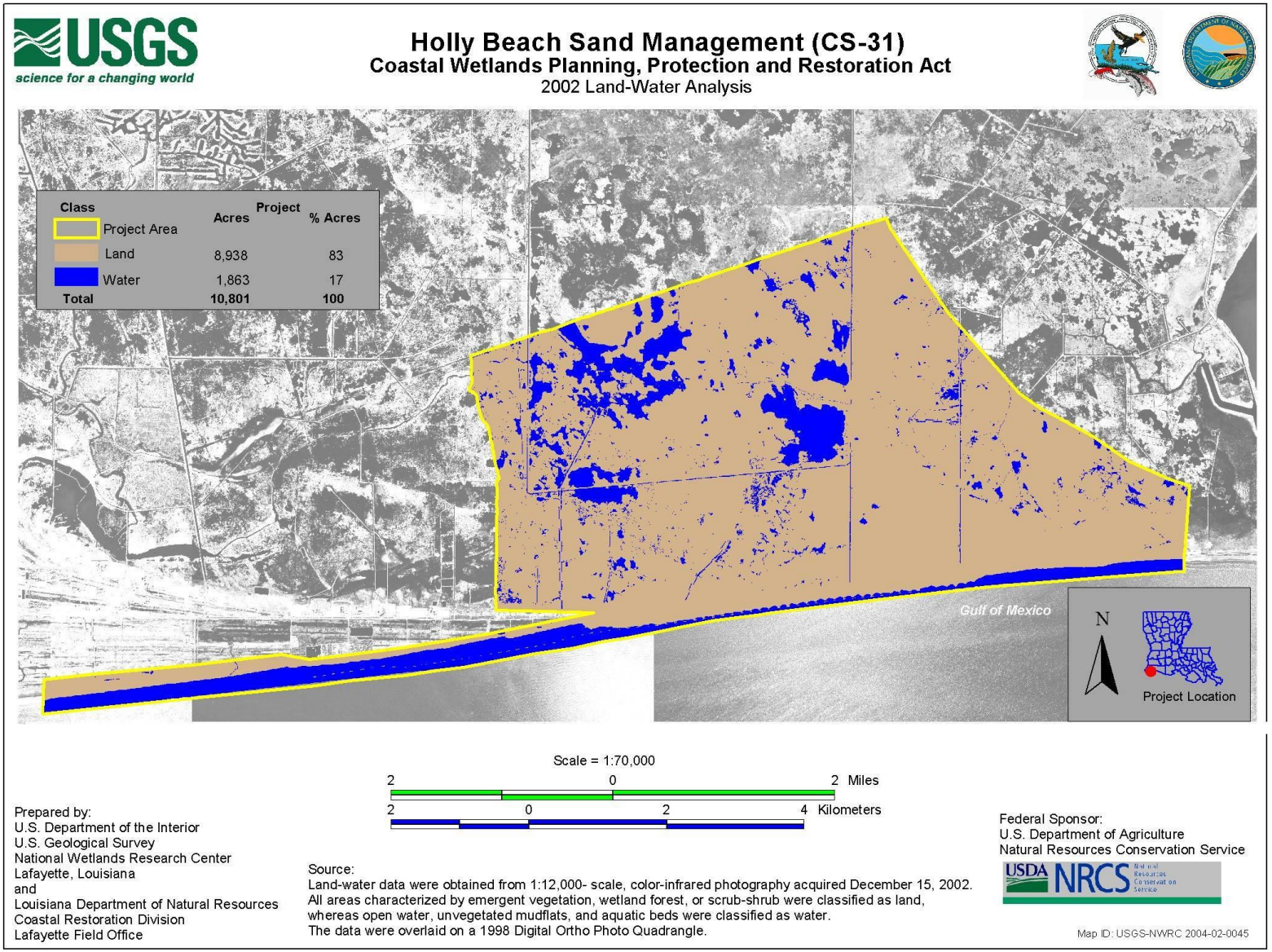


Figure 4. Land/Water analysis of the Holly Beach Sand Management (CS-31) project area from photography obtained December 15, 2002.

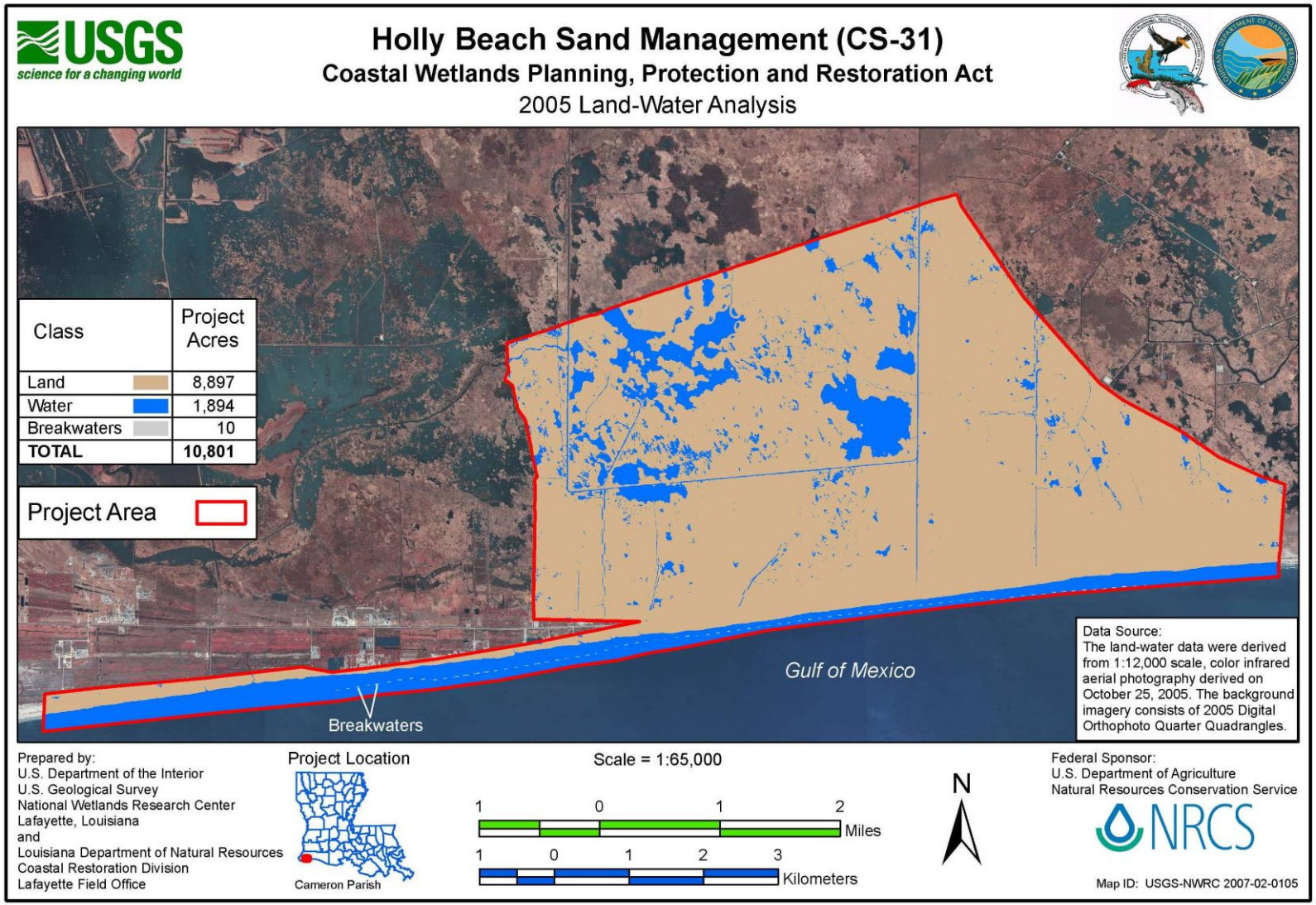


Figure 5. Land/Water analysis of the Holly Beach Sand Management (CS-31) project area from photography obtained October 25, 2005.

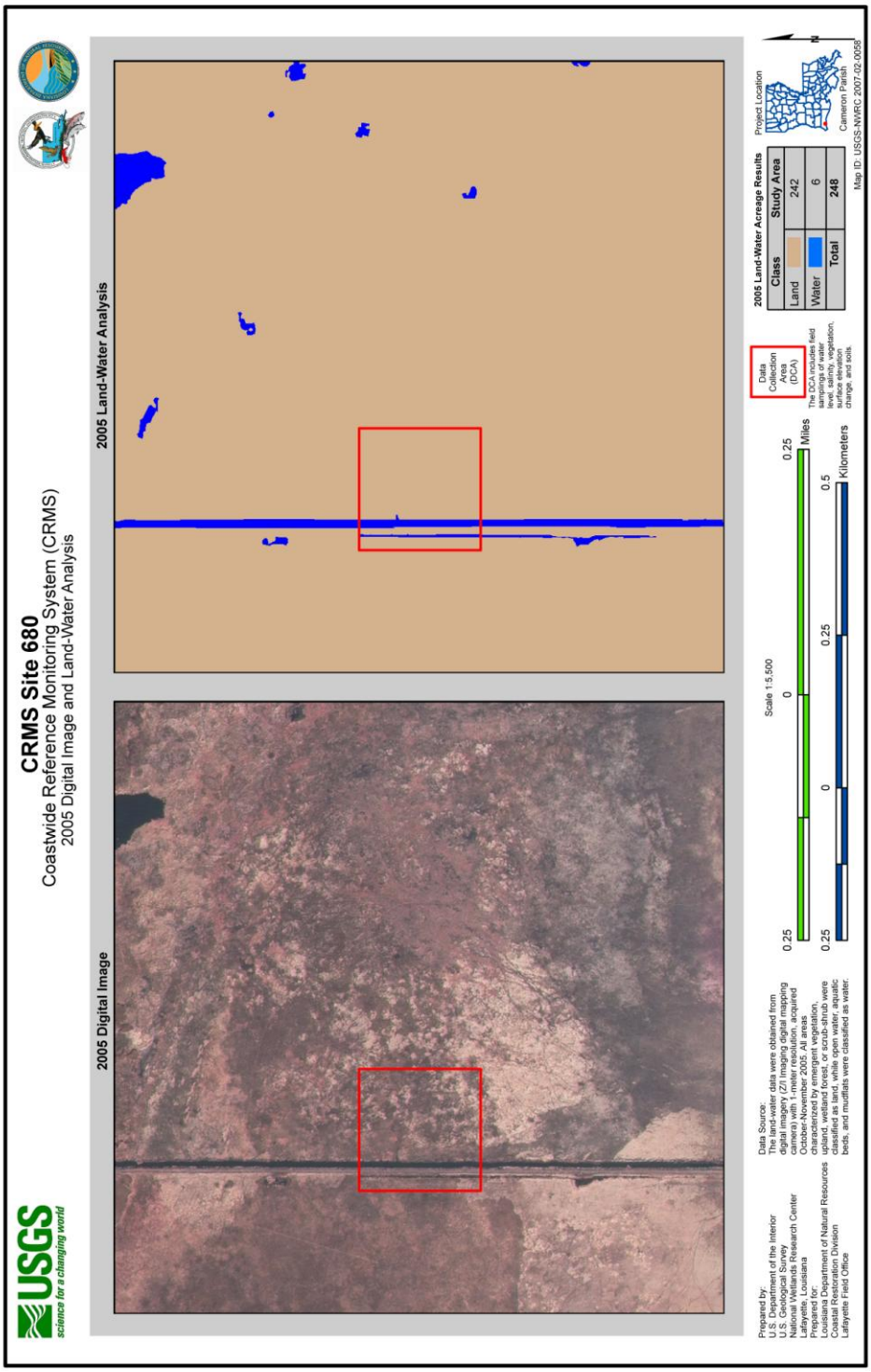


Figure 6. CRMS station 680 land/water analysis.

Bathymetry/Topography:

A Geographic Information System (GIS) database was developed to facilitate the data processing and analysis phase of this investigation. Substantial data processing was required to prepare survey coordinate data for beach profile analysis. Survey data were imported to ArcGIS and reprojected to a Universal Transverse Mercator (UTM) coordinate system for surface interpolation. A triangulation-based (TIN) digital terrain model was then generated from each survey in order to produce two interpolated surfaces for comparison.

Shoreline position change rates were calculated using the Digital Shoreline Analysis System (DSAS Ver. 3.2). Shoreline position was defined as the location of the 2.55 foot contour along the beach. Inspection of the beach profiles indicated that the 2.55 foot contour tended to coincide with a distinct break in slope along the upper beach. This position is an interpretation of the upper limit of wave activity at high tide; relative to geomorphology, this position is generally recognized as the berm crest or a scarp at the toe of the dune (see Byrnes and Hiland 1995). Transect start points were generated using a baseline created by drawing a straight line north of the beach, running parallel to the beach (for breakwaters 10 thru 72). Transects were placed perpendicular to the baseline, spaced 20 m apart, and measured from the baseline to the shoreline position at the 2.55 ft contour within each survey. Shoreline change was calculated by subtracting the August 2005 shoreline position from the January 2006 shoreline position. The data indicate that the shoreline retreated at an average of 21 ft/yr during this time period (figures 7a and 7b).

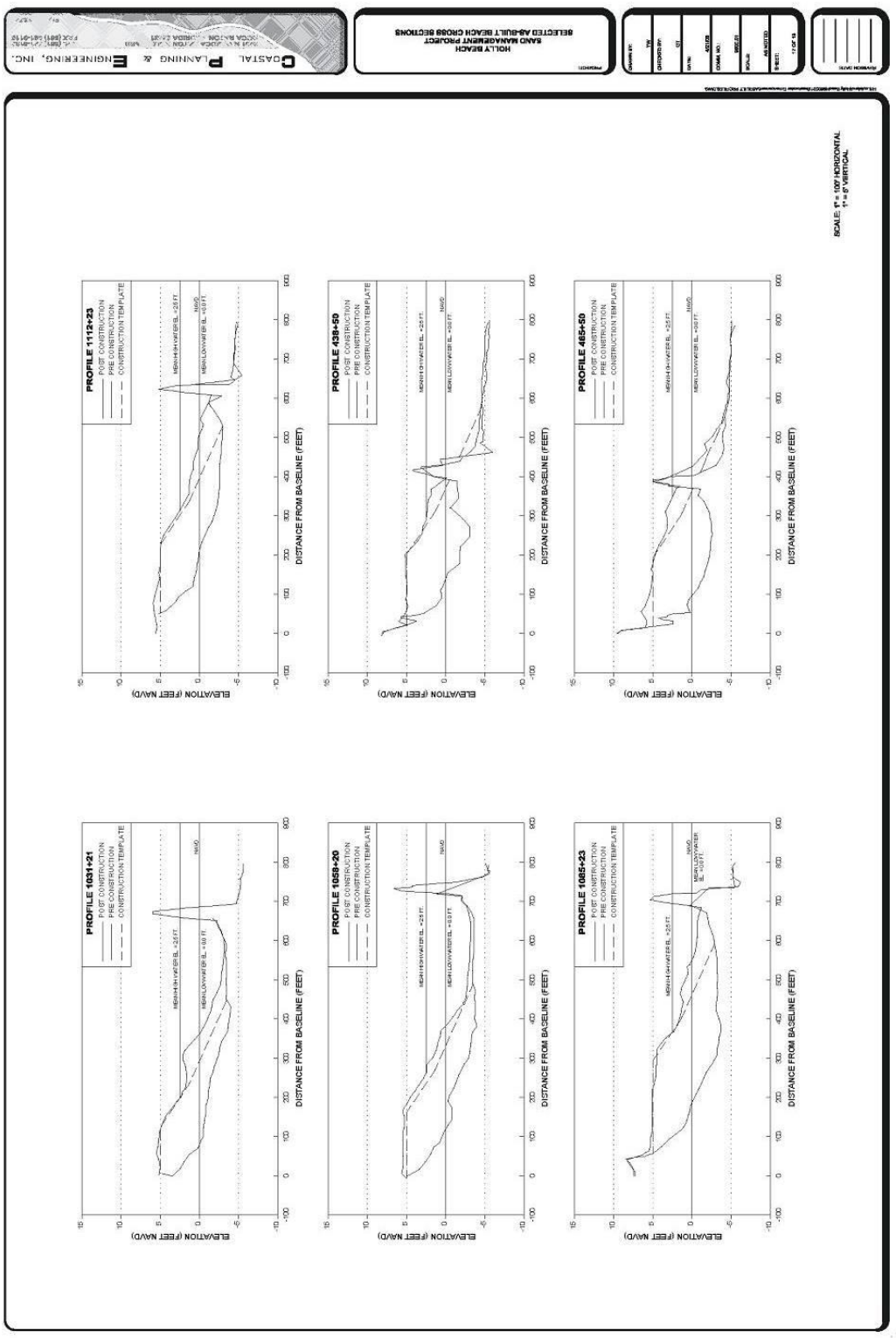


Figure 7a. Holly Beach Sand Management selected pre-construction and as-built cross-sections.

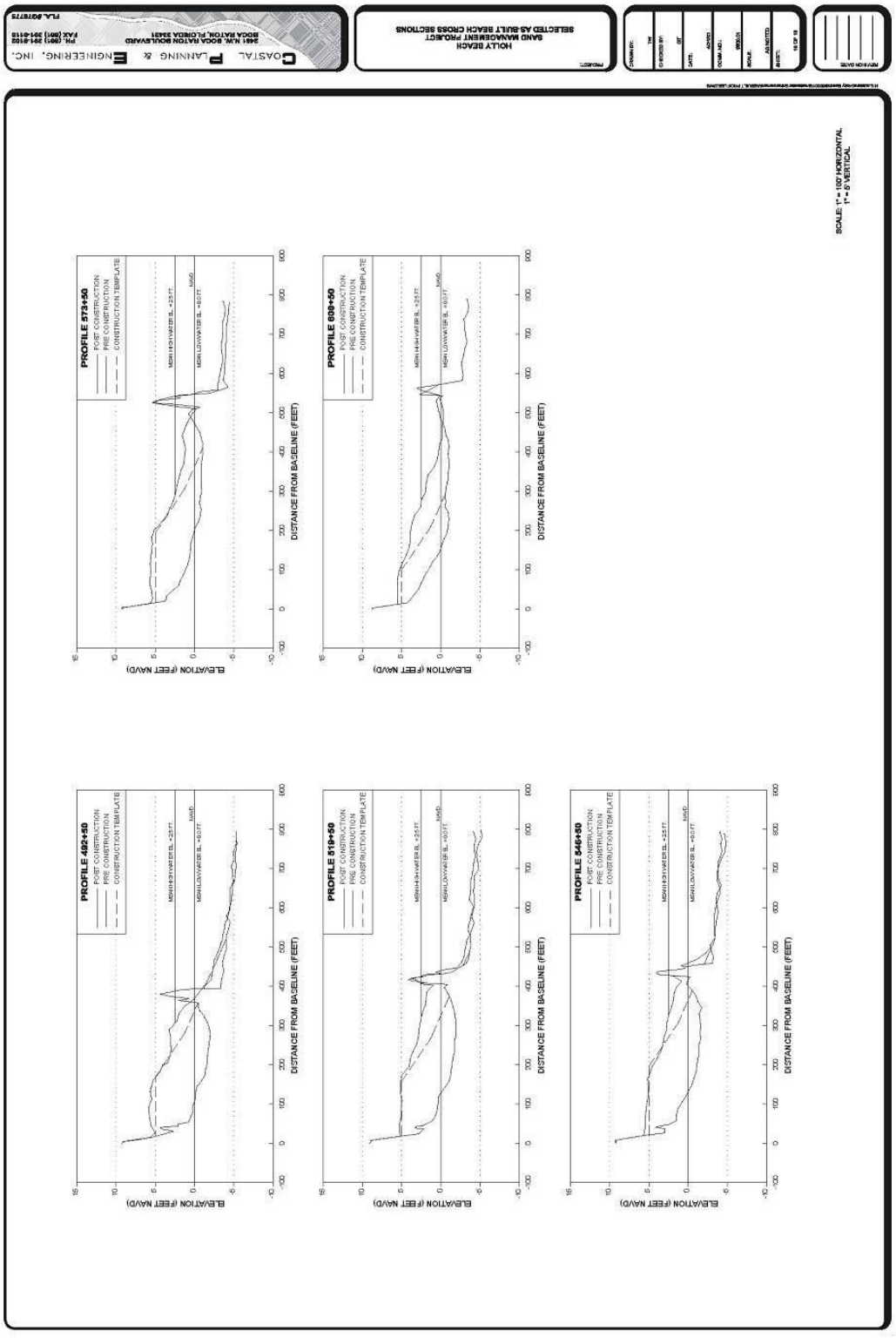


Figure 7b. Holly Beach Sand Management (CS-31) selected pre-construction and as-built cross-sections.

Vegetation Plantings:

Data were collected on October 6, 2003, April 20, 2004 and October 12, 2004 (Table 1, figures 8 & 9). Mean percent survival and mean percent cover in the fall of 2003 were 82.5% and 13.07%, respectively. In the spring of 2004 mean percent survival was 81.1% and mean percent cover was 26.7%. Mean percent survival dropped to 76.7% in the fall of 2004, while mean percent cover increased to 46.4% (figure 9). Many of the original plants were actually covered by the dune that formed behind the fences. The dunes were becoming colonized by both *Panicum amarum* and other species as well. The last scheduled monitoring of the vegetation plantings occurred in the fall of 2004. As documented in the inspection report, though, the plantings were severely impacted by Hurricane Rita and were replanted by the La Dept. of Agriculture and Forestry. These plantings were again severely impacted by Hurricane Ike and are to be replanted in the summer of 2011. The condition of the vegetation plantings and dunes will be documented using O&M surveys.

Figure 8a. View of the sand fencing and Vegetation Plantings at Station CS31-108 taken in April 2004. Note the dune formation almost covering the fences. The photograph is facing east.

Figure 8b. View of the Sand Fencing and Vegetation Plantings at Station CS31-150 taken in October 2004. The photograph is facing east.

Figure 8c. View of a section of the sand fencing and vegetation plantings taken October 2005, following Huricane Rita. The photograph is facing west.

Holly Beach Sand Management (CS-31)
Vegetation Plantings

Table 1. Vegetative species observed during the 2002, 2003, and 2004 Vegetation plantings survey.

Scientific Name	**Common Name**
Cakile geniculata	gulf searocket
Chrysopsis mariana	Maryland goldenaster
Pluchea odorata	sweetscent
Symphyotrichum subulatum	eastern annual saltmarsh aster
Spartina patens	marshhay cordgrass
Solidago sempervirens	seaside goldenrod
Amaranthus rudis	tall amaranth
Amaranthus australis	southern amaranth
Eclipta prostrata	false daisy
Alternanthera philoxeroides	alligatorweed
Ipomoea pes-caprae	bayhops
Vigna luteola	hairypod cowpea
Cyperus odoratus	fragrant flatsedge
Ipomoea imperati	beach morningglory

Holly Beach Sand Management (CS-31)

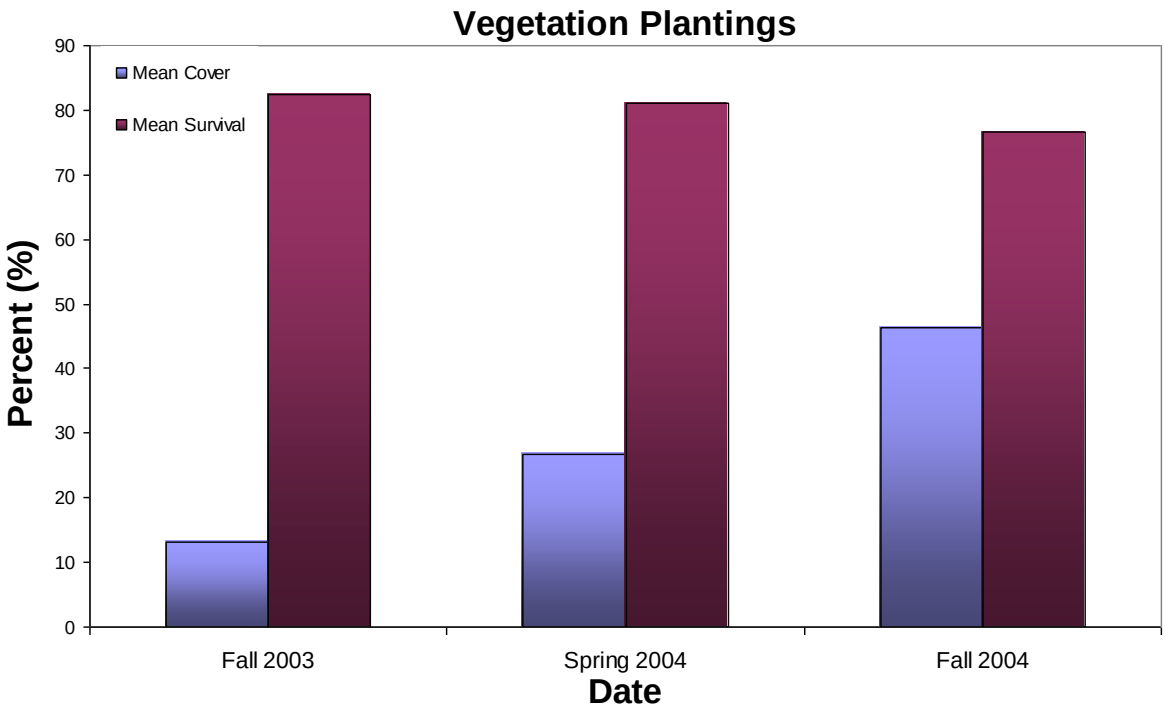


Figure 9. Mean percent cover and survival of the *Panicum amarum* plantings on the 2003 and 2004 surveys.

Shoreline Change:

Data were collected in the spring and fall of 2003, 2004, 2005, the spring of 2006, and the fall and spring of 2007 and 2009. No monitoring was scheduled for 2006, but a survey was conducted to evaluate the effects of Hurricane Rita. The data indicate an average loss of 6.12 ft/yr between the spring 2003 and spring 2004 surveys. This period would be considered the initial adjustment period after construction when the beach was taking shape. The beach was expected to quickly degrade during this time period due to an overfill of sand by the contractors. The pre-Hurricane Rita data (spring 2003 to spring 2005) indicate an average loss rate of 17.72 ft/yr. The post-hurricane Rita survey (comparing spring 2005 to fall 2005) showed an average of 46.33 ft/yr was lost during the storm (figure 11). Comparing the fall 2005 to spring 2006, which would be considered the recovery period after the impact, indicated an average loss rate of 41.47 ft/yr. The post-hurricane Ike survey (comparing spring 2007 – fall 2009) showed an average of 5.27 ft/yr was lost during the storm (figure 12). Average loss across all surveys (spring 2003 to fall 2009) was 13.44 ft/yr (figure 10). These should not be taken individually as an actual indication of loss rates along the beach, but rather an indication of the processes occurring along the beach. Unlike the bathymetric/topographic surveys, these shoreline surveys can be influenced by tide levels considering the gentle slope of the beach (1:40 during construction) and the fact that elevation is not taken into account during data collection. Tide levels during the surveys are presented in Table 2. Loss rates appeared to be fairly uniform across the project area in most surveys prior to Hurricane Rita. However, the post-Hurricane Rita and post-Hurricane Ike data indicate greater loss rates along the eastern side of the beach and some gain along the western end (figure 11). The hurricanes appear to have shifted large amounts of sand to the western side.

Holly Beach Sand Management (CS-31)
Shoreline Change

Table 2. Tide levels during shoreline surveys. Data were collected at Sabine Pass in ft Mean Sea Level.

Date of Survey	Tide level (Ft MSL)
Spring 2003	0.51
Fall 2003	0.47
Spring 2004	0.18
Fall 2004	-0.17
Spring 2005	0.17
Fall 2005	-0.89
Spring 2006	0.77
Spring 2007	-0.70
Fall 2007	0.71
Spring 2009	-0.42
Fall 2009	0.78

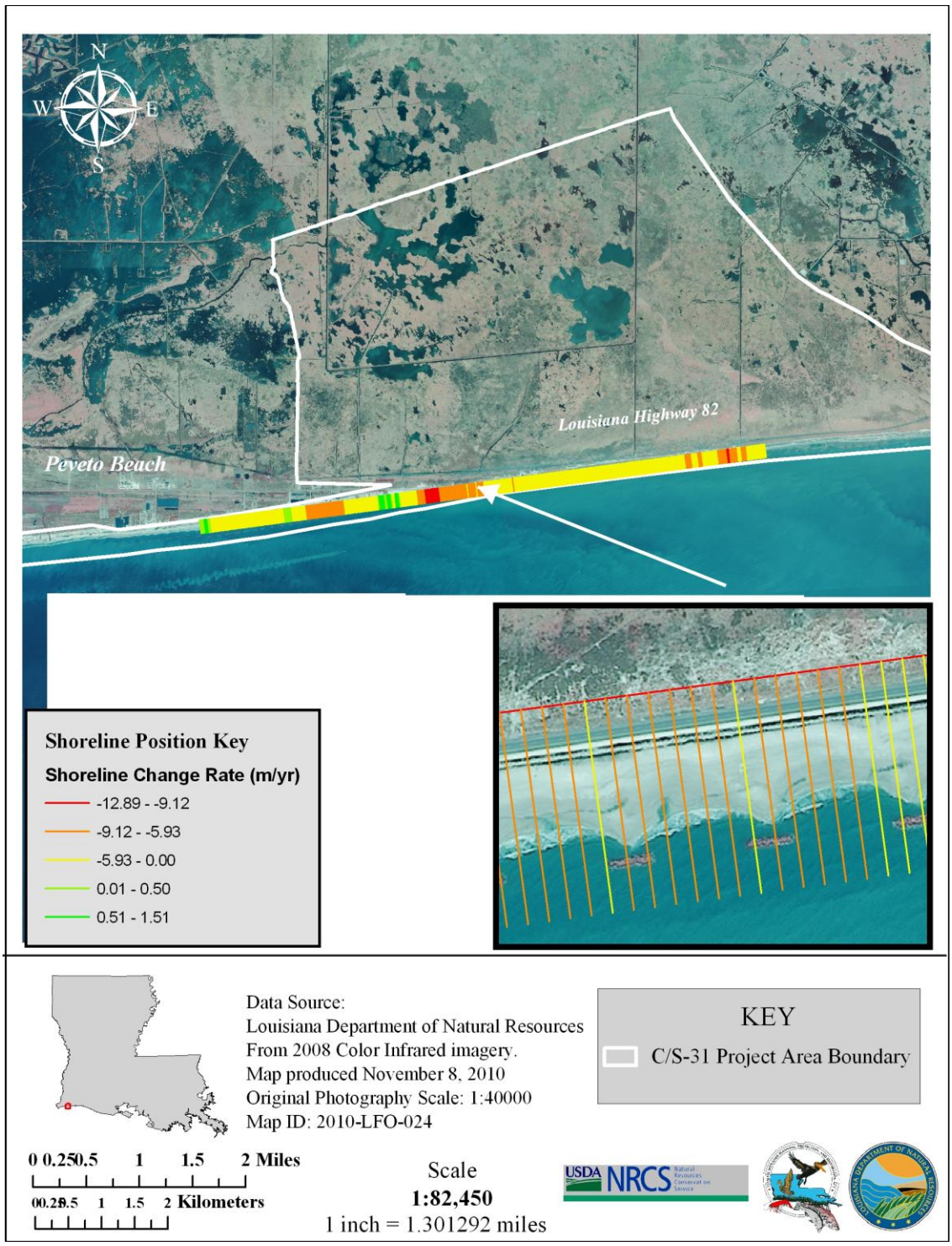


Figure 10. Shoreline Change Rates across all surveys from Spring 2003 to Fall 2009.

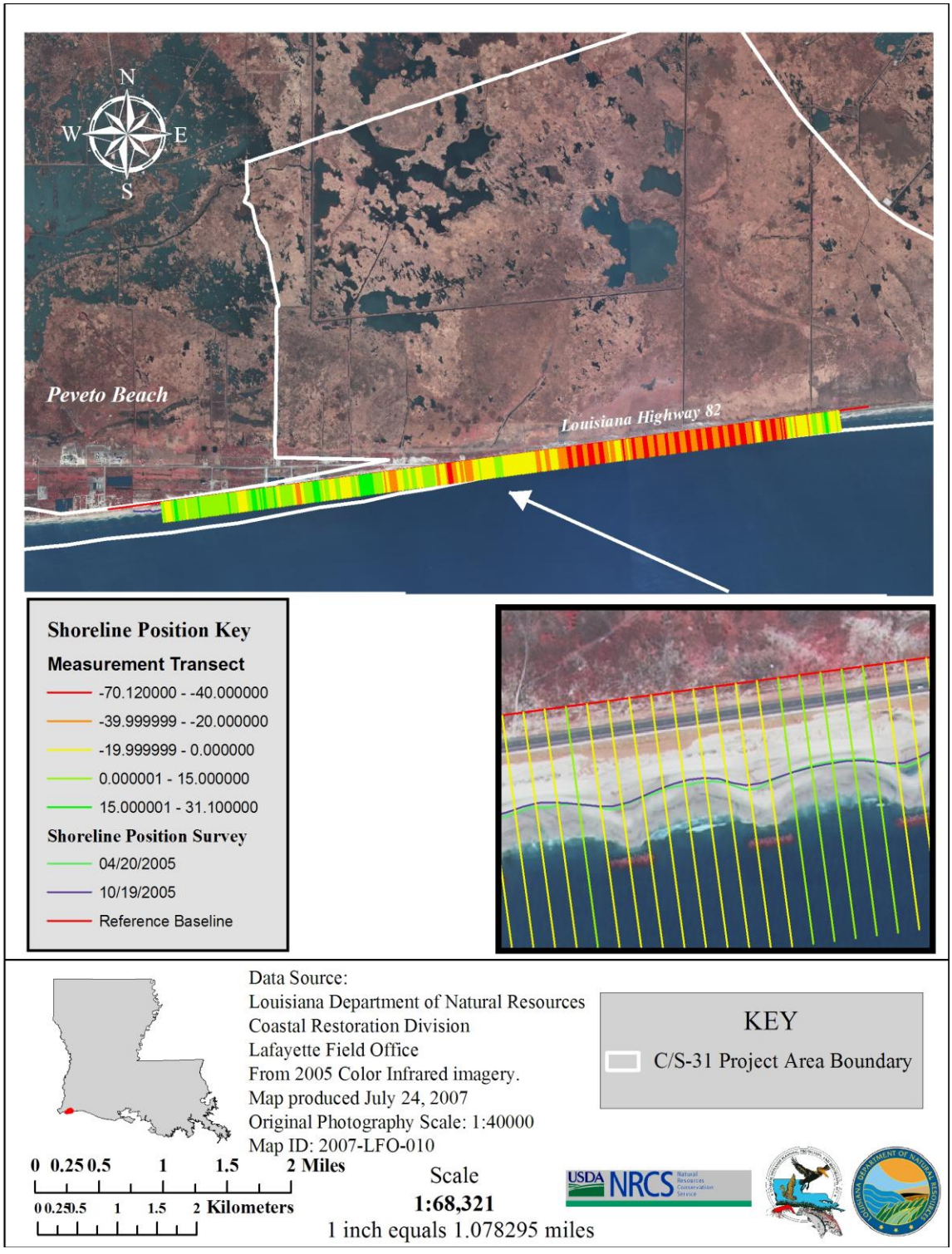


Figure 11. Shoreline change rates comparing pre- and post- Hurricane Rita surveys.

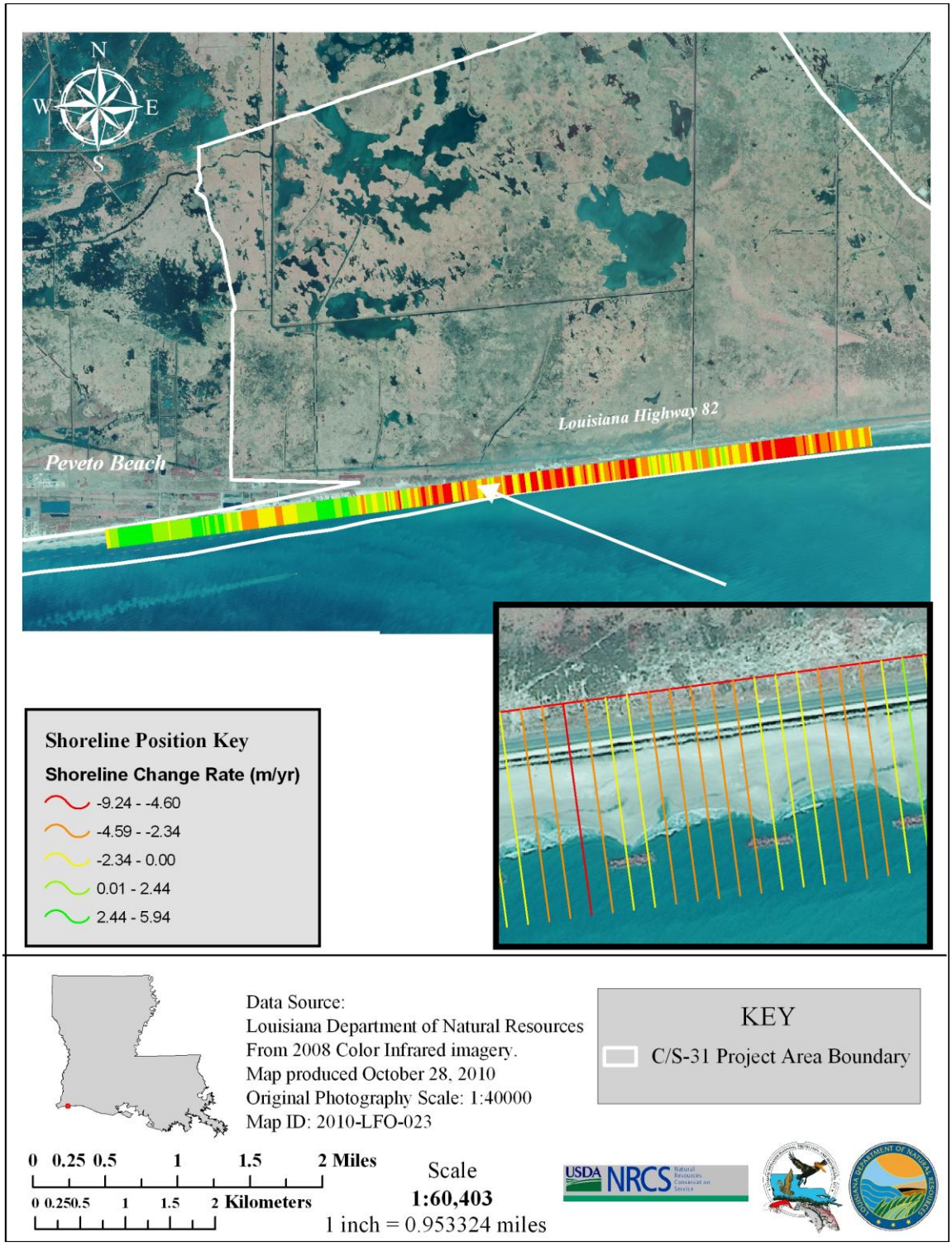


Figure 12. Shoreline change rates comparing pre- and post- Hurricane Ike surveys

Water Salinity:

Hourly salinity data have been collected at the following continuous recorder stations (figures 13 and 14a-c).

Station	Data collection period
CS31-01	9/10/02 – 6/11/07
CS31-02	2/18/03 – 6/11/07
CS31-03	2/18/03 – 5/1/07
CS20-15R	1/1/95 – 12/31/09
CRMS0680	7/30/07 – 12/31/09
CRMS2219	12/12/07 – 12/31/09

The project goals for salinity were to maintain levels within the intermediate to brackish range of 3-12 ppt (figure 13). Yearly means of all project area recorders were less than 3 ppt through 2004. Monthly means at all project area stations stayed within the target range until Hurricane Rita struck in September. CS31-02 was the only recorder that continued to log through the Hurricane where salinities reached 24 ppt. Monthly salinity means remained above 20 ppt at stations CS31-01 and CS31-02 until December 2005 (figure 14a – 14c). CS31-03 was not redeployed until March 2006. In July 2006, monthly salinities returned to normal and remained below 7 ppt until April 2007. Data from station CS20-15R in the East Mud Lake Marsh Management (CS-20) reference area, which reflects conditions in Calcasieu Lake, are presented for comparison. The data from this recorder was used since the recorder at CS23-01R did not collect data for much of 2005 and 2006. Yearly mean salinities at this recorder were below 12 ppt for the years preceding Hurricane Rita. However, following Rita, monthly mean salinities remained around 15 ppt through the end of 2006 as salinities in the project area had returned to normal. In May and June of 2007, salinities spiked at CS20-15R to near 20 ppt. An increase was also detected at CS31-01 and CS31-02 indicating some influence from the Calcasieu Ship Channel may have occurred in the project area.

The recorder at CRMS0680 is located in the same canal as CS31-03. Salinities at this station were below 5 ppt until Hurricane Ike made landfall in September 2008. During this event, the salinity reached 26 ppt. Monthly salinities dropped below the target level of 12 ppt in December of 2008 and have remained below that level through the end of 2009, even though salinities reached 20 ppt at CS20-15R in the summer of 2009. CRMS2219 had similar salinities as CRMS0680 for the latter part of 2009.

Project area yearly salinities were within the target range of 3-12 ppt 93% of the time in years 2003 – 2009 (Figure 14d). Yearly salinities at reference station CS20-15R were within this range only 46% of the time.

Water level data did not indicate any overwash events other than the surges from Hurricanes Rita and Ike. There was a maximum storm surge in the project area of 14-15 ft for Hurricane Rita (Barras, 2006) and 15-16 ft for Hurricane Ike (East et al. 2008).

Figure 13. Location of continuous recorder stations at Holly Beach Sand Management (CS-31) project.

Holly Beach Sand Management (CS-31)
Salinity Data

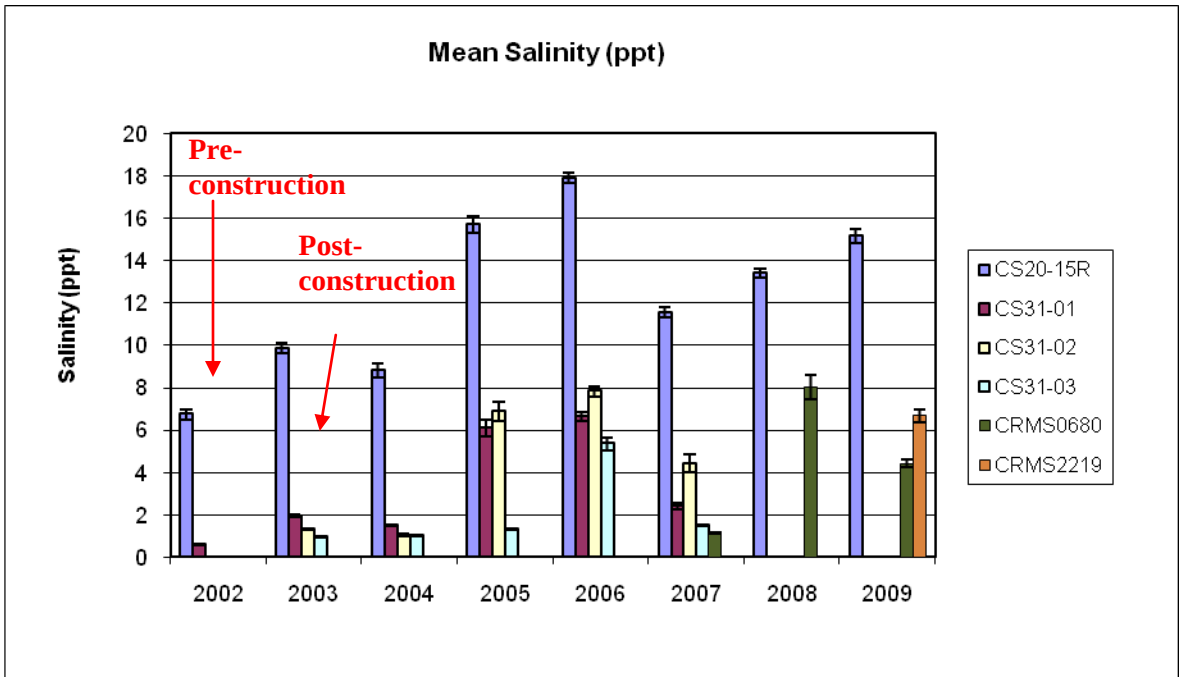


Figure 14a. Yearly salinity means at all CS-31 project area stations, CS20-15R, CRMS0680 and CRMS2219 for years 2002-2009.

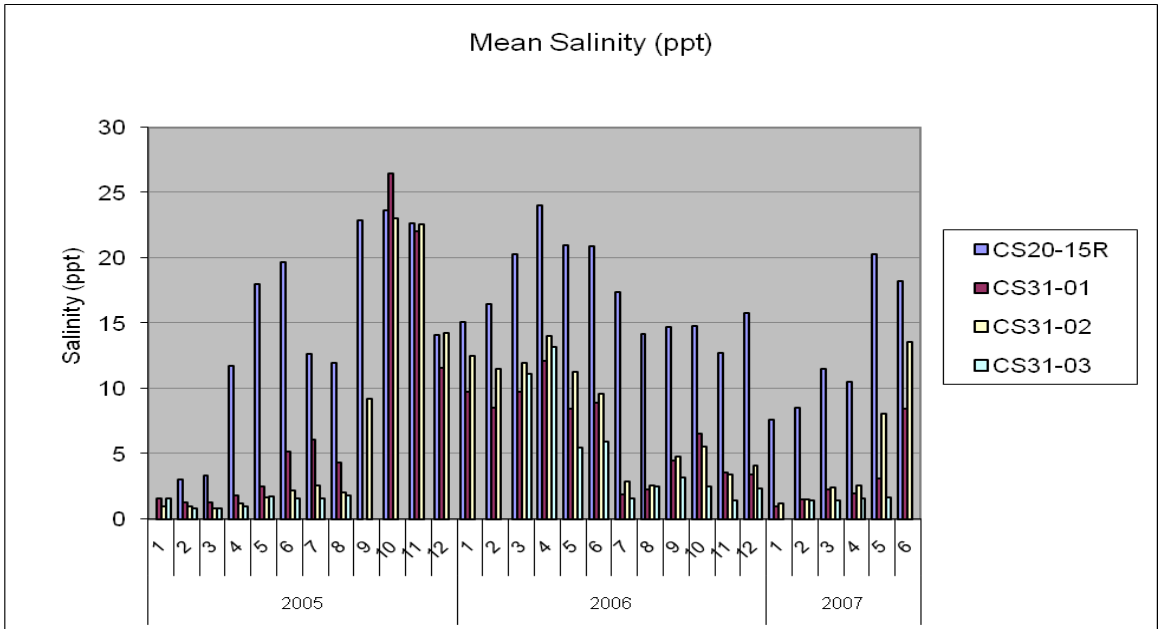


Figure 14b. Monthly means at CS-31 project area stations and CS20-15R for years 2005 - 2007.

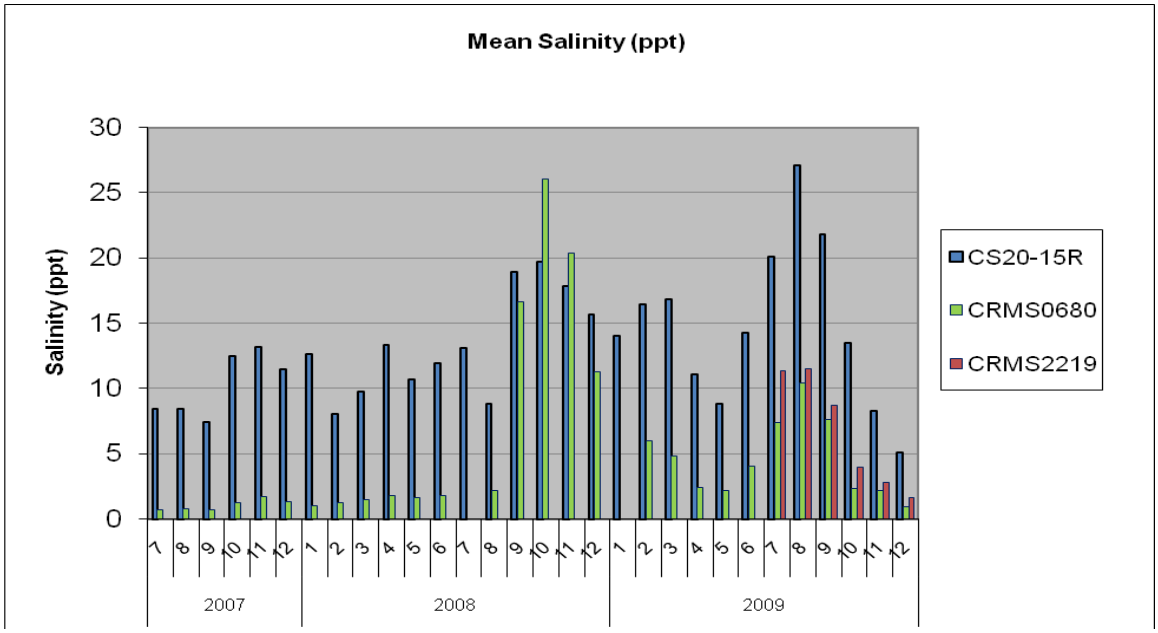
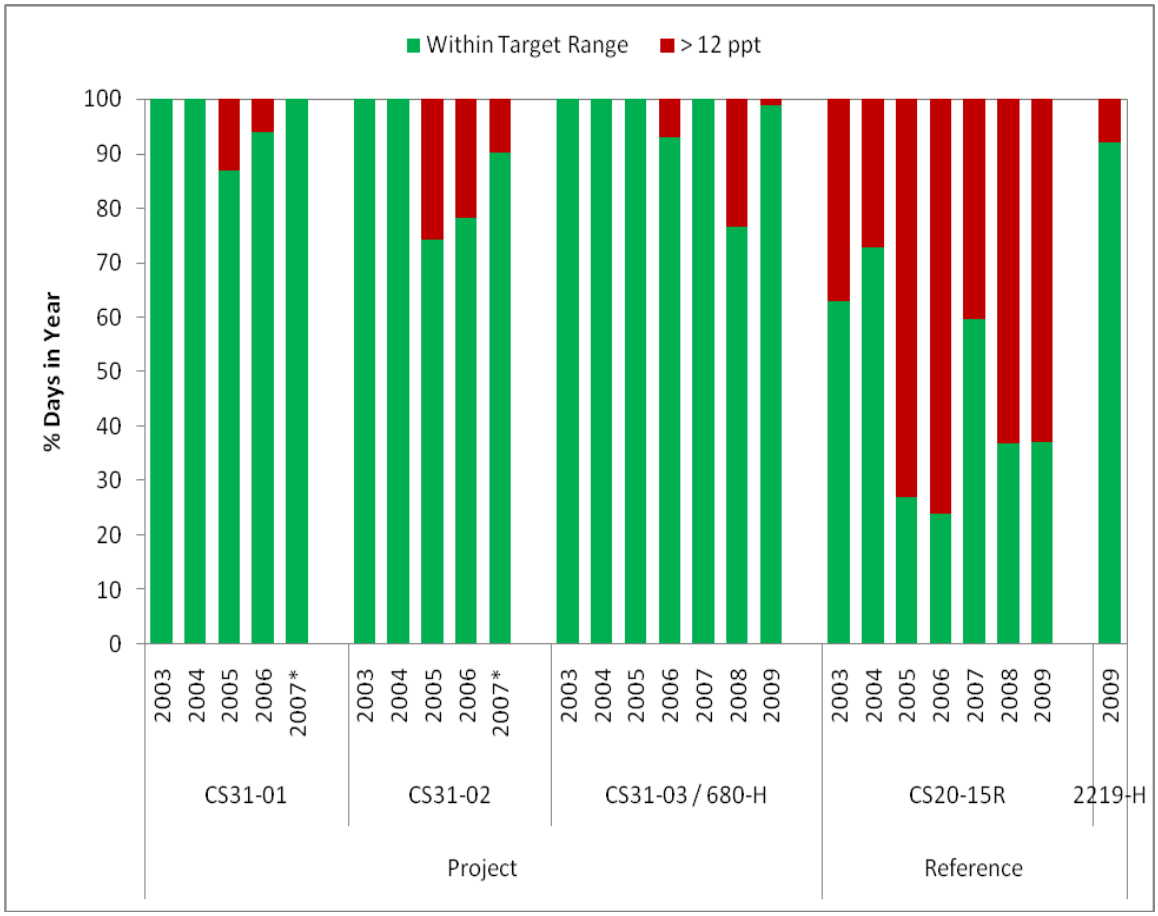


Figure 14c. Monthly means at CS20-15R, CRMS0680 and CRMS2219 for years 2007 – 2009.



*Represents the first 6 months of the year

Figure 14d. Percentage of year salinities were inside and outside of target range post-construction for project and reference stations.

Emergent Vegetation:

The project goal for emergent vegetation was to maintain the existing vegetation community as that typical for intermediate and brackish marsh in project Area A north of the chenier/beach ridge. The dominant species in all surveys were *Spartina patens*, *Schoenoplectus americanus* and *Distichlis spicata.* Other frequently occurring species were *Paspalum vaginatum*, *Schoenoplectus robustus,* and *Paspalum distichum.* These species would fit into either the Olighohaline Paspalum or Oligohaline wiregrass classification described by Visser et al 2000 (Table 3, figures 15a-c).

Total percent cover for the pre-construction survey in 2002 was over 100% with an FQI score of 76. The FQI score dropped in 2003 and 2004 but still remained above 60. Following Hurricane Rita, cover and FQI (6.4) dropped dramatically, but showed a good recovery in 2006. Percent cover, as well as the quality of vegetation rebounded in 2007 to the 2002 level but dropped in 2008 following Hurricane Ike. A slight decrease in FQI score occurred again in 2009 (43 versus 47 FQI score), but cover remained the same as in the 2008 survey (Figure 15b).

CMRS site 680 showed the same trend as the project-specific sites; however the 2008 CRMS survey showed an increase in FQI and cover. The 2009 values were essentially the same as the project-specific sites. CRMS2219 showed a mild increase in cover and FQI from 2006 to2007. Cover dropped in 2008 following Hurricane Ike, but, unlike the sites in the CS-31 project area, cover and FQI score increased in 2009.

Holly Beach Sand Management (CS-31)
Emergent Vegetation

Table 3. Plant species observed during the 2002, 2003, 2004, 2005, 2006, 2007, 2008 and 2009 vegetation surveys of the CS-31 project area.

Scientific Name	Common Name
Amaranthus australis	southern amaranth
Baccharis halimifolia	eastern baccharis
Batis maritima	turtleweed
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	bigleaf sumpweed
Lycium carolinianum	Carolina desert-thorn
Mikania scandens	climbing hempvine
Paspalum distichum	knotgrass
Paspalum vaginatum	seashore paspalum
Pluchea camphorate	camphor pluchea
Rumex crispus	curly dock
Salicornia bigelovii	dwarf saltwort
Schoenoplectus americanus	chairmaker's bulrush
Schoenoplectus californicus	california bulrush
Schoenoplectus maritimus	cosmopolitan bulrush
Schoenoplectus pungens	common threesquare
Schoenoplectus robustus	sturdy bullrush
Sesbania herbacea	bigpod sesbania
Solidago sempervirens	seaside goldenrod
Spartina patens	saltmeadow cordgrass
Spartina spartinae	gulf cordgrass
Suaeda linearis	annual seepweed
Symphyotrichum subulatum	eastern annual saltmarsh aster
Symphyotrichum tenuifolium	perennial saltmarsh aster
Typha	cattail
Vigna luteola	hairypod cowpea

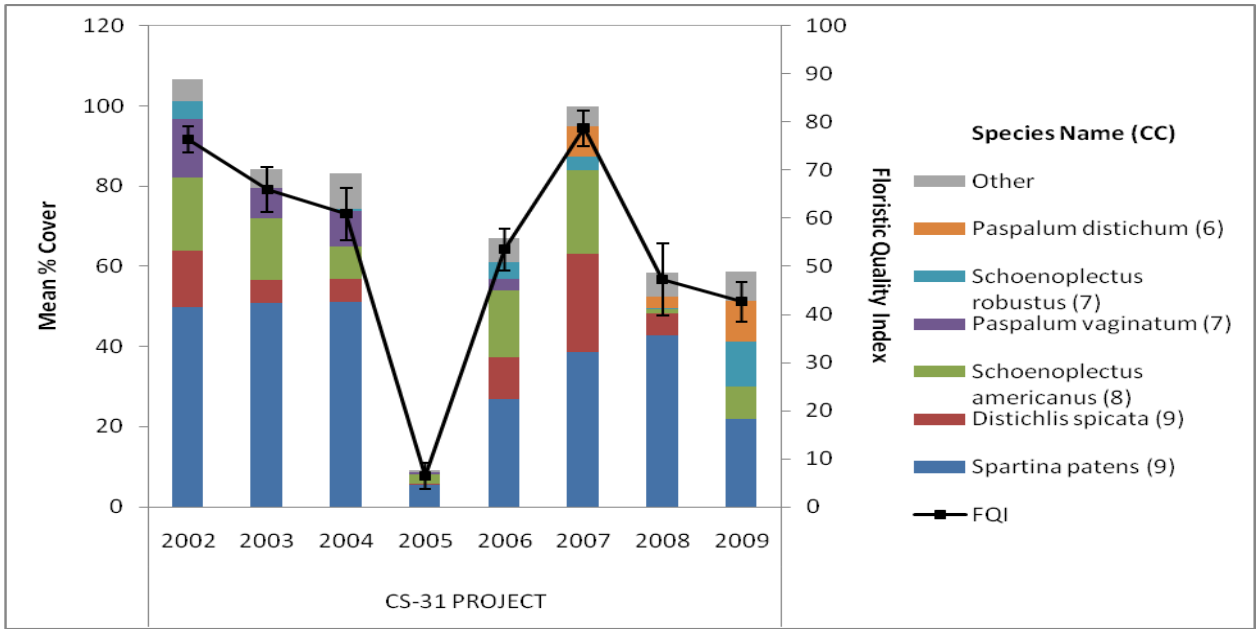


Figure 15a. Percent coverage and floristic quality index of species collected from the CS-31 project area in years 2002 – 2009. Values are means of 30 stations within the project area; therefore, the sum of % coverage of individual species can be greater than 100%.

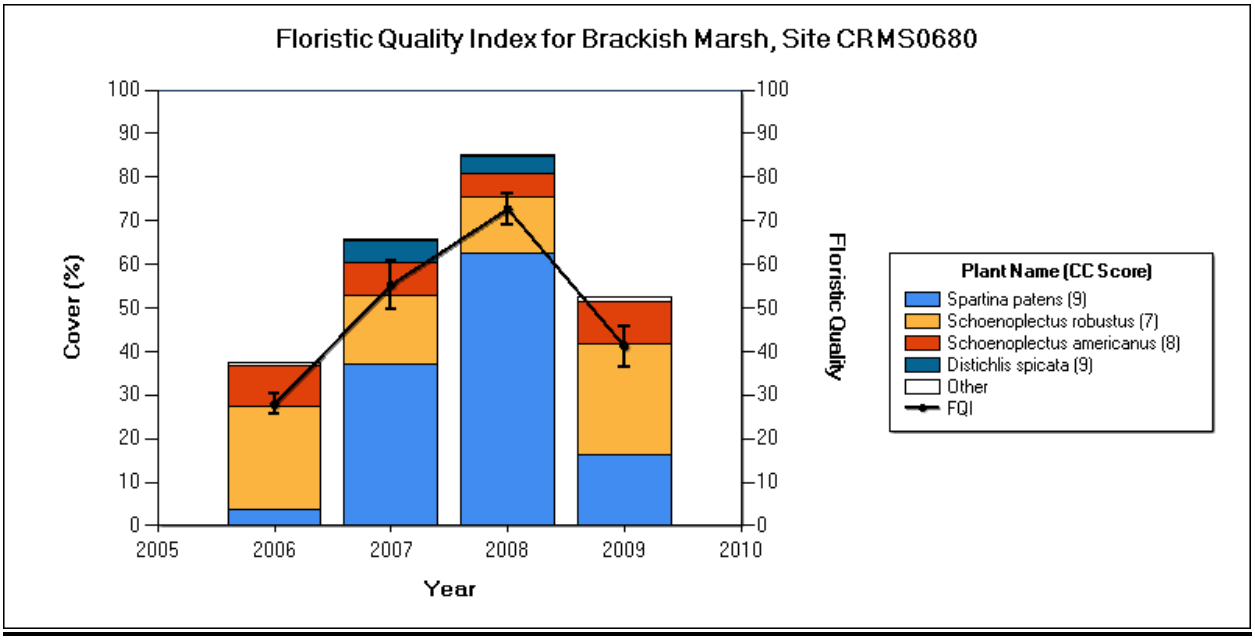


Figure 15b. Percent coverage and floristic quality index of species collected from CRMS site 680 within the project area in years 2006 – 2009. Values are means of 10 stations within the site; therefore, the sum of % coverage of individual species can be greater than 100%.

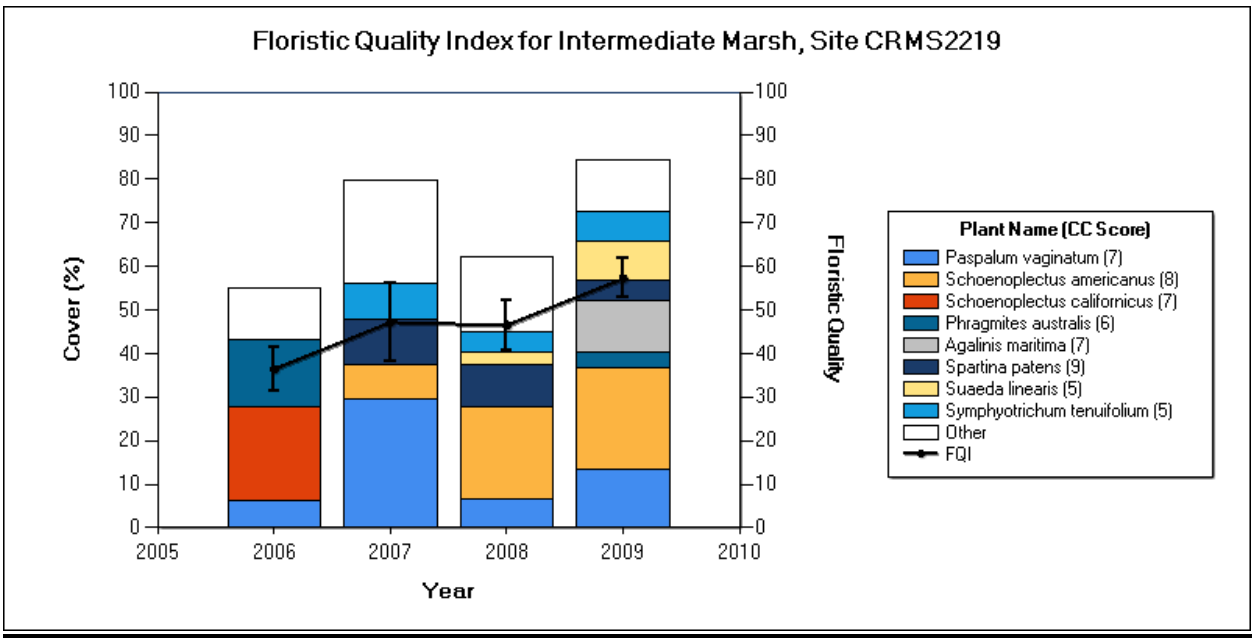


Figure 15c. Percent coverage and floristic quality index of species collected from CRMS reference site 2219 in years 2006 – 2009. Values are means of 10 stations within the site; therefore, the sum of % coverage of individual species can be greater than 100%.

Porewater Salinity:

In the 2002 and 2004 surveys, mean interstitial water salinity data was nearly identical at just over 3 ppt. Due to the hardness of the ground in 2003 we weren't able to obtain data at any stations. The mean salinity in 2005 and 2008 following Hurricanes Rita and Ike rose to approximately 16.5 ppt. We could only obtain data at 2 stations in 2006. These stations had a mean of 13.2 ppt. Salinities in 2007 and 2009 were around 8.5 ppt (figure 16a).

Means by month of interstitial water salinity for CRMS stations 680 and 2219 are presented in figures 16b and 16c. Salinities at both stations rose to around 20 ppt following Hurricane Ike but have slowly dropped to near pre-hurricane levels at the 10 cm level in 2010. The 30 cm salinities were still above 10 ppt as of July 2010.

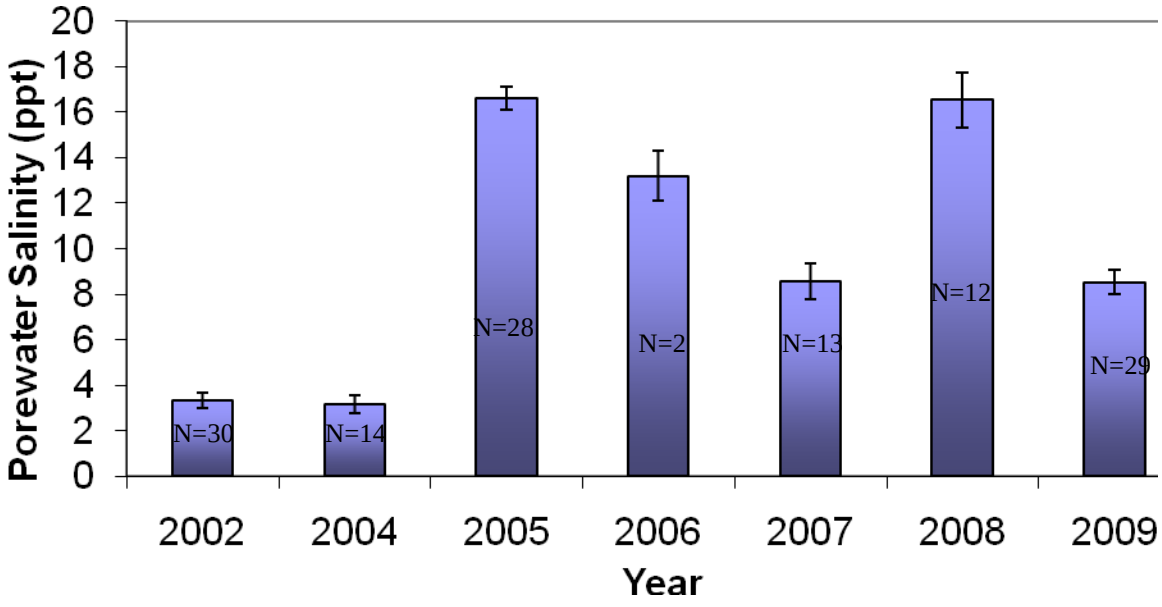


Figure 16a. Interstitial salinities collected at emergent vegetation stations on 2002, 2004, 2005, 2006, 2007, 2008 and 2009 surveys. Error bars represent the mean of stations for that month ± 1 Std. Err.

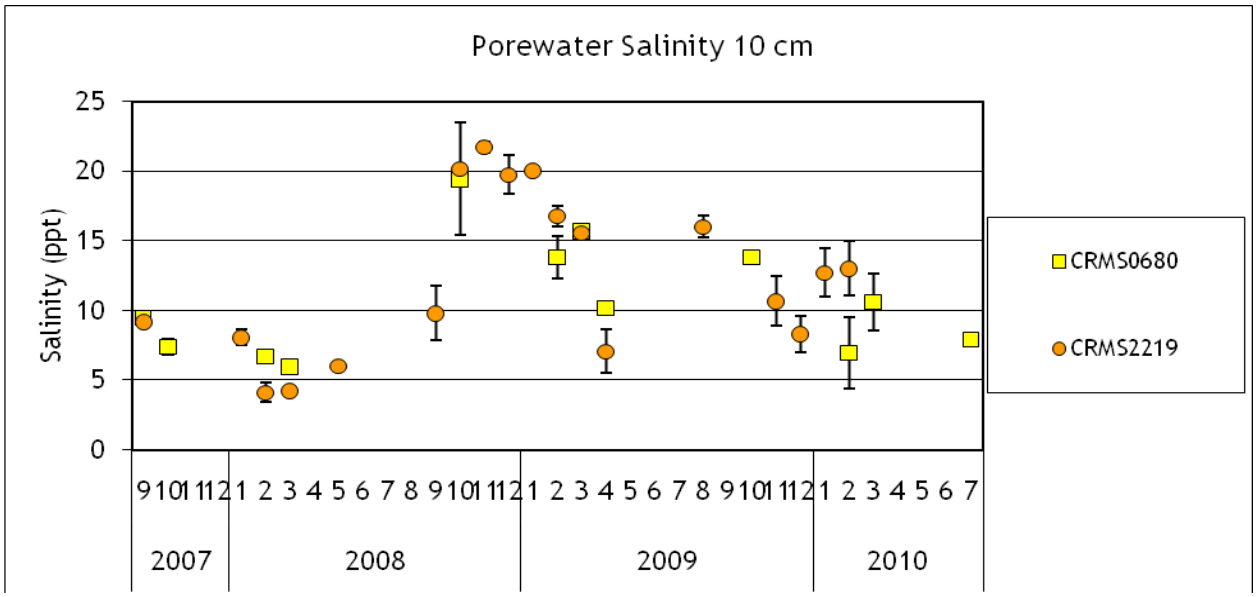


Figure 16b. Interstitial water salinity at 10 cm below the soil surface for CRMS stations 680 and 2219. Error bars, where present, represent the mean of stations for that month ± 1 Std Err.

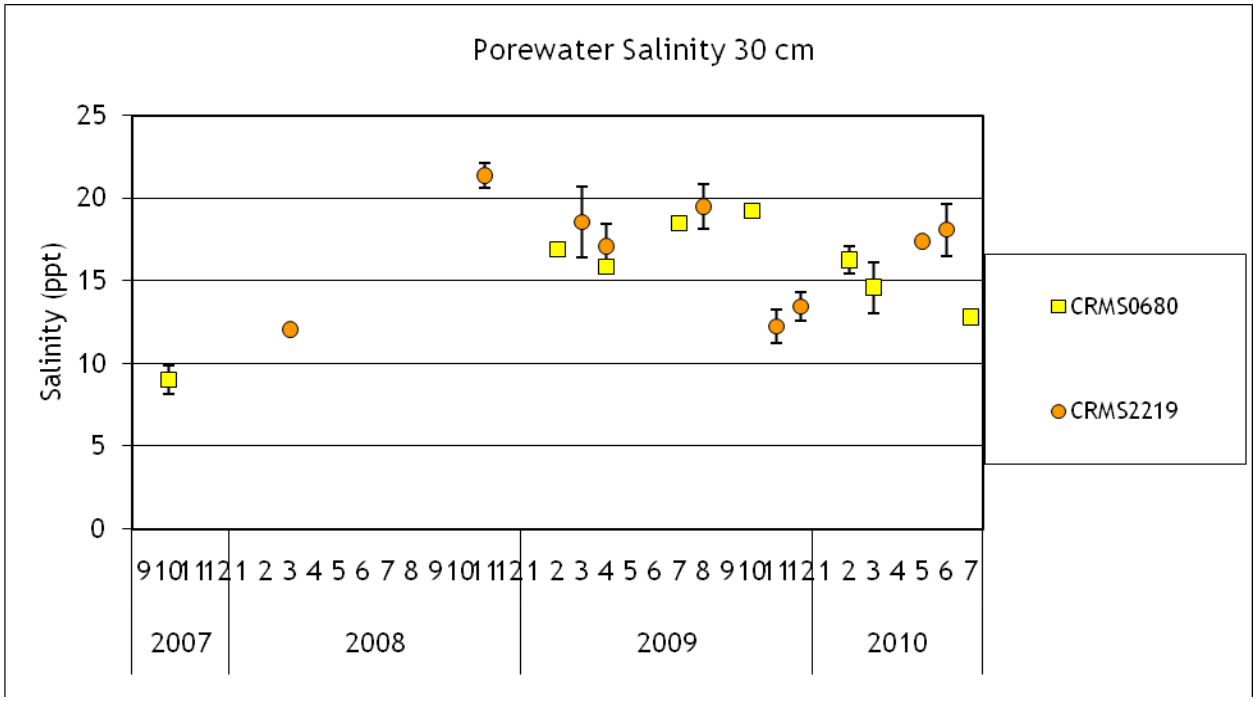


Figure 16c. Interstitial water salinity at 30 cm below the soil surface for CRMS stations 680 and 2219. Error bars, where present, represent the mean of stations for that month ± 1 Std. Err.

CRMS Supplemental:

Soils:

Soil cores were collected one time (within a year of site establishment) to describe soil properties (bulk density and percent organic matter). Three, 4" (10.16-cm) diameter cores were collected to a depth of 24 cm and divided into 6, 4-cm sections at the site.

Soil samples were collected at CRMS0680 in the project area and CRMS2219 in the reference area. The cores were sampled at CRMS0680 in July 2007. The soil core data for CRMS2219 were not available at the time of this report. Figures for mean bulk density and organic matter at CRMS0680 are presented in figures 17a and 17b.

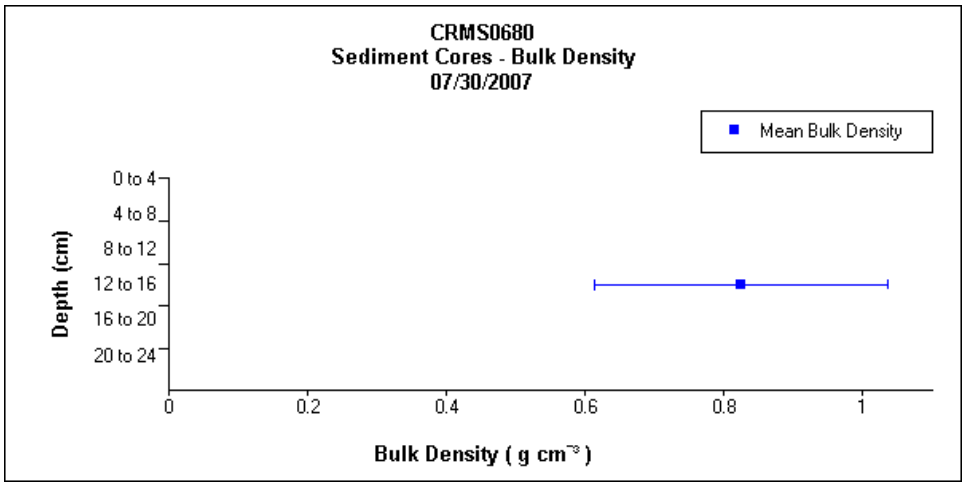


Figure 17a. Mean ± 1 Standard error of soil bulk density collected at CRMS 0680.

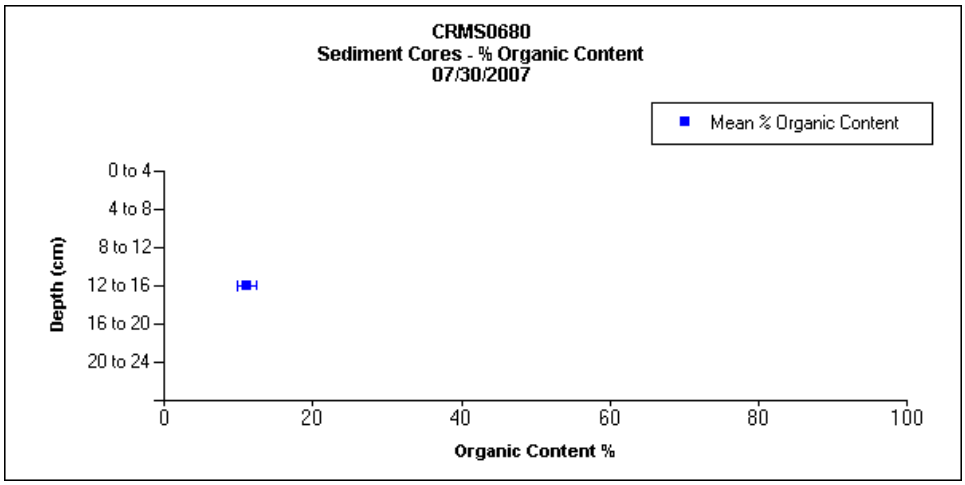


Figure 17b. Mean ± 1 Standard error of soil organic matter content collected at CRMS 0680.

Soil Surface Elevation Change:

Soil surface elevation change utilizing a combination of sediment elevation tables (RSET) and vertical accretion from feldspar horizon markers are being measured twice per year at each site. This data will be used to describe general components of elevation change and establish accretion/subsidence rates. The RSET was surveyed to a known elevation datum (ft, NAVD88) so it can be directly compared to other elevation variables such as water level.

Project station CRMS0680 (Figure 18) showed almost identical accretion and elevation change rates for the sampling period indicating the material being accreted is contributing to the elevation change. There was a slight gain in elevation (0.59 cm/yr). Reference station CRMS2219 has not had enough samplings to generate an elevation change rate at this point. These rates are still preliminary and caution should be used in making decisions from a limited dataset. Estimates will improve with time.

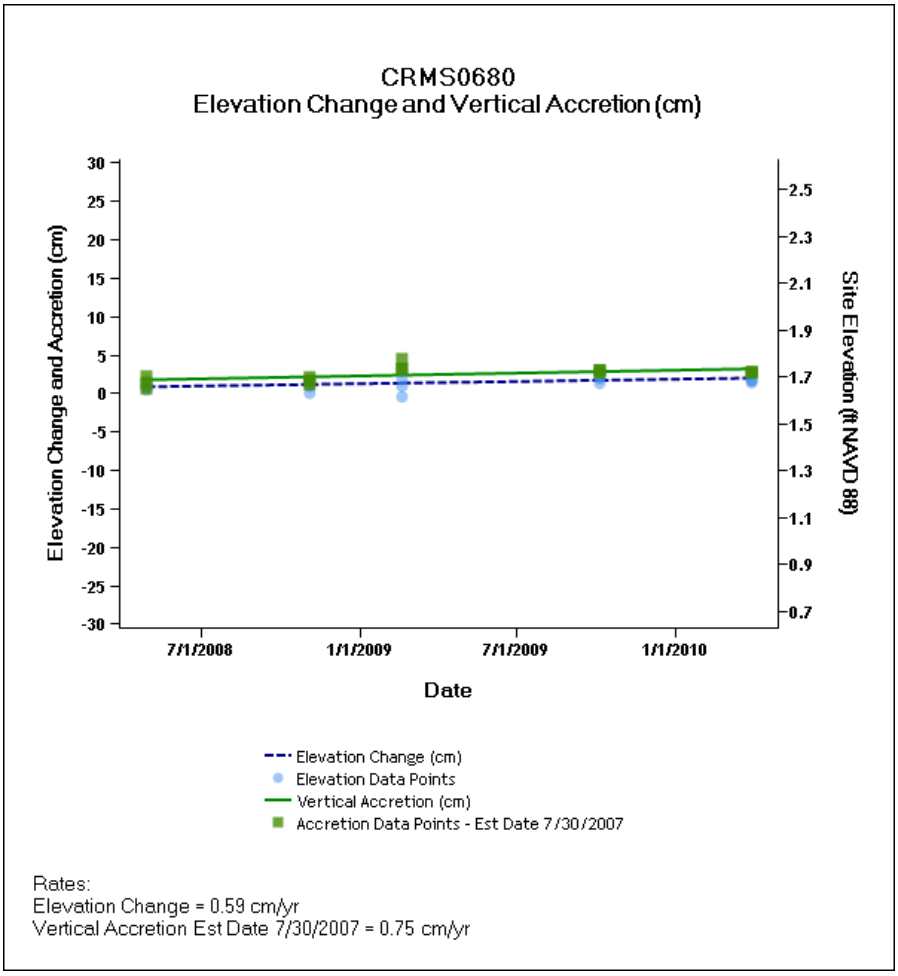


Figure 18. Accretion and Elevation change for project station CRMS0680 over 5 samplings for the period July 2007 to March 2010.

V. Conclusions

a. Project Effectiveness

The Land:Water analysis completed after Hurricane Rita showed 30 acres of land were lost within the project area during the storm, occurring mostly along the shoreline.

Topographic/Bathymetric survey results indicated 21 ft/yr were lost along the shoreline between the August 2005 and January 2006. Shoreline surveys completed by OCPR suggest a larger loss during this time period (46.33 ft/yr). However, these shoreline surveys did not collect vertical data and thus were influenced by tide level differences. The difference between the pre-Rita and Post-Rita tide levels were approximately one foot. The post-Ike survey showed a much smaller loss than the post-Rita survey (5.27 ft/yr). Tide levels during these two surveys were nearly identical. The overall change rate for all shoreline surveys was -13.44 ft/yr. Again, tide levels only differed by 0.27 ft between surveys. In their study of historical shoreline dynamics along Louisiana's Gulf of Mexico shoreline, Byrnes et al. (1995) found that average erosion rates for this area are -3.9 ft/yr with a maximum retreat rate of -8.2 ft/yr (Byrnes et al. 1995). The rates found by the Topo/Bathy surveys and the OCPR surveys are much greater (excluding the post-Ike survey). However, the Topo/Bathy surveys were only done immediately prior to and following Hurricane Rita. Without a large tidal variation, the rates found by the OCPR surveys are much closer to the rates found by Byrnes et al. As mentioned above, the OCPR surveys didn't collect vertical data, though, and thus are more useful in determining the changes occurring along the beach rather than an indication of actual loss rates. The post-hurricane surveys indicated a large amount of sand has been shifted to the western side of the project area.

The vegetation plantings were severely impacted by Hurricane Rita. They were replanted by the La Dept of Agriculture and Forestry and again were severely impacted by Hurricane Ike. They are to be replanted in 2011. No monitoring is scheduled for the new plantings.

The project has been effective in maintaining salinities within the intermediate to brackish range. Yearly salinities at project stations were within the target range 93% of the time as opposed to 46% at the reference station.

The marsh vegetation appears to be meeting the goal of maintaining intermediate to brackish vegetation. Total percent cover and FQI of emergent vegetation were high in the surveys preceding Hurricane Rita, but were severely impacted by Hurricane Rita. Porewater salinities spiked to over 16 ppt following the storm. The vegetation recovered to the pre-construction level by 2007 but, following Hurricane Ike in 2008, cover and FQI dropped at the project-specific sites but rose at CRMS site 0680. Porewater salinities again rose above 16 ppt following Hurricane Ike. In 2009, however, vegetation cover and quality dropped at both to around the same level.

Though porewater salinities at the 10 cm level have dropped to near pre-hurricane levels, salinities at the 30 cm level are still above 10 ppt. The reference site showed a better recovery than the project sites in 2009, even though porewater salinities are nearly identical to the project area stations. The difference appears to be the dominance of *Spartina patens* in the project area, which showed a dramatic decrease in cover in 2009. The reference area station is dominated by *Schoenoplectus americanus*, which increased in cover in both the project and reference areas in 2009.

b. Recommended Improvements

Overall, the Holly Beach Sand Management Project is in fair condition and functioning as designed with problems as noted above. The existing remnants of the sand fencing will need to be removed and disposed of and new sand fencing will need to be installed. Vegetative plantings will need to be placed along the new sand fence alignment. A post Hurricane Ike survey was conducted in January 2009 to compare to post Hurricane Rita survey performed in 2005 to determine any sand quantities lost that can be attributed to Hurricane Ike which will made part of a FEMA claim. The initial response from FEMA was to deny the claim. An appeal has been submitted by the State objecting to the denial of the claim. Replacement of the displaced sand is considered a priority by residents in Cameron Parish. A maintenance event is planned for FY 2010 to address the following:

- Replace 46,000 linear feet of sand fence.
- Replace 28,000 vegetative plantings.

c. Lessons Learned

Future monitoring efforts on similar projects should focus more on topographic/bathymetric surveys for shoreline monitoring. This would allow a more accurate determination of loss or gain in ft/yr.

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APPENDIX A
(Inspection Photographs)

Photo No. 1, Typical view of destroyed sand fence and erosion to beach

Photo No. 2, Close up view of beach

Photo No. 3, View of beach near Hwy 82

Photo No. 4, View of western end of project looking eastward

APPENDIX B
(Three Year Budget Projection)

HOLLY BEACH SAND MANAGEMENT/ CS-31 / PPL 11

Three-Year Operations & Maintenance Budgets 07/01/2010 - 06/30/2013

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Pat Landry	*Darrell Pontiff*	*NRCS*	*Darrell Pontiff*

	2010/2011	2011/2012	2012/2013
Maintenance Inspection	$ 5,909.00	$ 6,086.00	$ 6,269.00
Structure Operation			
Administration	$6,000.00		$ -
Maintenance/Rehabilitation			

10/11 Description: Replace sand fence and vegetative plantings.

E&D	$30,000.00
Construction	$508,200.00
Construction Oversight	$20,000.00
Sub Total - Maint. And Rehab.	$ 558,200.00

11/12 Description:

E&D	
Construction	
Construction Oversight	
Sub Total - Maint. And Rehab.	$ -

12/13 Description:

E&D	$ -
Construction	$ -
Construction Oversight	$ -
Sub Total - Maint. And Rehab.	$ -

	2010/2011	2011/2012	2012/2013
Total O&M Budgets	**$ 570,109.00**	**$ 6,086.00**	**$ 6,269.00**

O &M Budget (3 yr Total)	**$ 582,464.00**
Unexpended O & M Budget	**$ 191,320.00**
Remaining O & M Budget (Projected)	**$ (391,144.00)**

Note: CPRA has obligated State Surplus money ($564,200) while awaiting FEMA Appeal.

OPERATION AND MAINTENANCE BUDGET 07/01/2010-06/30/2011

HOLLY BEACH SAND MANAGEMENT/CS-31/PPL11

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$5,909.00	**$5,909.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$30,000.00	**$30,000.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$20,000.00	**$20,000.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$5,000.00	$5,000.00
FEDERAL SPONSER Admin.	LUMP	1	$1,000.00	$1,000.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$6,000.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:				
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION: Replace sand fence and vegetative plantings

Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navagation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency (10%)		LUMP	1	$46,200.00	$46,200.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
Sand Fencing			46,000	$7.00	$322,000.00
Vegetative Plantings			28,000	$5.00	$140,000.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$508,200.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$570,109.00**

OPERATION AND MAINTENANCE BUDGET 07/01/2011-06/30/2012

HOLLY BEACH SAND MANAGEMENT/CS-31/PPL11

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,086.00	**$6,086.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	0	$0.00	$0.00
FEDERAL SPONSER Admin.	LUMP	0	$0.00	$0.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navagation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,086.00**

OPERATION AND MAINTENANCE BUDGET 07/01/2012-06/30/2013

HOLLY BEACH SAND MANAGEMENT/CS-31/PPL11

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$6,269.00	**$6,269.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$0.00	**$0.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$0.00	**$0.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$0.00	$0.00
FEDERAL SPONSER Admin.	LUMP	1	$0.00	$0.00
SURVEY Admin.	LUMP	1	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$0.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	0	$0.00	$0.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$0.00**

GEOTECHNICAL

GEOTECH DESCRIPTION:					
Borings	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL GEOTECHNICAL COSTS:	**$0.00**

CONSTRUCTION

CONSTRUCTION DESCRIPTION:					
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	0	$0.00	$0.00
Navagation Aid		EACH	0	$0.00	$0.00
Signage		EACH	0	$0.00	$0.00
General Excavation / Fill		CU YD	0	$0.00	$0.00
Dredging		CU YD	0	$0.00	$0.00
Sheet Piles (Lin Ft or Sq Yds)			0	$0.00	$0.00
Timber Piles (each or lump sum)			0	$0.00	$0.00
Timber Members (each or lump sum)			0	$0.00	$0.00
Hardware		LUMP	1	$0.00	$0.00
Materials		LUMP	1	$0.00	$0.00
Mob / Demob		LUMP	1	$0.00	$0.00
Contingency		LUMP	1	$0.00	$0.00
General Structure Maintenance		LUMP	1	$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
OTHER				$0.00	$0.00
				TOTAL CONSTRUCTION COSTS:	**$0.00**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$6,269.00**

APPENDIX C
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name: CS-31 Holly Beach

Date of Inspection: October 20, 2009 Time: 10:25 am

Structure No.

Inspector(s): Darrell Pontiff, Dewey Billodeau (OCPR)
Donald Taffi (NRCS)

Structure Description: Sand fencing and beach fill.

Type of Inspection: Annual

Weather Conditions:sunny & cool

Item	Condition	Physical Damage	Corrosion	Photo #	Observations and Remarks
Steel Bulkhead / Caps	N/A				
Steel Grating	N/A				
Stop Logs	N/A				
Hardware	N/A				
Timber Piles	N/A				
Timber Wales	N/A				
Galv. Pile Caps	N/A				
Sand Fencing	Poor			1-4	Sand fence completely destroyed, no signs of any vegetation.
Signage /Supports	N/A				
Sand (fill)	Fair			1-4	Beach fill in fair condition, minimal trash and debris from high tides.
Earthen Embankment	N/A				

What are the conditions of the existing levees?
Are there any noticeable breaches?
Settlement of rock plugs and rock weirs?
Position of stoplogs at the time of the inspection?
Are there any signs of vandalism?