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

2007 Operations, Maintenance, and Monitoring Report

for

Marsh Island Hydrologic Restoration

State Project Number TV-14
Priority Project List 6

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Iberia Parish

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I. Introduction

The Marsh Island Hydrologic Restoration Project is located in Iberia Parish approximately six miles south of Cypremort Point. The project area encompasses approximately 7,310 acres (2,958 ha) of wetlands on the northeast tip of Marsh Island east of Bayou Blanc (figure 1). It comprises 4,290 acres (1,736 ha) of brackish marsh and 3,020 (1,222 ha) acres of open water, based on the Louisiana Department of Natural Resource's GIS data for 2004. Common plant species found in the project area include *Juncus roemerianus* (needlegrass rush), *Spartina patens* (saltmeadow cordgrass), *Schoenoplectus maritimus* (cosmopolitan bulrush), *Schoenoplectus americanus* (chairmaker's bulrush), *Spartina alterniflora* (saltmarsh cordgrass), and *Vigna luteola* (hairypod cowpea) (Chabreck and Linscombe 1988, United States Department of Agriculture, Natural Resources Conservation Service 2002).

Between 1930 and the present, the hydrology of Marsh Island has changed due to tidal-influenced erosion, subsidence, and oil and gas exploration (Orton 1959, SCS 1978). Several oil field canals were constructed to facilitate oil and gas exploration in the project area during the 1950's. Recent deterioration and subsidence of the spoil banks deposited in the 1950's have resulted in cuts in the spoil banks that have become conduits for rapid tidal exchanges between the surrounding bays and the interior marshes. These rapid exchanges have resulted in tidal scouring and the loss of marsh vegetation through erosion and subsidence. Lake Sand and a number of interior lakes also supported a significant amount of submerged aquatic vegetation (SAV). Today these lakes are almost devoid of SAV, presumably due to the effects of increased tidal exchange and increased turbidity. Erosion has also led to the deterioration of the northeast end of Marsh Island and the north rim of Lake Sand, leaving exposed a highly organic brackish marsh.

During the life of the 20-year project, 408 acres (168 ha) of wetlands will be protected (USACE 1994). The project consists of the construction of nine closures in oil and gas canals at the northeast end of Marsh Island and isolating Lake Sand from Vermilion Bay with a free-standing rock breakwater (figure 1). There is also a shoreline protection of the northeast shoreline of Marsh Island. Hydrologic Restoration project construction began on July 25, 2001, with the construction of approximately 4,000 linear feet (1291 m) of rock breakwater to protect the north shoreline on Lake Sand by contractor Tacon Company, Inc. of Bartlett, Tennessee, and subcontractor Luhr Brothers, Inc. of Columbia, Illinois. A total of seven canals were plugged with rock armor while one was plugged with an earthen closure only. An additional closure, constructed of painted steel sheetpile and rock armor, was constructed at the mouth of an oil exploration canal on the eastern end of the project area. Construction of the $2.9 million project was completed on December 12, 2001.

Hurricane Rita struck the coast of southwestern Louisiana on September 24, 2005, with maximum storm surge of 10 ft (3.1 m) in the TV-14 project area. The U.S. Geological Survey (USGS) calculated the amount of land that changed to water resulting from the storm to be 98 square miles in southwestern Louisiana, with 5 square miles in the Teche/Vermilion basin

(Barras 2006). This loss can be attributed to shearing, which is ripping and removal of marsh vegetation in historically healthy marshes. Shearing was observed bordering the east bank of Freshwater Bayou. The removal of remnant marsh from areas with historical land loss was observed in the marsh west of Pecan Island.

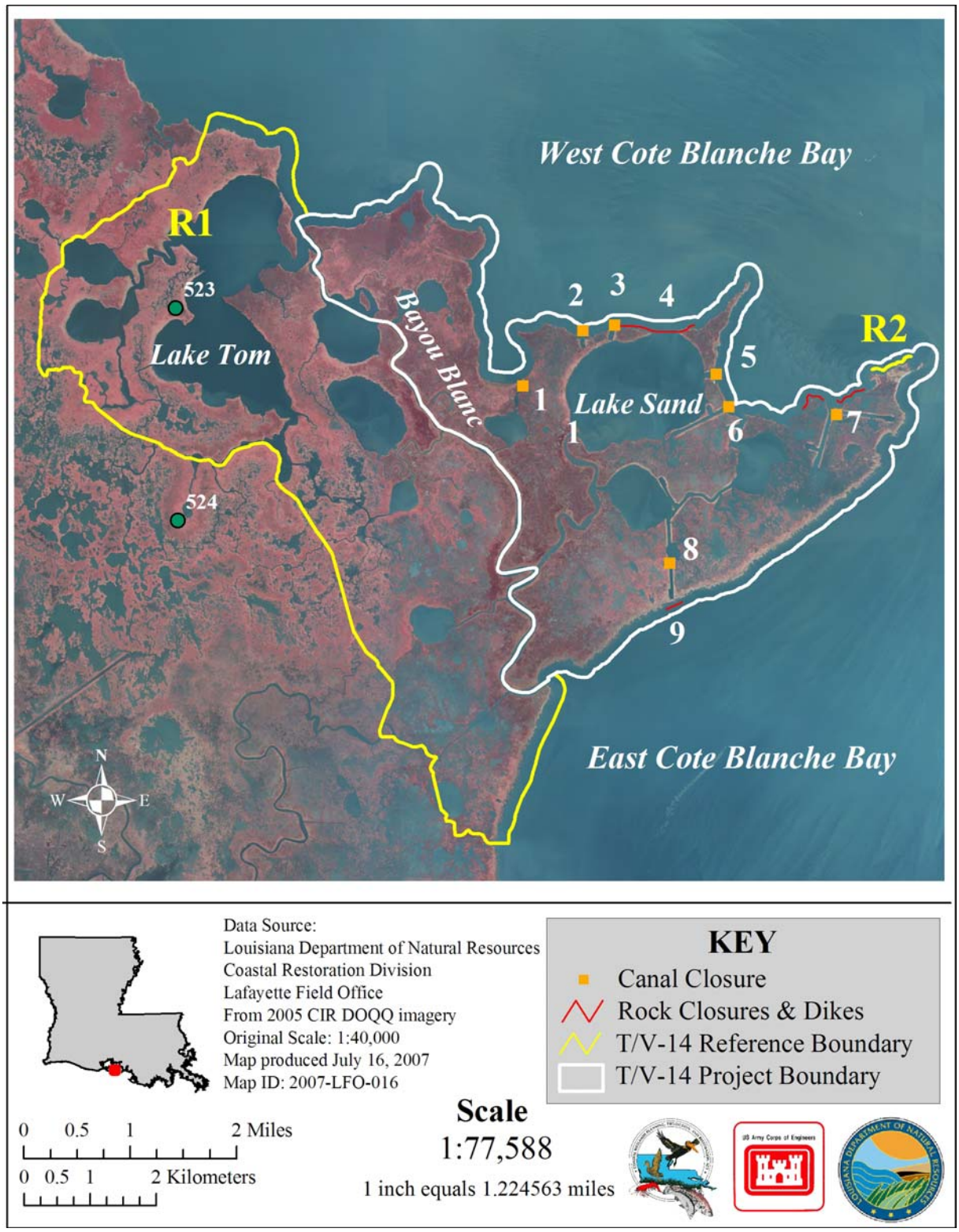

Figure 1. Marsh Island Hydrologic Restoration (TV-14) project boundary and features.

II. Maintenance Activity

a. Project Feature Inspection Procedures

The purpose of the annual inspection of the Marsh Island Hydrologic Restoration (TV-14) project 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, the Louisiana Department of Natural Resources (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. The annual inspection report also contains a summary of maintenance projects 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 C.

An inspection of the Marsh Island Hydrologic Restoration (TV-14) project was held on November 9, 2006, under clear skies and mild temperatures. In attendance were Herb Juneau and Stan Aucoin from LDNR, Bill Hicks representing The Army Corps of Engineers (COE), and Cassidy LeJeune and Paul Provence representing Louisiana Department of Wildlife and Fisheries (LDWF). The annual inspection began at approximately 10:00 a.m. at Structure No. 9. However, the LDNR work boat developed mechanical problems with the boat motor and had to be towed back to Burns Point landing by LDWF. As a result, this report is based on field notes taken prior to this date, August 17, 2006, where LDNR, COE, and Aucoin Associates (LDNR consultant) were inspecting proposed maintenance work and Hurricane Rita repair work to be done during 2006-2007.

The field inspection included a complete visual inspection of most of the project features. Staff gauge readings and existing temporary benchmarks where available were used to determine approximate elevations of water, embankments, and weir features. Photographs were taken at each project feature (see Appendix B) and field inspection notes were completed in the field to record measurements and deficiencies (see Appendix D).

b. Inspection Results

<u>Closure No. 1:</u>

As per the results of the 2006 inspection there is some erosion on each end where the rock plug ties back into the adjacent marsh. Damages were determined to be related to Hurricane Rita. This condition will allow for additional erosion and eventual “flanking” of the canal closure. As a result of the inspection of Closure No. 1, LDNR and COE agree that corrective actions will be required this year. The marsh on each end of the closure should be paved with 15’’ of 110# stone to make this area “hard” and less subject to erosion and thereby prevent

eventual flanking of the structure. This proposed work is currently included in our maintenance project for repair of Hurricane Rita damages. (Photos: Appendix B, Photo 1).

Closure No. 2:

It was observed that extensive erosive damage by Hurricane Rita's surge to each end of the closure had occurred, especially on the east end, where there is now a major "flanking" cut that allows a water connection to the bay. The original rock structure that was constructed is still in good condition. LDNR and COE agree that maintenance will be required at this time. The closure dike needs to be extended on the east end to cut off and fill the flanking channel that was caused by Hurricane Rita. On the west end, the area that suffered erosion needs to be adjusted with some new stone paving. As a preemptive effort, the "new" ends of the closure dike should be paved and made "hard" as described for Closure No. 1. (Photos: Appendix B, Photo 2).

Closure No. 3:

The rock closure dike appears in good condition and the stone appears to not have suffered major displacement. Also, it was observed (and confirmed with aerial photography post-Hurricane Rita) that a large open water area has developed within the marsh near the western terminus of Closure No. 3 and that the bankline between that point and the eastern end of Closure No. 2 has eroded very severely. These developments are such that the "landbridge" between Vermilion Bay on the north of Marsh Island and the northwestern portion of Lake Sand proper is now narrow and may become subject to breaching, thus allowing an undesirable water connection between the two bodies of water. LDNR and COE agree that this area is in poor condition and should be considered for maintenance at this time. It is recommended that an additional reach of shoreline protection dike be constructed, an estimated 1,500 to 1,800 linear feet, to connect the western end of Closure No. 3 to the eastern end of Closure No. 2. This reach of bank has been recently surveyed, and once an evaluation and cost data is developed, LDNR and COE will decide upon corrective action to be taken, if any. (Photos: Appendix B, Photos 3 and 4).

Closure No. 4:

The Lake Sand Dike closure as originally constructed and recently repaired for Hurricane Lili damages, appears in good condition. The stone appears to have not suffered major displacement except for some of the eastern reach where some of the stone, which had existed to +4.0 NAVD88, appears to be a bit low in elevation. This latter reach is several hundred feet in length and the most easterly tie-in bank has been reduced in cross-section for 80 to 100 feet. LDNR and COE agree that this area is deficient and maintenance will be required at some time. The low areas described above in the reach within the old dike that was to +4.0 elevation will need to be restored with rock riprap, though bank protection is still being afforded by the existing stone shoreline protection. (Photos: Appendix B, Photo 5).

Closure No. 5:

The inspection at Closure No. 5 revealed there had been some degradation of the earthen/marsh areas in the adjacent marsh. The steel sheet pile, rock riprap wingwalls, and stone bank/marsh paving placed as part of the Hurricane Lili repair project is in good condition and were apparently very effective in preventing additional damage by the erosive action of Hurricane Rita. The staff gauge needs to be re-set and made plumb to provide accurate readings. This work will be a part of a survey effort to be performed within the next year. The overbank marsh areas paved to make same "hard" and paid for with O & M funding need to be continually evaluated for their effectiveness. Marsh overbank areas, especially on the north end of the structure, sustained much erosion in areas not protected by the "hard" paving, such that it is possible that the unpaved area to the north end of the closure may not be wide enough to withstand many more years without experiencing storm-induced breaching. (Photos: Appendix B, Photo 6).

Closure No. 6:

The initially constructed closure at this site still has an excellent cross-section, but the breach on the south end of the closure has been enlarged by Hurricane Rita. The repair of same is included in an upcoming maintenance contract currently being developed. (Note: the breach was discovered approximately one month prior to Rita and was narrow and about two feet in depth). The breach is now larger, post-Rita, and approximately one foot deeper in depth. On the north end of the closure, the erosion of the marsh area was sustained at the dike tie-in location, to an extent that it is predicted that "flanking" of the closure has occurred. LDNR and COE agree that this area is deficient and maintenance will be required at this time. The existing flanking channel cut needs to be plugged off by extending the rock riprap closure to the south with stone. Cost will be shared with the Federal Emergency Management Agency (FEMA) such that a channel breach existed pre-Rita. It is the opinion of this office that the cost-sharing proportions would be equitable if shared at 1/3 State and 2/3 FEMA as the storm event made the pre-existing flanking breach wider and deeper in about those proportions. Also, as a recommended additional preemptive work, each resulting end of the closure dike will be paved and made "hard" per discussion for Closure No. 1. Again this work is currently being designed for a maintenance contract to be performed, once a permit for the work is acquired. (Photos: Appendix B, Photo 7).

Closure No. 7:

This closure site is in good condition except that the bank areas at both ends of the rock riprap have experienced some minor erosion. The closure tie-ins to the bank, however, appear still adequate at this time. LDNR and COE agree that this area is in good condition and no maintenance will be required at this time. (Photos: Appendix B, Photo 8).

Closure No. 8:

This closure site is in good condition and no damage was noted. LDNR and COE agree that this project feature requires no maintenance at this time. (Photos: Appendix B, Photo 9).

Closure No. 9:

The rock riprap shoreline protection dike constructed on the south shoreline of Marsh Island was noted to now sit out farther into the waters of the Gulf as discussed in the last inspection. Conditions that existed pre-Rita were such that the feature was functioning well and that sediment had accreted and a growth of marsh vegetation had extended over the new fill. This rock shoreline feature will still function as a breakwater and extend the life of the earthen pipeline closure to the north. It was discussed that perhaps each end of the current rock riprap dike be extended to the east and to the west, or perhaps that extensions be constructed on each end of the existing stone to the northwest and northeast alignment directions to the shoreline. Conditions at this location need to be evaluated and a design for some east and west extensions of the current dike concluded after some study. (Photos: Appendix B, Photo 10).

c. Maintenance Recommendations

i. Immediate/ Emergency Repairs

There are none at this time.

ii. Programmatic/ Routine Repairs

Repair breaches and damages caused by Hurricane Rita and provide bank paving at ends of closures as described above.

d. Maintenance History

General Maintenance : Below is a summary of completed maintenance projects and operation tasks performed since December 2001, the construction completion date of the Marsh Island Hydrologic Restoration (TV-14) project.

2005 Maintenance Project–Grillot, Inc. (Through lease agreement with Bertucci Contracting Corp.) This maintenance project included the placement of paving stone (18" thick) spread out around the wingwalls of the plug at Lake Sand Canal Closure No. 5 to "harden" the area while still allowing flow in extreme tidal events to pass around the structure without washing away the existing bank. Also included was the extension of the rock dike on the southern end of Canal No. 5. Approximately 4,000 tons of 1000# stone was placed on Lake Sand Closure No. 4 to reconstruct the rock dike where stone was displaced. This maintenance project was a result of damages that occurred during Hurricane Lili in 2002. The

costs associated with the engineering, design and construction of the Marsh Island Maintenance Project are as follows:

Construction (FEMA)	$267,059.11*
Construction (CWPPRA)	$ 64,092.00
E & D, construction oversight, as-builts	$ 30,262.00
TOTAL CONSTRUCTION COST:	**$361,413.11**

* This cost was reimbursed by FEMA

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

As mandated in the monitoring plan, the four continuous recorders were removed at the end of 2006. Pursuant to a Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) Task Force decision on August 14, 2003, to adopt the Coastwide Reference Monitoring System-*Wetlands* (CRMS-*Wetlands*) for CWPPRA, updates were made to the TV-14 Monitoring Plan to merge it with CRMS-*Wetlands* and provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. There are no CRMS-*Wetlands* sites inside the TV-14 project area; however, there are nine sites located on Marsh Island.

a. Monitoring Goals

The objective of the Marsh Island Hydrologic Restoration project is to restore more natural hydrologic conditions in the project area resulting in the protection of the existing marsh.

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

1. Reduce water level variability in the project area.
2. Decrease the rate of marsh loss in the project area.
3. Reduce erosion rate of the northeast shoreline of Marsh Island.
4. Increase the occurrence of submerged aquatic vegetation in Lake Sand and in shallow open water within the project area.

b. Monitoring Elements

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 areas. The photography was obtained in 2000 prior to project construction and approximately 3 years post-construction in 2004. Additional photography will be acquired in 2009 and 2016. 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/National Wetlands Research Center (NWRC) personnel according to standard operating procedures (Steyer et al. 1995, revised 2000) (figure 2).

Shoreline Change:

To document shoreline movement along the northeast shoreline of Marsh Island, a differential GPS (DGPS) survey of unobstructed sections of shoreline was conducted at the vegetative

edge of the bank to document the position of the shoreline in 1999 (pre-construction) and 2003 (post-construction) (figures 3-4). Subsequent surveys will be conducted post-construction in 2007, 2009, and 2016. A similar survey will be conducted concurrently along a 2,000 ft (609.6 m) section of reference area 2 (R2). DGPS shoreline positions were mapped and used to compare shoreline erosion/growth rates in the project area and in R2 using GIS analysis.

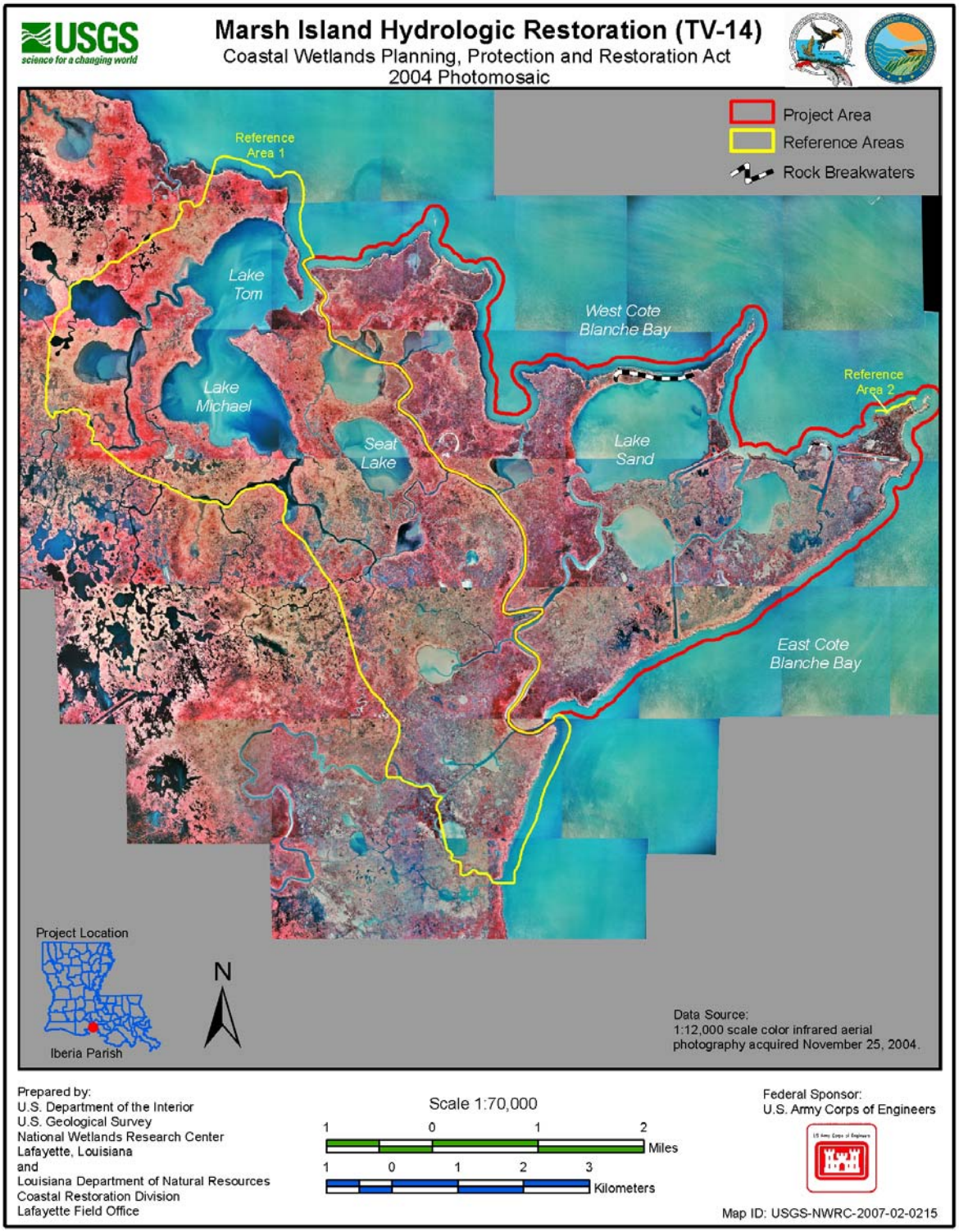

Figure 2. Photomosaic of the 2004 color-infrared aerial photography for the TV-14 project and reference areas from aerial photography taken November 25, 2004.

Figure 3. Aerial view of the northeastern shore (left edge of photo) of the TV-14 project.

Figure 4. Shoreline configuration of the eastern shore of the TV-14 project.

Water Level:

Water level variability was monitored hourly at two continuous data recorders deployed in the project area and two continuous data recorders deployed in reference area 1 (R1) (figure 5). Staff gauges adjacent to the continuous recorders were surveyed to correlate water levels to a known datum, the North American Vertical Datum of 1988 (NAVD88). Continuous data recorders were installed in October 1999 documented hourly water level data until December 31, 2006, a period of five years following project construction.

Submerged Aquatic Vegetation (SAV):

SAV was monitored using the rake method (Chabreck and Hoffpauir 1962). Restoration of the Lake Sand shoreline is expected to influence SAV primarily in Lake Sand, while canal plugs and spoil bank repair work is expected to influence SAV primarily in other shallow open water areas. Separate tests were therefore used to evaluate SAV in Lake Sand and SAV in shallow open water areas. The frequency of occurrence of SAV in Lake Sand was compared to the frequency of occurrence of SAV in Lake Tom found in R1. Three parallel transects were established and separated by a distance approximately equal to one-fourth the pond width (figure 6). Each transect is composed of a minimum of 25 equally spaced sampling stations. At each station, aquatic vegetation was sampled by dragging a garden rake on the pond bottom for one second. The presence of vegetation was recorded to determine the frequency of aquatic plant occurrence (frequency = number of occurrences/25 x 100). When vegetation was present, the species present were recorded in order to determine the frequencies of individual species (Nyman and Chabreck 1996). In shallow open water areas, three small ponds in the project area were compared to three small ponds in R1. Two parallel transects, separated by a distance approximately equal to one-third the pond width, were established in each pond and investigated using similar sampling techniques as discussed above. Ancillary salinity data, collected with continuous data recorders and monthly discrete samples, will be evaluated in concert with the statistical analysis to aid in the interpretation of SAV data. SAV was monitored in the fall preceding construction in 1999 and in post-construction years 2002, 2004, and 2006, and will be surveyed in 2009, 2011, 2013, and 2016.

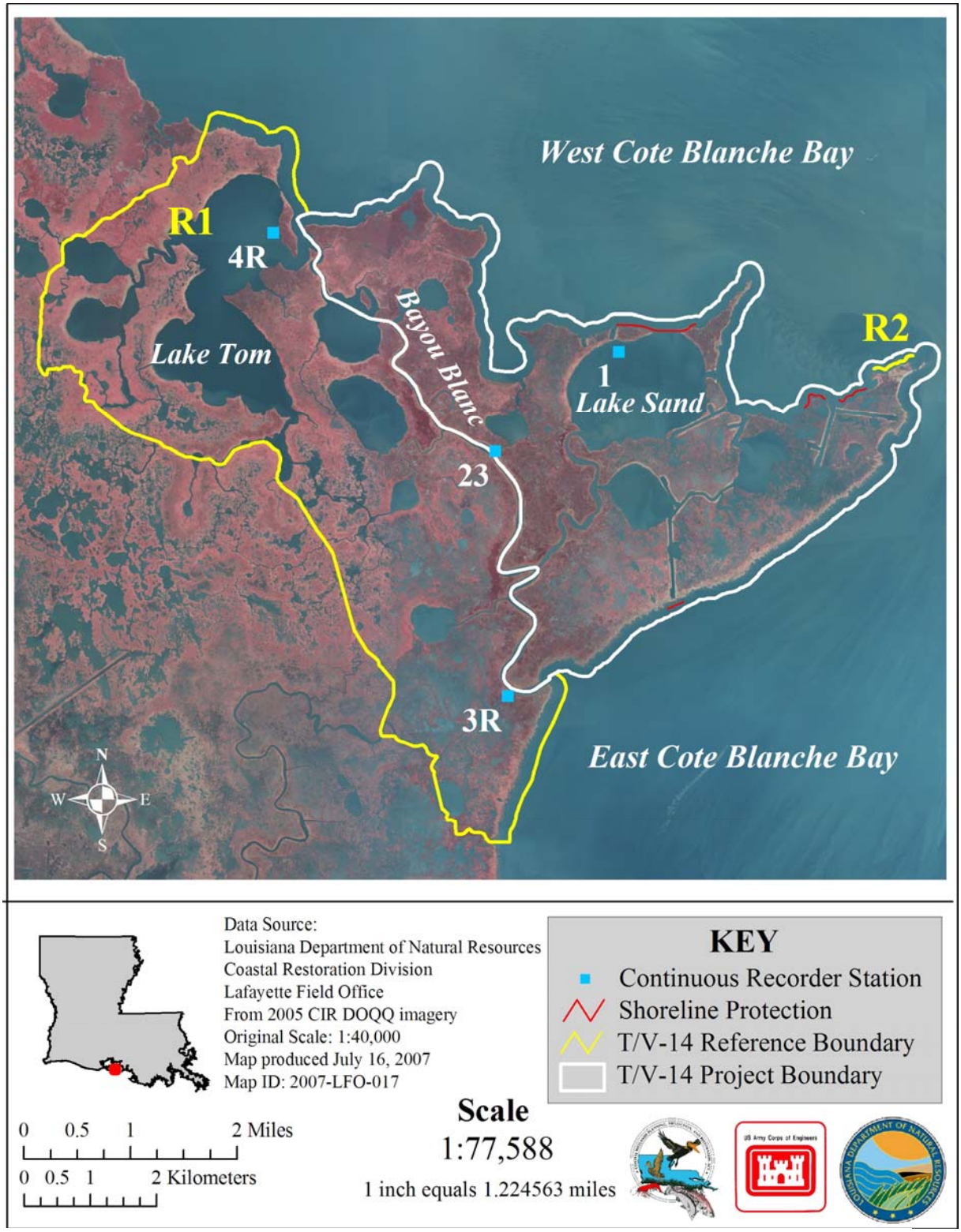

Figure 5. Continuous hydrographic monitoring stations for the TV-14 project.

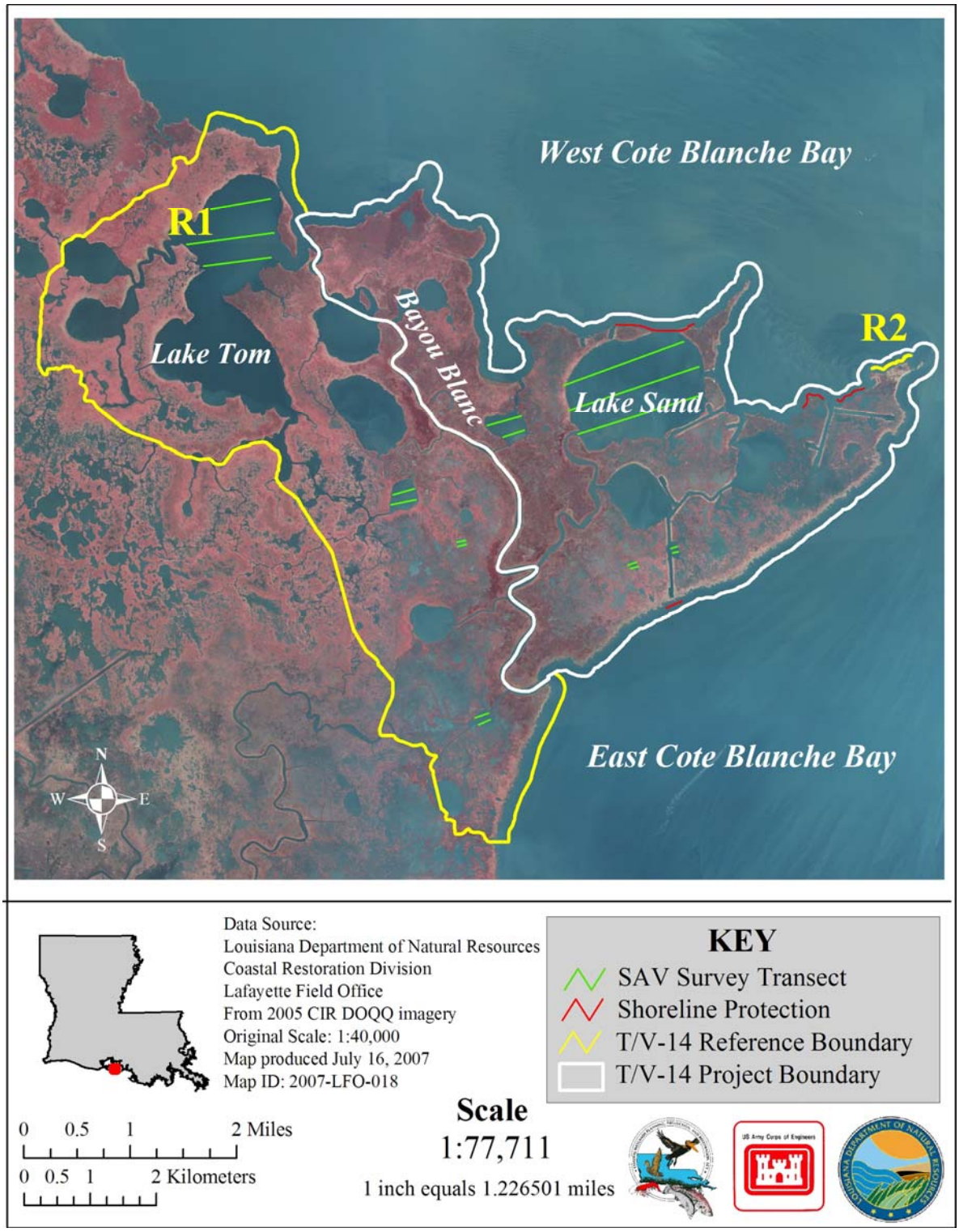

Figure 6. Typical SAV monitoring survey transects for the TV-14 project and reference areas.

IV. Monitoring Activity (continued)

c. Preliminary Monitoring Results and Discussion

Aerial Photography:

Pre-construction classification (2000) indicated 69.8% land and 30.2% water within the project area and 64.4% land and 35.6% water within R1. Post-construction classification of land area and open water, collected in November 2004, indicated 58.6% land and 41.4% water in the project area and 58.3% land and 41.7% water within R1 (figure 7). However, due to a correction of the project and R1 boundaries resulting in a change in acreage for both areas, the pre- and post-construction classifications are not directly comparable. The project and R1 boundaries were updated to correct inaccuracies due to the low-resolution satellite imagery used to create the boundaries during project planning. Because of the low resolution, some parts of the project and R1 were excluded. For both areas, the boundaries were expanded to include these areas as well as some open water surrounding the project area and R1. As a result, the first comparison of land and water area will not occur until the next scheduled aerial photography dataset is collected and analyzed in 2009. These results will be presented in the next report.

Shoreline Position:

The 2003 data were processed and compared to the pre-construction dataset to determine changes in shoreline position and configuration. GIS analysis of the shoreline datasets indicated a loss of 2.07 ac (0.84 ha) and a gain of 1.85 ac (0.75 ha) for a net loss of 0.22 ac (0.09 ha) in the project area between 1999 and 2003. In the reference area, a net loss of 0.05 ac (0.02 ha) was documented. However, since the pre-construction shoreline position was documented more than 3 years prior to project construction, this loss may not necessarily be attributable to project features. There is also some degree of error due to limitations in the GPS technology used for the surveys, as well as temporal variations in water level, which may affect data accuracy. This amount of loss is not considered to be ecologically significant. No shoreline position data were collected in 2006.

Water Level:

Hourly salinity and relative water level data for the two project and two reference stations for the pre-and post-construction time periods were analyzed from the following datasets:

Station	Data collection period
TV14-01	10/12/1999 – 12/31/2006
TV14-02*	10/12/1999 – 3/14/2002
TV14-23	3/14/2002 – 12/31/2006
TV14-03R	10/12/1999 – 12/31/2006
TV14-04R	10/12/1999 – 12/31/2006

*The continuous recorder at TV14-02 was removed because of access problems following project construction. The replacement station, TV14-23 was installed closer to Bayou Blanc, a more accessible location.

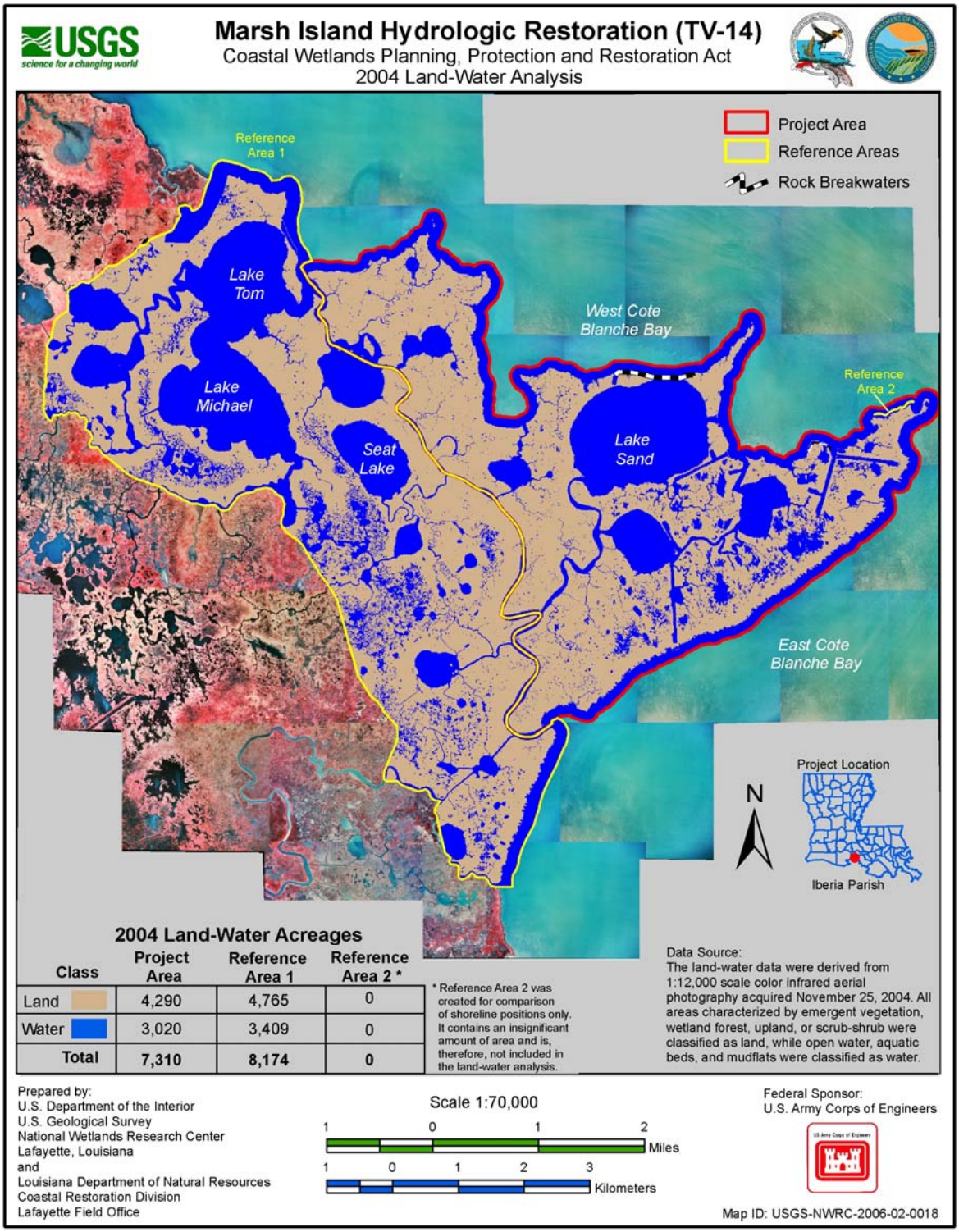

Figure 7. Results of the 2004 Land:Water GIS image classification for the TV-14 project and reference areas from aerial photography taken November 25, 2004.

The difference in project area and R1 water level range (variability) was significantly higher post-construction than pre-construction ($p<0.0001$) (R1 had a water level range 0.16' higher than the project area post-construction and 0.06' higher pre-construction). Water level variability in the project area was found to be significantly less than that in R1, for both the pre- and post-construction periods (figure 8). Water level variability appeared to increase following project construction in R1 and the project appears to have been successful at preventing a similar increase in the project area. It is not known what factors contributed to the increase in water level variability in R1 following project construction. However, it is not likely to be due to any effects of the project but rather variations in weather and tides. The model was also significant for years (figure 9). Each year showed a similar trend. There was less variability in the project area before construction but ranges in the reference area increased relative to the project area post-construction. Thus, the project appears to have reduced water level variability as designed.

Visser (2007) determined that there was a significant decrease in flood stress for two TV-14 project gauges in an analysis of hydrologic data on CWPPRA Hydrologic Restoration projects. Because the flooding stress was so small in the TV-14 project area, Visser determined that this was not biologically significant. Flooding stress was calculated by multiplying the stress level from flood events of different durations by the percentage of time that the stress level occurred and the percentage of plant productivity.

Submerged Aquatic Vegetation (SAV):

Overall percent cover of SAV was significantly higher (13%) in R1 than the project area prior to construction in 1999. Pre-construction SAV abundance in the project area was 1% while the reference area abundance was 14%. The common SAV species encountered during the pre-construction and post-construction abundance surveys are presented in tables 1 and 2, respectively. Post-construction SAV abundance was determined in the fall of 2002, 2004, and 2006. In the large SAV lakes, Lake Sand in the project area and Lake Tom in R1, SAV abundance was significantly higher in R1 prior to, and one year following, project construction (figure 10). However, by the third year following project construction, SAV abundance became significantly higher in the project area than R1 ($p<0.05$). This was also observed in 2006, five years following project construction. Although SAV abundances are temporally highly variable due to numerous environmental factors, the data indicate that a significant increase in SAV abundance compared to R1 following construction was observed. This increase could indicate a project effect due to reduced water level variability and reduced turbidity. Analysis of the small SAV ponds sampled (figure 11) indicated that the project had no significant effect on abundance. Thus, the positive effect of the project in Lake Sand did not carry over to the small ponds and may be due to reduced turbidity, which is probably less of an issue in the smaller ponds. This may be why the project had no effect in the small ponds.

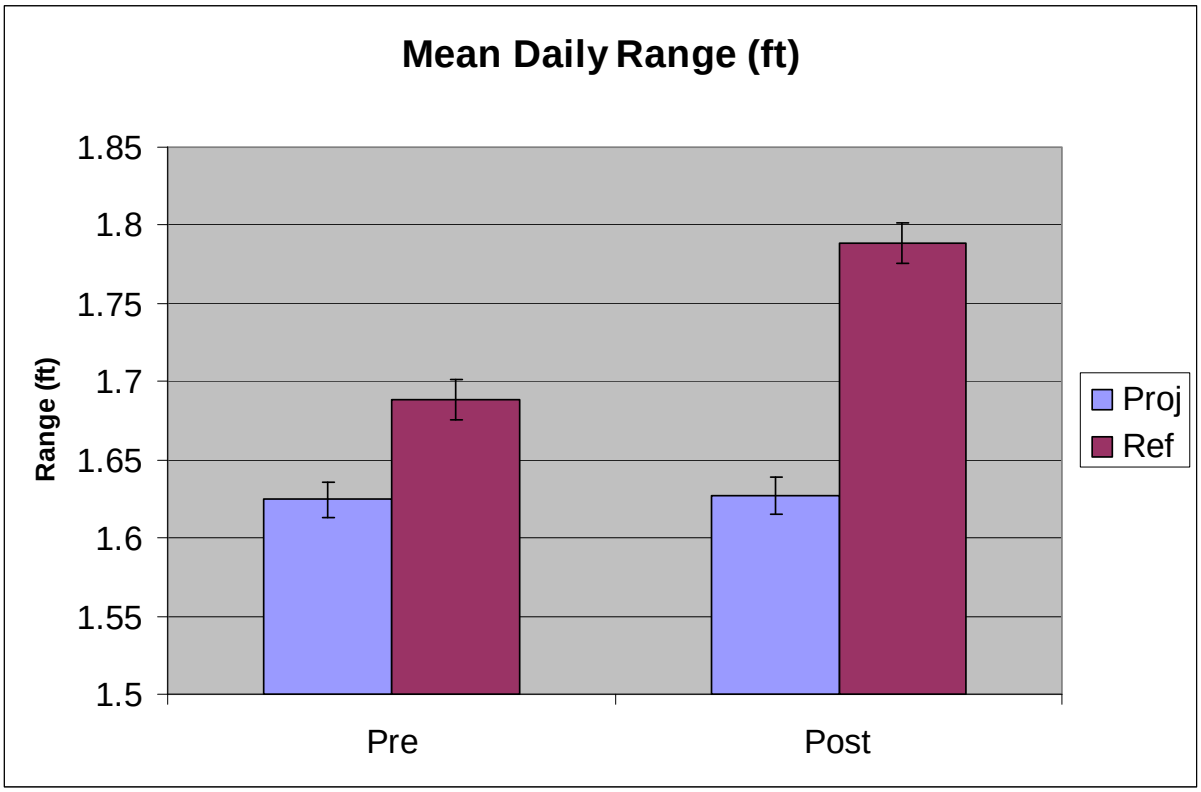

Figure 8. Mean daily water level range (variability) ± standard error during the pre- and post-construction periods for both the TV-14 project and R1.

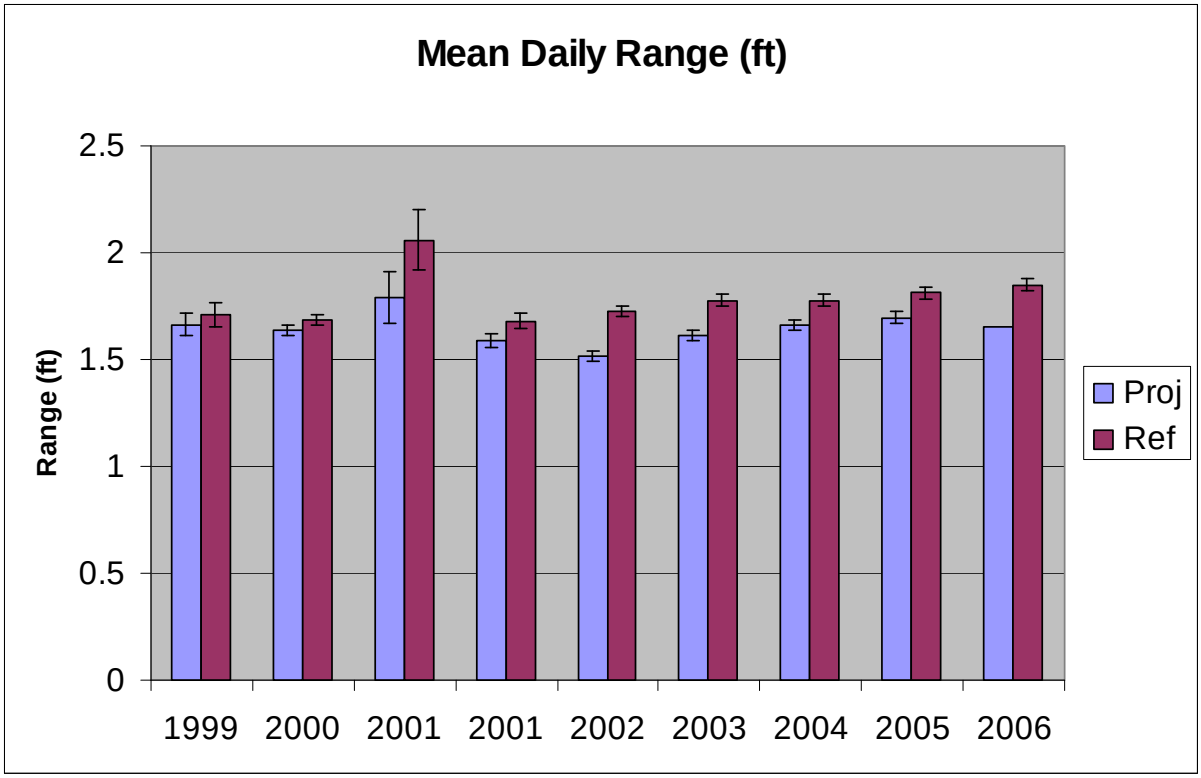

Figure 9. Mean daily water level range (variability) ± standard error by year for both the project and R1.

Table 1. SAV species encountered during the abundance survey (pre-construction)-10/28/1999

Scientific Name	Common Name
Algae spp.	Alga
Cabomba caroliniana	Common Fanwort
Myriophyllum spicatum	Eurasian Watermilfoil
Ruppia maritima	Widgeon Grass

Table 2. Common SAV species encountered during the post-construction abundance surveys

Scientific Name	Common Name
Algae spp.	Alga
Myriophyllum spicatum	Eurasian Watermilfoil

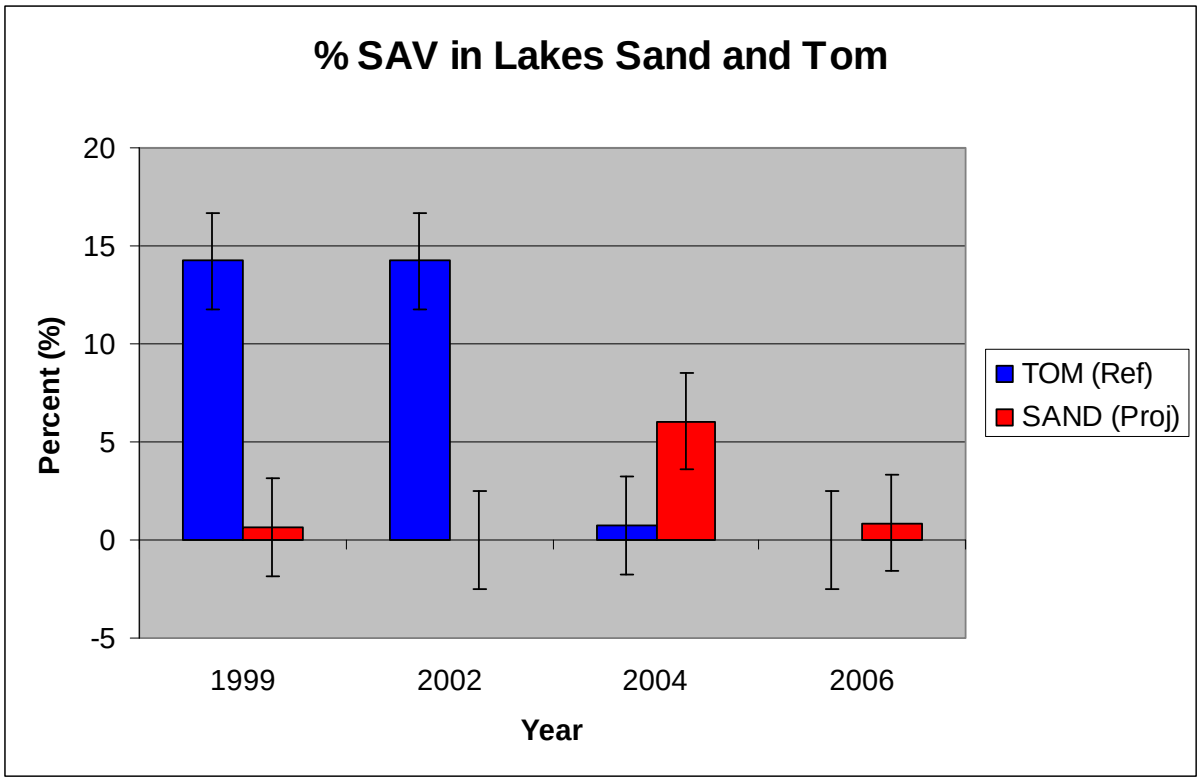

Figure 10. Submerged aquatic vegetation abundance ± standard error by survey year for both the TV-14 project and R1 large lakes.

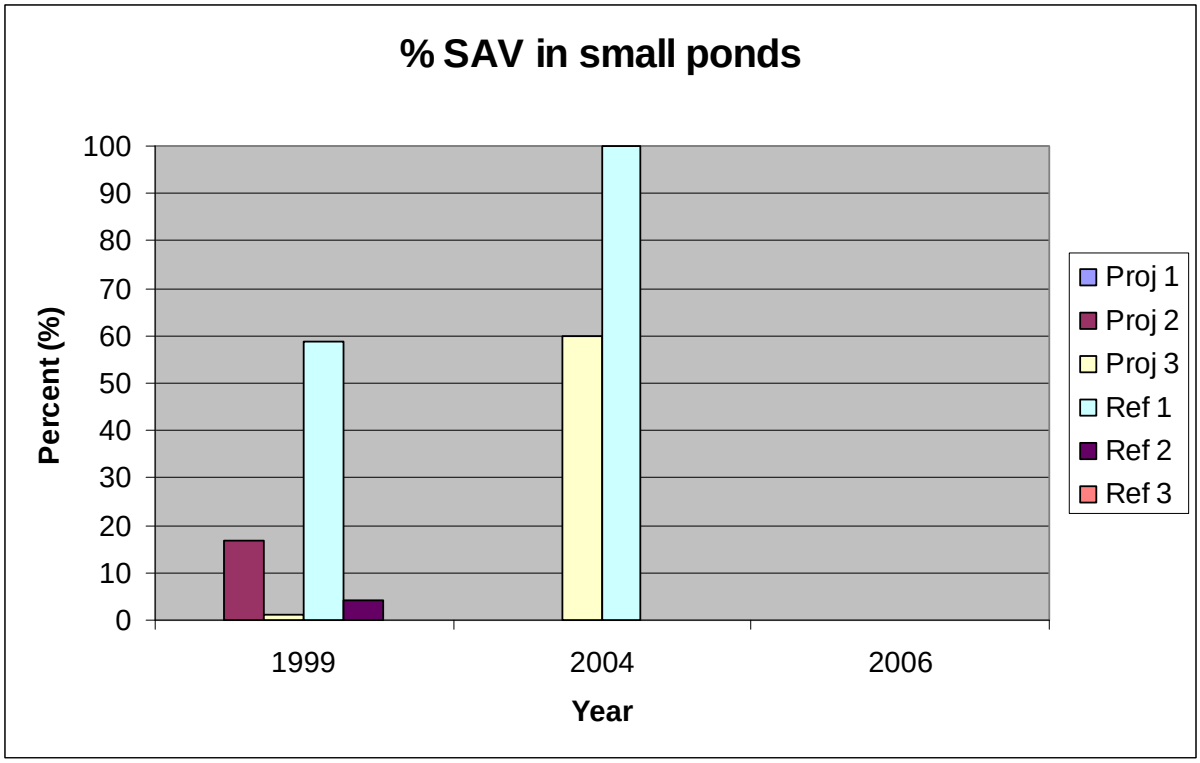

Figure 11. Submerged aquatic vegetation abundance by survey year for both the TV-14 project and R1 small ponds. Small ponds were not sampled during 2002 due to access problems.

V. Conclusions

a. Project Effectiveness

The Marsh Island Hydrologic Restoration project has been effective at reducing water level variability as compared to an ecologically similar reference area (R1). Water level variability did not increase in the project area as it did in R1 post-construction. The project also was effective at increasing SAV abundance relative to R1 in Lake Sand in the years following construction. However, the project did not increase SAV relative to R1 in the small, shallow open water ponds of the project area. Thus far, the protection level of project shoreline protection features cannot be clearly determined. Data from the next scheduled shoreline position survey should provide information on the effectiveness of the project in reducing shoreline erosion. Likewise, due to a change in the project and R1 boundaries, the effectiveness of the project in reducing land loss cannot be determined at this time. After the next scheduled aerial photography analysis, direct comparisons of the project and R1 can be made to determine the effect of the project on land loss.

b. Recommended Improvements

Overall, the Marsh Island Hydrologic Restoration project structural components are in fair condition with most features still functioning as designed. However, corrective work as listed below needs to be accomplished as soon as possible, as the "flanking" channel cuts will only enlarge with time, thus making the corrective construction effort more costly. Surveys of the features with damages have recently been performed. Designs for a maintenance contract are currently being performed and drawings for the permit application are being developed. It is expected that the proposed work will be accomplished with approximately $115,000 of FEMA Rita funding and the balance of the contract cost covered by O & M funding for the project. Estimated cost of the maintenance work is not yet available.

- Closure No. 1 – bank paving on each end of closure.
- Closure No. 2 – extending rock dike east end, bank paving each end of closure.
- Closure No. 3 – extending rock dike approximately 1,500 linear feet to connect west end of Closure No. 3 to east end of Closure No. 2, pending additional survey data and cost analysis.
- Closure No. 5 – replace staff gauge.
- Closure No. 6 – extend rock dike to close breach, bank paving each end of closure.

c. Lessons Learned

The stone bank paving installed at each end of Closure No. 5 after Hurricane Lili proved to be successful in preventing erosion during the Hurricane Rita storm surge event. This application will be applied to other closure sites for bank stabilization and protection.

VI. Literature Cited

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APPENDIX A
Response of Emergent Vegetation to Hurricane Rita

METHODS

In response to Hurricane Rita in 2005, 163 LDNR emergent vegetation stations were sampled in the late summer/early fall of 2005 and 2006. The stations represented a subset of the LDNR vegetation stations established on the Chenier Plain to monitor CWPPRA projects, including CS-20 (40 stations), CS-17 (24 stations), CS-31 (30 stations), CS-28 (18 stations), ME-04 (18 stations), and ME-11 (12 stations) (figure 1).

After the 2005 data collection, the stations were classified according to the level of disturbance/stress they had experienced and the resulting vegetation response. Stations were classified as either Open Water, Severely Stressed, Moderately Stressed (also classified as "Stressed"), or Slightly Stressed (Table 1). Data collected in 2006 and the last CWPPRA data available from before Hurricane Rita were also classified by stress.

At each station, a marker had been previously established. A 2m x 2m square was placed on the marsh and Total % Cover, % Cover of each species present in the plot, and height of the dominant species were collected. Presence of other species that were not in the plot, depth of surface water, salinity, and sometimes porewater salinity were noted.

The compiled vegetation data from the three sampling periods were utilized to classify each site according to Visser's vegetation types of the Chenier Plain (Visser et al. 2000). The pre-storm types were determined with photographs and Visser Type definitions. The stations were reclassified after the 2005 and 2006 sampling. Stations that did not fit into any Visser Type after the storm maintained their pre-storm types. If the dominant species shifted to an identifiable Visser Type, the station was reclassified.

The data were analyzed to determine the impact of the storm on Total % Cover and Species Richness at three levels; overall by year (all 163 stations), by CWPPRA restoration project (seven projects), and with Visser vegetation type (six types).

Table 1. Vegetation Stress Classifications used in this survey.

Vegetation Classification	Description
Open Water	Vegetation has been ripped out. 100% of plot is open water.
Severely Stressed	>50% of plot is open water. Vegetation is weak.
Stressed	Perennial grasses and herbs are mostly dead (>50%) or >25% open water. Often dominated by annual shrubs.
Slightly Stressed	Perennial grasses are healthy and vigor (ous.

RESULTS

COASTWIDE

Prior to Hurricane Rita, most of the vegetation stations utilized for this survey were healthy and intact (>80%). Following the hurricane in 2005, most of the stations were stressed (67%) or worse (20%). A year later in 2006, over 50% of the stations were back to pre-storm stress levels. Severely stressed stations either converted to open water or recovered to a less stressed state. Most stations that had been converted to open water in 2005 did not recover (figures 1 and 2).

ANOVA was utilized to test for differences in Total % Cover (% of plot covered by living vegetation) and Species Richness (n species per plot) over the three sampling periods, by CWPPRA project, and with Visser vegetation type classifications.

Total % Cover was significantly different over time (figure 3). Post-ANOVA comparisons (Tukey's HSD) revealed that all three sampling periods were significantly different, meaning Total % Cover for 2006 is still significantly lower than pre-Hurricane Rita levels. Species Richness was also significantly different over the three sampling periods (figure 4). The number of species present before Rita and in 2006 were statistically the same.

Most of the projects had significant differences over time for both Total % Cover and Species Richness, with trends similar to the overall model (figures 3 and 4). Post-ANOVA comparisons were utilized to determine whether the projects had recovered to pre-storm levels for both Cover and Richness (Table 2).

Visser Type was added to the overall model and the interaction between Visser Type and time was analyzed. Both models had significant differences in Visser Type over time (figures 5 and 6). Post-ANOVA contrasts of Cover and Richness pre-Rita and post-06 for each Visser Type revealed that all Visser Types were the same in Total Cover (had recovered to pre-storm

levels) and in Richness except Fresh Bulltongue (mostly in the ME-04 project area), which had not recovered, and Oligohaline Wiregrass, which had significantly more species per plot post-Rita than before (up from 2.83 to 3.22 species).

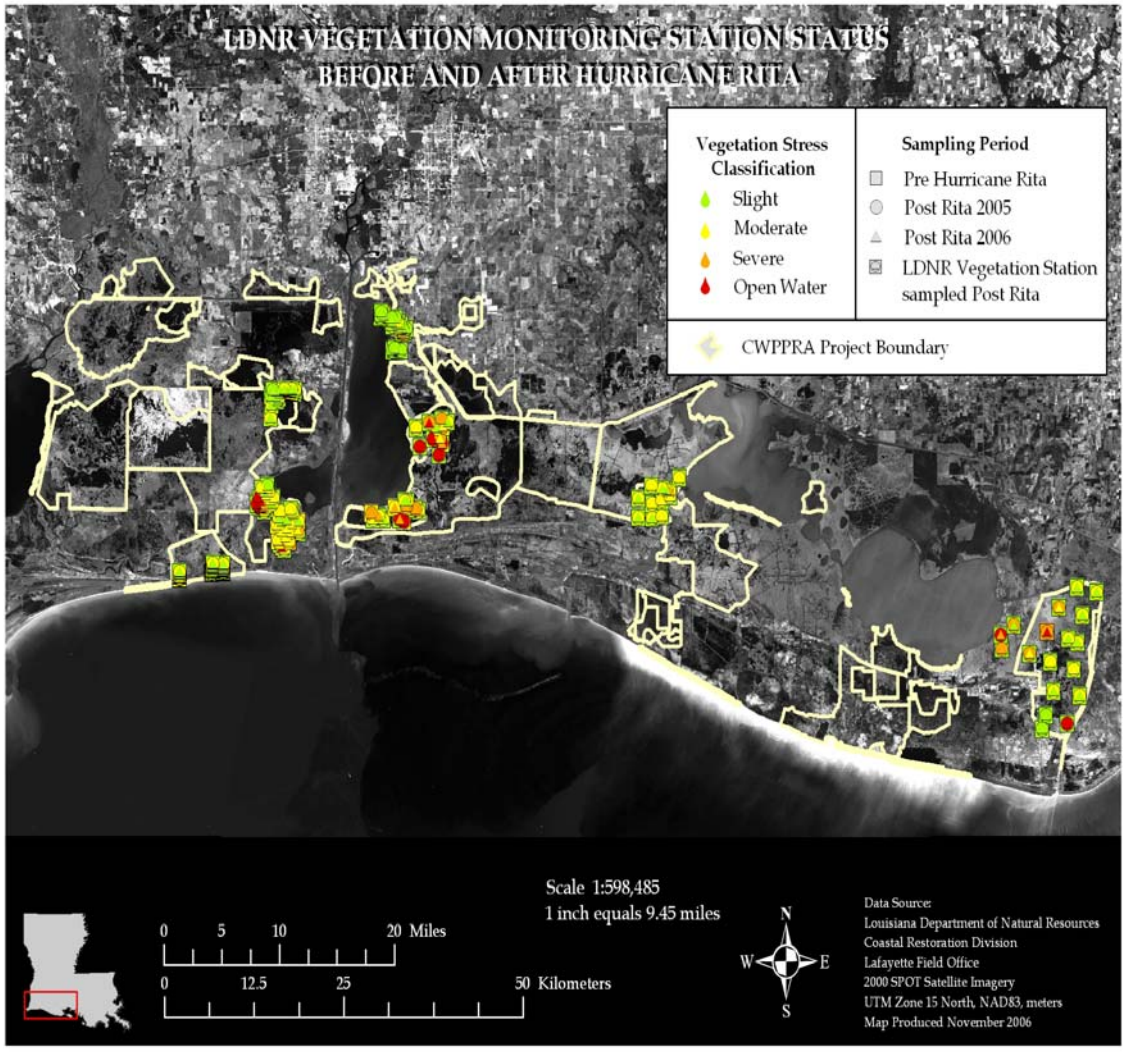

Figure 1. Location and status of LDNR vegetation stations sampled after Hurricane Rita. Stations were classified according to storm-induced stress as described in Table 1.

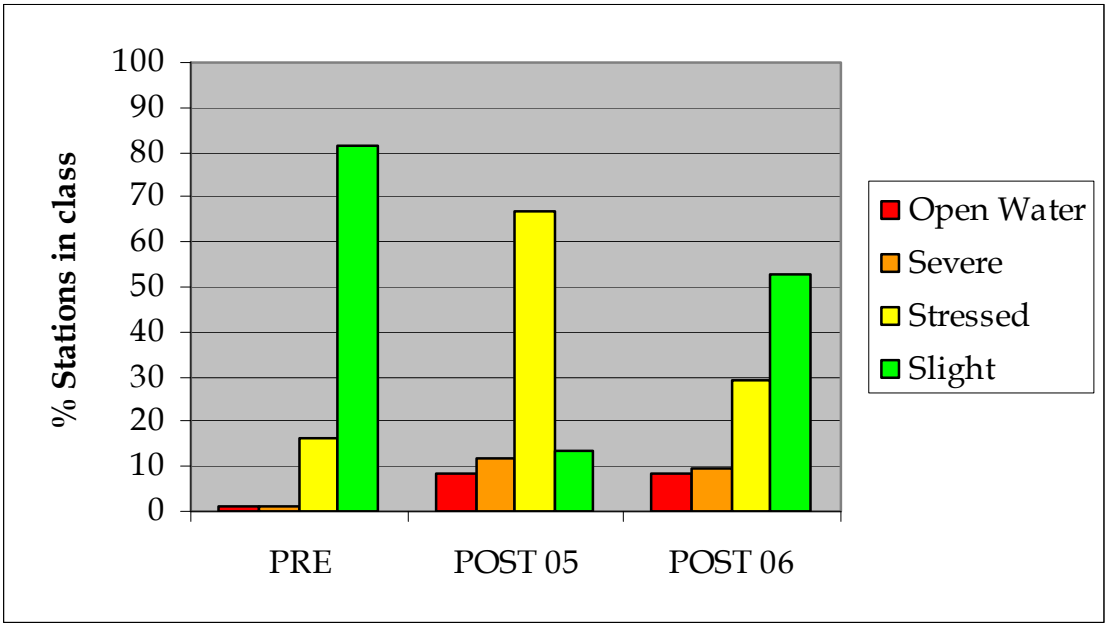

Figure 2. Percent of LDNR vegetation stations in each stress class before and after Hurricane Rita (n=163).

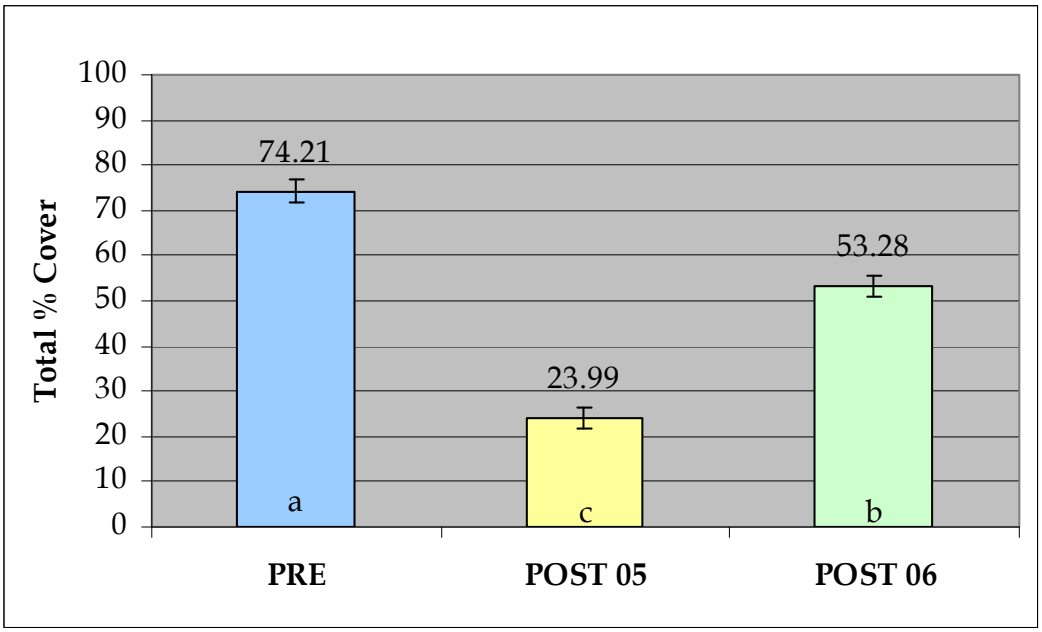

Figure 3. Total % Cover pre- and post-Hurricane Rita. LS Mean ± SE, n=163 stations, $F_{2, 488}$=109.7, p<0.0001. Levels not connected by same letter are significantly different.

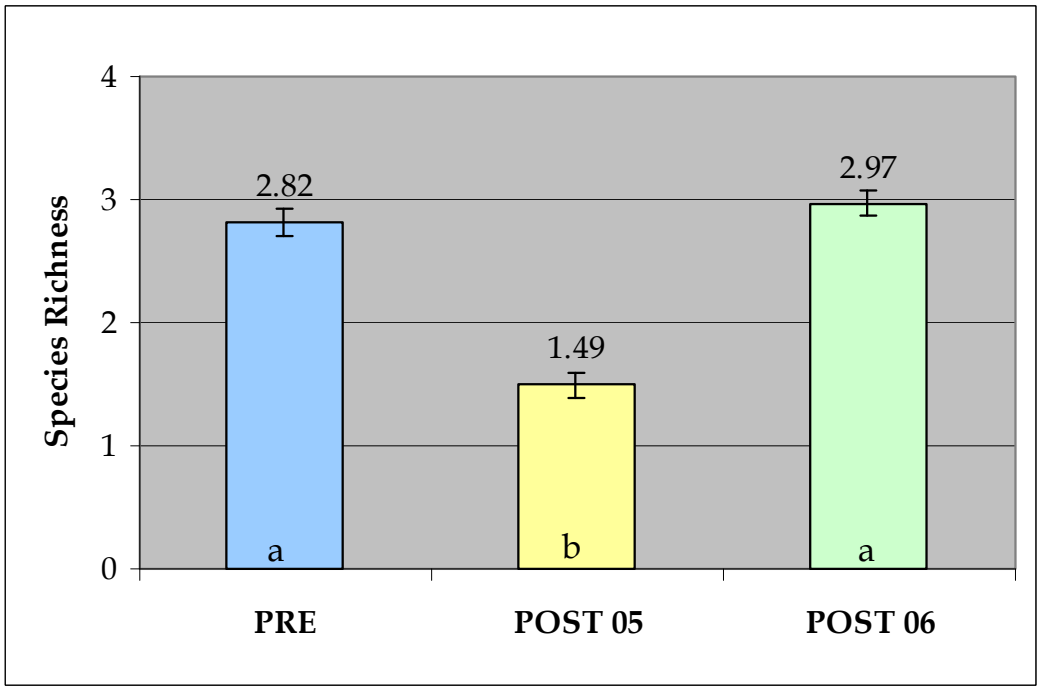

Figure 4. Species Richness pre- and post-Hurricane Rita. LS Mean ± SE, n=163 stations, $F_{2, 488}$=56.8, p<0.0001. Levels not connected by same letter are significantly different.

Table 2. CWPPRA Project ANOVA Results

Results of Post-ANOVA comparisons by CWPPRA Project Summary of 2006 levels relative to Pre-Hurricane Rita and 2005		
Project	**Total Cover**	**Species Richness***
CS-17	Not Recovered	Recovered
CS-20	Not Recovered	Recovered
CS-21	Recovered	Recovered
CS-28	Recovered	No Rita Impact.
CS-31	Not Recovered	Recovered
ME-04	Not Recovered	Recovered
ME-11	No Rita Impact	Recovered

*****Although the number of species present returned to pre-Rita levels at most projects, many of the species present were disturbance species.

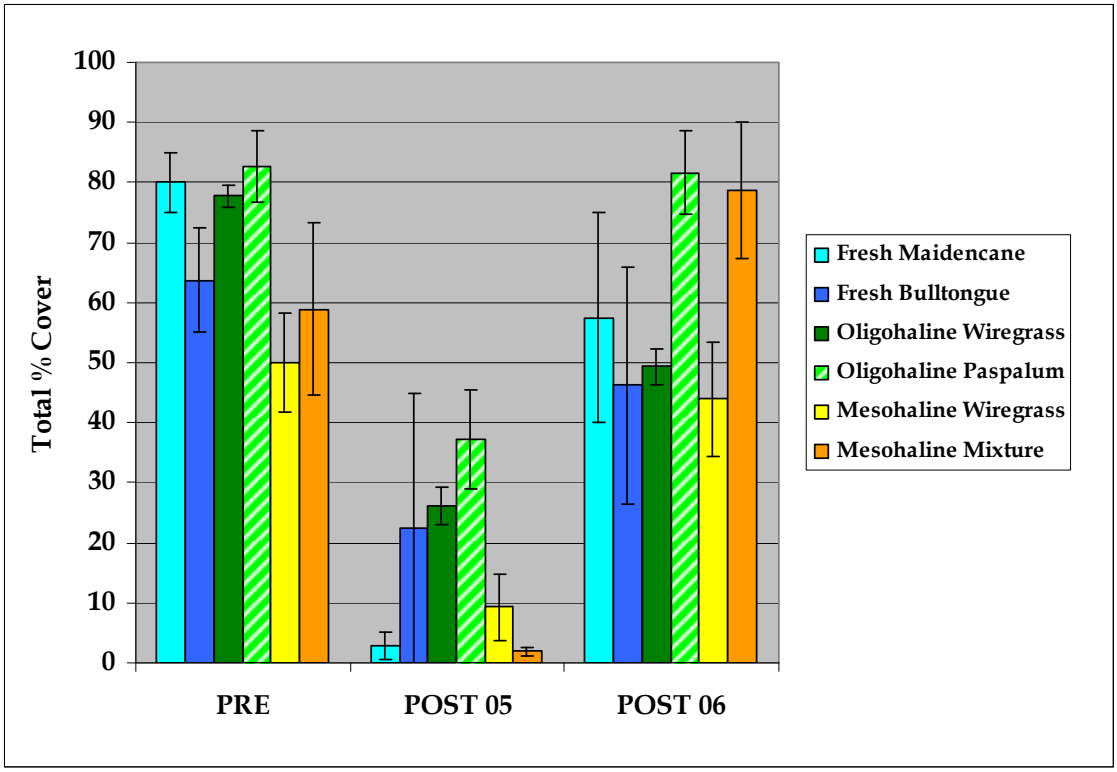

Figure 5. Total % Cover by Visser Vegetation Type. LS Mean ± SE, n=163 stations, $F_{17, 488}$=17.0, p<0.0001.

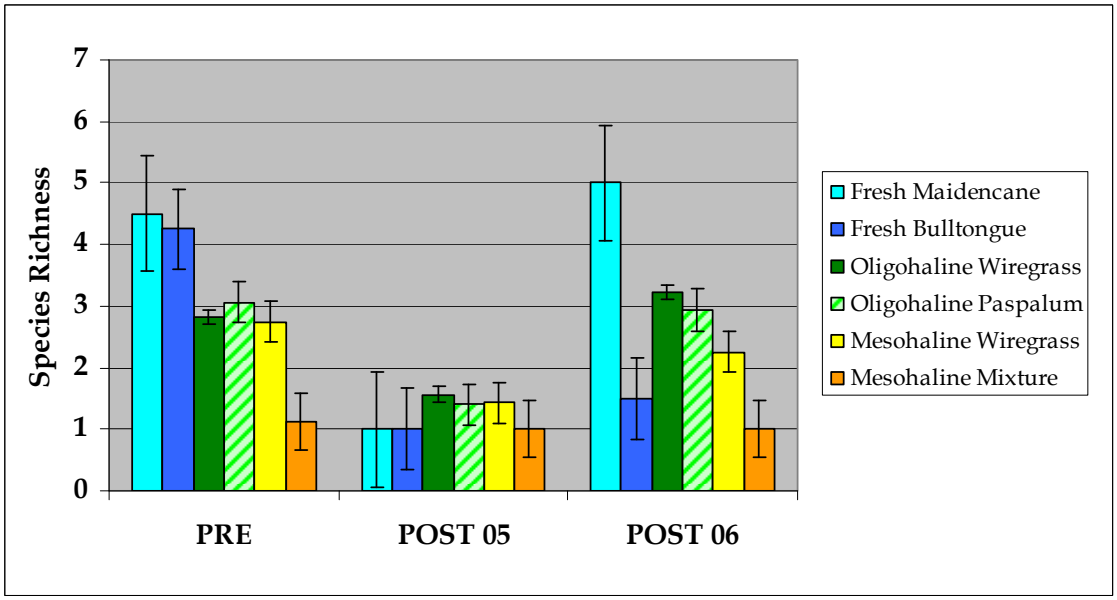

Figure 6. Species Richness by Visser Vegetation Type. LS Mean ± SE, n=163 stations, $F_{17, 488}$=10.9, p<0.0001.

LITERATURE CITED

Visser, J. M., R. H. Chabreck, and R. G. Linscombe. 2000. Marsh vegetation types of the Chenier Plain, Louisiana, USA. Estuaries 23(3) 318-327.

APPENDIX B
(Inspection Photographs)

Appendix B
(Inspection Photographs)

Photo 1, Closure No. 1. Note low areas of stone in center of structure.

Photo 2, Closure No. 2. View showing “flanking” cut on east end.

Photo 3, Area between west end of Closure No. 3 and east end of Closure No. 2, showing narrow section of marsh requiring shoreline protection.

Photo 4, Closure No. 3. View looking east, Lake Sand Dike in the background.

Photo 5, East end of Lake Sand Closure No. 4. Note low areas of stone.

Photo 6, North end of Closure No. 5. View of northern portion of structure and of the repair work post-Hurricane Lili prior to Hurricane Rita landfall.

Photo 7, Closure No. 6. Note breach on south end of closure stone fill. Breach had begun prior to Hurricane Rita but was not as wide.

Photo 8, Shoreline protection at Closure No. 7.

Photo 9, Closure No. 8. View looking east.

Photo 10, Closure No. 9, along south shore of Marsh Island. Note that shoreline protection dike is now away from the current shoreline post-Hurricane Rita.

APPENDIX C
(Three Year Budget Projection)

Appendix C
(Three Year Budget Projection)
MARSH ISLAND/ TV-14 / PPL 6
Three-Year Operations & Maintenance Budgets 07/01/2007 - 06/30/10

Project Manager	O & M Manager	Federal Sponsor	Prepared By
Pat Landry	*Herb Juneau*	*COE*	*Herb Juneau*

	2007/2008	2008/2009	2009/2010
Maintenance Inspection	$ 5,407.00	$ 5,570.00	$ 5,737.00
Structure Operation			
Administration	$ 15,000.00		$ -
Maintenance/Rehabilitation			

07/08 Description: Hurricane Rita Repairs/Bank Paving

E&D	$ 21,921.00
Construction	$ 563,853.71
Construction Oversight	$ 21,674.00
Sub Total - Maint. And Rehab.	$ 607,448.71

08/09 Description :

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

09/10 Description:

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

	2007/2008	2008/2009	2009/2010
Total O&M Budgets	**$ 627,855.71**	**$ 5,570.00**	**$ 5,737.00**

O &M Budget (3 yr Total)	**$ 639,162.71**
Unexpended O & M Budget	**$ 609,414.19**
Remaining O & M Budget (Projected)	**$ (29,748.52)**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2007 - 06/30/2008

MARSH ISLAND / PROJECT NO. TV-14 / PPL NO. 6

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$5,407.00	**$5,407.00**
General Structure Maintenance	LUMP	1	$0.00	**$0.00**
Engineering and Design	LUMP	1	$20,921.00	**$20,921.00**
Operations Contract	LUMP	1	$0.00	**$0.00**
Construction Oversight	LUMP	1	$21,674.00	**$21,674.00**

ADMINISTRATION

LDNR / CRD Admin.	LUMP	1	$10,000.00	$10,000.00
FEDERAL SPONSOR Admin.	LUMP	1	$5,000.00	$5,000.00
SURVEY Admin.	LUMP	0	$0.00	$0.00
OTHER				$0.00
			TOTAL ADMINISTRATION COSTS:	**$15,000.00**

MAINTENANCE / CONSTRUCTION

SURVEY

SURVEY DESCRIPTION:					
Secondary Monument	EACH	0	$0.00	$0.00
Staff Gauge / Recorders	EACH	2	$500.00	$1,000.00
Marsh Elevation / Topography	LUMP	0	$0.00	$0.00
TBM Installation	EACH	0	$0.00	$0.00
OTHER				$0.00
			TOTAL SURVEY COSTS:	**$1,000.00**

GEOTECHNICAL

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

CONSTRUCTION

CONSTRUCTION DESCRIPTION:	Hurricane RITA repairs, bank paving at ends of closures.				
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Dike	0	0.0	4,050	$65.00	$263,250.00
Bank Paving	0	0.0	800	$60.00	$48,000.00
	0	0.0	0	$0.00	$0.00
Filter Cloth / Geogrid Fabric		SQ YD	6,690	$8.00	$53,520.00
Navigation 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	$150,000.00	$150,000.00
Contingency		LUMP	1	$49,083.71	$49,083.71
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:	**$563,853.71**

TOTAL OPERATIONS AND MAINTENANCE BUDGET: **$627,855.71**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2008 - 06/30/2009

MARSH ISLAND / PROJECT NO. TV-14 / PPL NO. 6

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$5,570.00	**$5,570.00**
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 SPONSOR Admin.	LUMP	1	$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	
Rock Dike	0	0.0	0	$0.00	$0.00
Bank Paving	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
Navigation 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: **$5,570.00**

OPERATION AND MAINTENANCE BUDGET WORKSHEET 07/01/2009 - 06/30/2010

MARSH ISLAND / PROJECT NO. TV-14 / PPL NO. 6

DESCRIPTION	UNIT	EST. QTY.	UNIT PRICE	ESTIMATED TOTAL
O&M Inspection and Report	EACH	1	$5,737.00	**$5,737.00**
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 SPONSOR Admin.	LUMP	1	$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:	Hurricane RITA repairs, bank paving at ends of closures.				
Rip Rap	LIN FT	TON / FT	TONS	UNIT PRICE	
Rock Dike	0	0.0	0	$0.00	$0.00
Bank Paving	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
Navigation 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: **$5,737.00**

APPENDIX D
(Field Inspection Notes)

Appendix D
(Field Inspection Notes)

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 1

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Bill Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Good	Minor		1	Some erosion on each end of rock plug, marsh paving will be required to prevent further erosion.
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 2

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Bill Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Fair	Moderate		2	Some erosion on east end of rock plug, marsh paving will be required to prevent further erosion. A flanking cut has occurred on the west end of the plug and will need to be extended.
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 3

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Bill Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Good			3 & 4	Hurricane RITA eroded the marsh between Str. No. 2 & 3, leaving a narrow piece of marsh, and it is recommended that the shoreline between Str. 3 & 4 (+/- 1,500 to 1,800 L.F.) be armored with a rock dike.
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 4

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Billy Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Good	Minor		5	Several hundred feet of the rock dike on the eastern end has been displaced and will need to be restored to constructed height of +4.0.
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 5

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Billy Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Good			6	Staff gage leaning, needs to be re-set. Marsh overbank area on the north needs to be evaluated for possible extended marsh paving.
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 6

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Billy Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Poor	Major		7	The existing breach on the southern end has increased in size and depth and needs to be plugged. Some erosion on northern end of rock plug which will need marsh paving to harden this area.
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 7

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Billy Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Dike

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Good			8	
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 8

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Billy Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Good			9	
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?

MAINTENANCE INSPECTION REPORT CHECK SHEET

Project No. / Name:TV-14 Marsh Island Hydrologic Restoration

Date of Inspection: August 17, 2006 Time:

Structure No. 9

Inspector(s):Herb Juneau, Stan Aucoin (DNR), David Hidalgo, Randall Ward (Aucoin Assoc.), Billy Hicks (COE), Cassidy LeJeune, Paul Provence (LDWF)

Structure Description: Rock Plug

Water Level Inside:_____ Outside: _____

Type of Inspection: Annual

Weather Conditions: Clear skies and mild temperatures

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				
Cables	N/A				
Signage /Supports	N/A				
Rip Rap (fill)	Poor	Moderate		10	Hurricane RITA has eroded the marsh/sediment behind the rock plug and has exposed the earthen keyway to further erosion. The rock dike needs to be extended on each end and tie back into existing shoreline.
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?