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Department of Natural Resources
Coastal Restoration Division and
Coastal Engineering Division

2011 Operations, Maintenance, and Monitoring Report

for

Sabine Refuge Marsh Creation

State Project Number CS-28
Priority Project List 8

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Table of Contents

I. Introduction

The project area is composed of 5,776 acres (2337.5 ha) of wetlands located in the Calcasieu-Sabine Basin on the Chenier Plain. The area is within the Sabine National Wildlife Refuge and roughly bounded by Starks North Canal to the north and east, Back Ridge Canal to the south, and existing marsh to the west (figure 1). Hurricanes and canal building between 1956 and 1978 caused landloss in the area. Saltwater from the Calcasieu Ship Channel (CSC) is currently introduced from several sources including the GIWW through Alkali Ditch and probably more importantly through West Cove Canal via Back Ridge Canal (Miller 1997). Vegetation has shifted from intermediate sawgrass dominated marsh including *Cladium jamaicense* (sawgrass), *Schoenoplectus californicus* (giant bulrush), and *Phragmites australis* (Roseau cane), with some fresh marsh to more brackish species including *Spartina patens* (saltmeadow cordgrass), *Schoenoplectus americanus* (bulrush), and *Schoenoplectus robustus* (saltmarsh bulrush) since at least 1968 (Chabreck and Linscombe 1968, 1978, 1988). Most of the project is shallow open water with brackish marsh on the surrounding edges. The current land loss rate is approximately 0.5 square miles (1.3 km^2) per year (United States Army Corps of Engineers [USACE] 2000).

The Sabine Refuge Marsh Creation Project (CS-28) is designed to create approximately 1,120 acres (450 ha) of emergent vegetated marsh and to nourish and protect existing broken marsh via five cycles of spoil placement. During the January 2001 maintenance dredging of the Calcasieu River by the Operations Division of the U.S. Army Corps of Engineers-New Orleans District, via Cycle 1 of the project, approximately 1,000,000 cubic yards of sediment were dredged from the Calcasieu Ship Channel between miles 8.3 to 10.4 and placed in a confined area within the Sabine National Wildlife Refuge. The first cycle created approximately 200 acres of vegetated marsh. Sediments were pumped to 4.0 to 4.4 ft MLG.

The plan called for 36,000 *Spartina alterniflora* plants to be planted along the edges of the perimeter and the constructed canals in the Cycle 1 dredge placement area. This effort was completed, but the interior of the newly created marsh revegetated quickly on its own. Plantings were not utilized in after Cycle 1 since Cycle 1 appeared to have vegetated from the soil seedbank and windborne seed sources.

During the May 2007 maintenance dredging of the Calcasieu River 828,767 cubic yards of material was pumped into the Cycle 3 containment area from between miles 9 and 12 of the Calcasieu Ship Channel. Dredged materials were pumped to 2.6 to 4.2 ft MLG into a 230 acre containment area. Containment levees on the northwest side of the area were breached every 500 ft to allow for delta formation.

Marsh creation cycles were originally scheduled to occur every year beginning in 2005 (figure 2). To date, Cycles 1, 2, and 3 have been completed. Cycle 2 was completed in May 2010. Final construction documents for Cycle 2 have not been provided.

Each cycle had delta formation components where the lakeside levee was downgraded after construction and sediments were allowed to flow from the containment area. Cycle 2 had an extensive delta formation area that covered at least 100 acres.

Biological monitoring will not be conducted in Cycle 2 as it has been converted to a state only project and has no monitoring budget. Cycle 1 is going to be monitored with CRMS06301 only. Vegetation stations were established in Cycle 3 and those will be monitored in the future. Vegetation will be monitored in Cycles 4 and 5 if their budgets allow.

II. Maintenance Activity

There are no O&M monies for this project, therefore, no inspection, maintenance activity, operations or plan applies.

III. Operation Activity

a. Operation Plan

b. Actual Operations

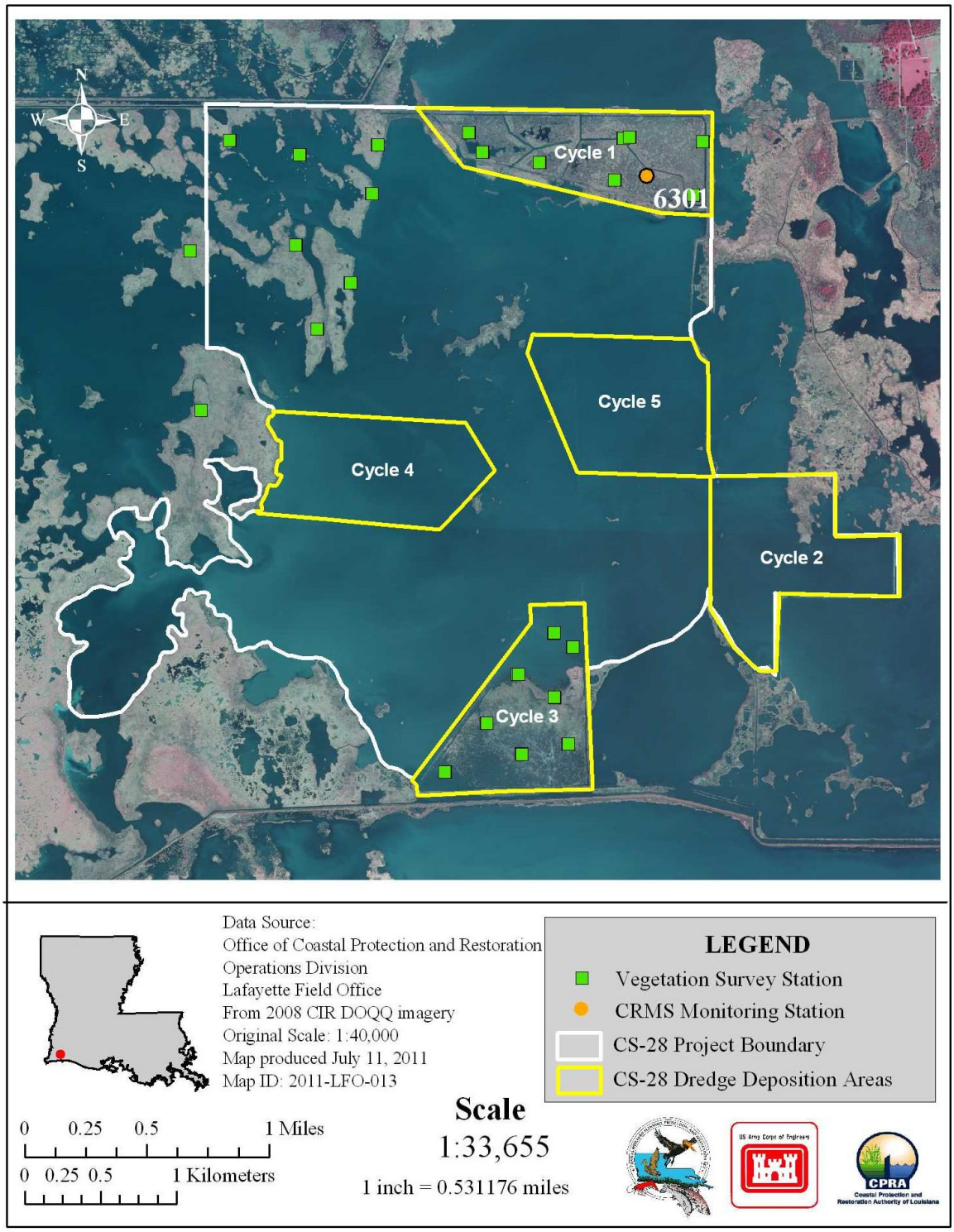

Figure 1: Sabine Refuge Marsh Creation (CS-28) project area boundary, deposition area boundaries, vegetation monitoring stations, and CRMS site.

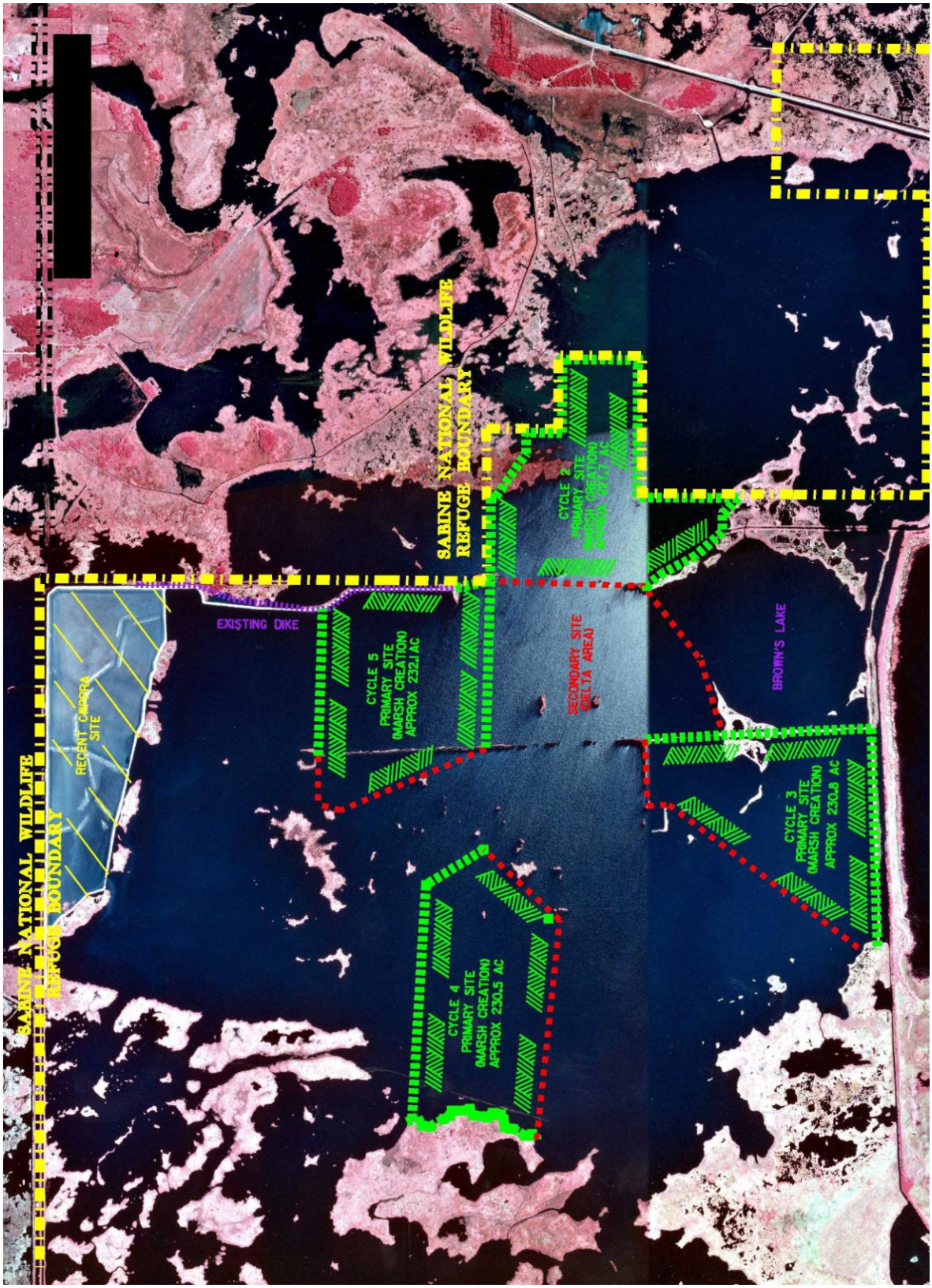

Figure 2. Location of Cycles 1 and 3 dredge placement area and the proposed location of Cycles 2, 4, and 5.

IV. Monitoring Activity

Pursuant to a 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 CS-28 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. CRMS06301 was constructed in the Cycle 1 dredge deposition area. No CRMS-*Wetlands* sites are located within the other cycles.

a. Monitoring Goals

The objective of the Sabine Refuge Marsh Creation Project is to create new vegetated marsh and enhance and protect existing surrounding marsh vegetation.

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

1 Place dredge spoil slurry to a maximum height of 4.5 ft (1.4 m) MLG to settle to a height of 2.5 ft (0.8 m) MLG, after five years, for each of five dredging cycles.

2. Create 125 acres (50 ha) of vegetated wetlands in the first dredge placement cycle and 230 acres (93 ha) in each cycle for Cycles 2 through 5.

3. Reduce loss of existing surrounding marshes within the project area.

b. Monitoring Elements

Aerial Photography:

Near-vertical color-infrared aerial photography (1:24,000 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, on December 15, 2002 after construction of Cycle 1, and on December 20, 2009 after construction of Cycle 3. 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/NWRC personnel according to standard operating procedures (Steyer et al. 1995, revised 2000). Additional photography will be collected in 2018.

Emergent Vegetation:

For Cycle 1, vegetation was monitored pre-construction in 2001 and post-construction in 2002 and 2004 and as part of a regional response to Hurricane Rita in 2005, 2006, 2007 and 2008. CRMS06301 was established in the Cycle 1 deposition area in 2008 and vegetation data collection began in 2009, replacing future Cycle 1 vegetation sampling. Eight vegetation monitoring stations were established in the Cycle 1 dredge deposition area after construction and before plantings were installed along the edges. Ten reference stations were established in

the pre-existing marshes (figure 1). In Cycle 3, eight vegetation stations were established in 2008 and were monitored in 2010. Two 2 m^2 plots were sampled at each of the stations. Percent cover, height of dominant species, and species richness were quantified. Cycle 3 will be sampled in 2012, 2014, 2016, and 2022. Cycle 2 will not be monitored.

Elevation Survey:

The elevation of the initial placed dredge material (as-built) was documented for each cycle at the end of construction. Elevation measurements were to be recorded one year after each cycle was built and then every other year if the USACOE requested monies to do so. To this date, no requests for survey funds have been made and no surveys other than as built surveys have been conducted.

A Rod Surface Elevation Table (RSET) was installed in Cycle 1 in 2009 at CRMS6301 to measure marsh elevation change. Marsh elevation was surveyed at the CRMS site during construction so we do have one localized survey from April 2009.

c. Preliminary Monitoring Results and Discussion

Aerial Photography:

Land:Water analysis was completed for photography acquired in December, 2002 (figure 3) and 2009 (figure 4). When the 2002 photography was flown 11 months after construction, the Cycle 1 area was entirely mudflat. When the 2009 photography was flown 21 months after construction, Cycle 3 was mostly vegetated. The Cycle 1 area continued to fill in from 2002 to 2009 increasing from 139 to 171 acres of land or 70% to 86% of the 200 acre cell (Table 1). The remaining 29 acres are existing land, trenasses, and 4 acres of dredged material that converted to water (figure 4). The Cycle 3 area had 133 acres of land in 2009 which is approximately 58% of the 230 acre cell. The remaining 97 acres of water in Cycle 3 should continue to fill in.

One of the suggested benefits of the project was nourishment of the adjacent natural marsh by the suspended dredge sediments released when the lake side levee was purposely degraded post-construction (small delta formation effect). There does appear to have been an increase in land on the southern border of the Cycle 1 deposition area (figure 4). If we account for the increase in existing land due to the addition of the Cycle 2 area, we can estimate that 47 acres were created outside of the Cycle 1 and 3 deposition areas.

Cycle 2 was pumped in 2010 and could have up to 230 acres inside plus a large delta formation area. The project is achieving its goals of creating land and preventing landloss in adjacent marshes.

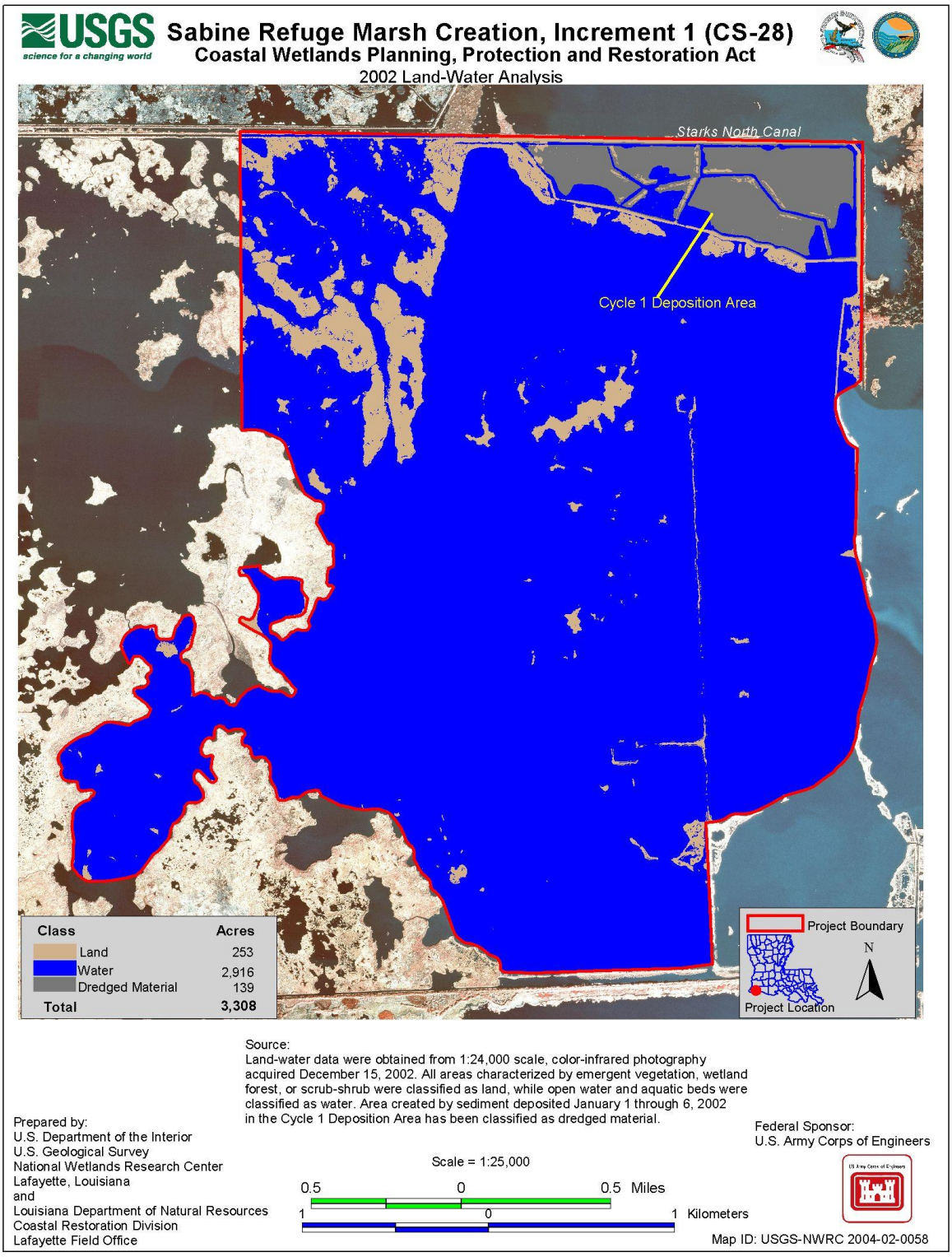

Figure 3. Land:Water analysis from photography obtained December 15, 2002 with project boundaries and land, water, and dredge material acreages.

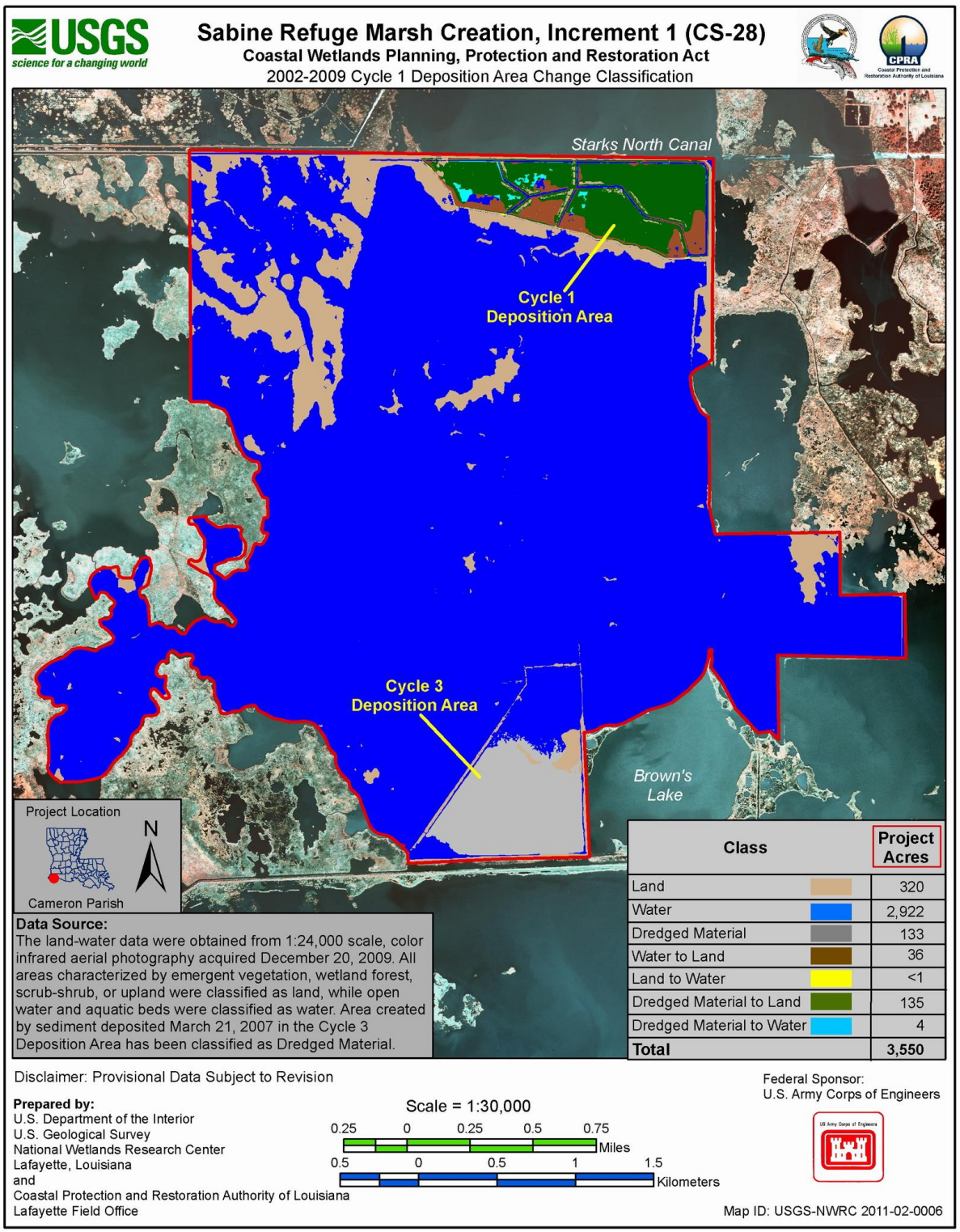

Figure 4. Land:Water change from photography obtained in December 2002 and 2009.

Table 1. Acreages and percentages of land and water from 2002 and 2009 aerial photography.

	2002		2009	
	Acres	**%**	**Acres**	**%**
Water	2916	88.1	2926*	82.4
Total Land	392	11.9	624	17.6
Land (Existing)	253	7.6	320*	9.0
Cycle 1 (Created)	139	4.2	171	4.8
Cycle 3 (Created)			133	3.7
Total	3308		3550*	

*242 total acres added in 2009 due to a boundary change to include Cycle 2. Of those approximately 20 were land and 222 were water.

Emergent Vegetation:

Vegetation stations were established in Cycle 1 post construction in 2002 while the cell was still a mudlflat (figure 5). *Spartina alterniflora* was planted along the edges of Cycle 1 in 2002. By 2004, the Cycle 1 area was dominated by *Spartina alterniflora* over five feet tall (figure 6). The dredge material probably contained mineral rich clays that *S. alterniflora* was responding to. Hurricane Rita knocked back Cycle 1 vegetation significantly (figure 7). The immediate hurricane impact was much stronger in the project area than in the reference (figure 8). The Cycle 1 deposition area recovered quickly from Hurricane Rita in total cover (figure 9), height of dominant species (figure 10), and continued to slowly increase in species richness (figure 11).

Cycle 3 was pumped in 2007 and had begun to vegetate prior to the first measurements in 2008 (figure 12). The species assemblage in Cycle 3 was slightly different than in Cycle 1 in the first couple of years (figure 13). Cycle 1 was essentially a monoculture of *S. alterniflora* while Cycle 2 had some stands of *Salicornia depressa*. We can assume the difference was due to the plantings (which were not installed in Cycle 3). The assumption that the cell would vegetate from seed appears to have been correct. In fact, there was as much cover in Cycle 3 after one year as there was in Cycle 1 after two years. It will be interesting to see whether the community that develops in Cycle 3 is similar to Cycle 1. It will take a long time for either area to be as diverse as the reference area although Cycle 1 did begin to see more species in 2009. The main difference between Cycle 1 and the reference area is the absence of *Spartina patens.*

Hurricane Ike did not impact the project or reference areas as severely as Hurricane Rita did (Sharp and Juneau, 2007). In fact 2008 vegetation data was collected after Ike and there was really no apparent impact other than new sediment deposited on the surface. Although the storms had similar surge heights in this area, the conditions prior to the storm were very different. Before Hurricane Rita the area was in a drought and water levels were below the surface of the marsh throughout the region. Prior to Hurricane Ike, the region had just experienced heavy rains from Hurricane Gustav and the marsh was flooded. It is thought that the Ike storm surge was not absorbed by and held in the marsh like Rita's was.

Figure 5. Photograph of vegetation station (CS28-205) in the Cycle 1 deposition area at time of establishment (September, 2002). The plants in the background are *Salicornia bigelovii*.

Figure 6. Photograph of vegetation station (CS28-205) in the Cycle 1 deposition area two years after construction (August, 2004).

Figure 7. Photograph of vegetation station (CS28-200) in the Cycle 1 deposition area six weeks after Hurricane Rita and three years after construction (October, 2005).

Figure 8. Photograph of vegetation station (CS28-150) in the reference area six weeks after Hurricane Rita (October, 2005).

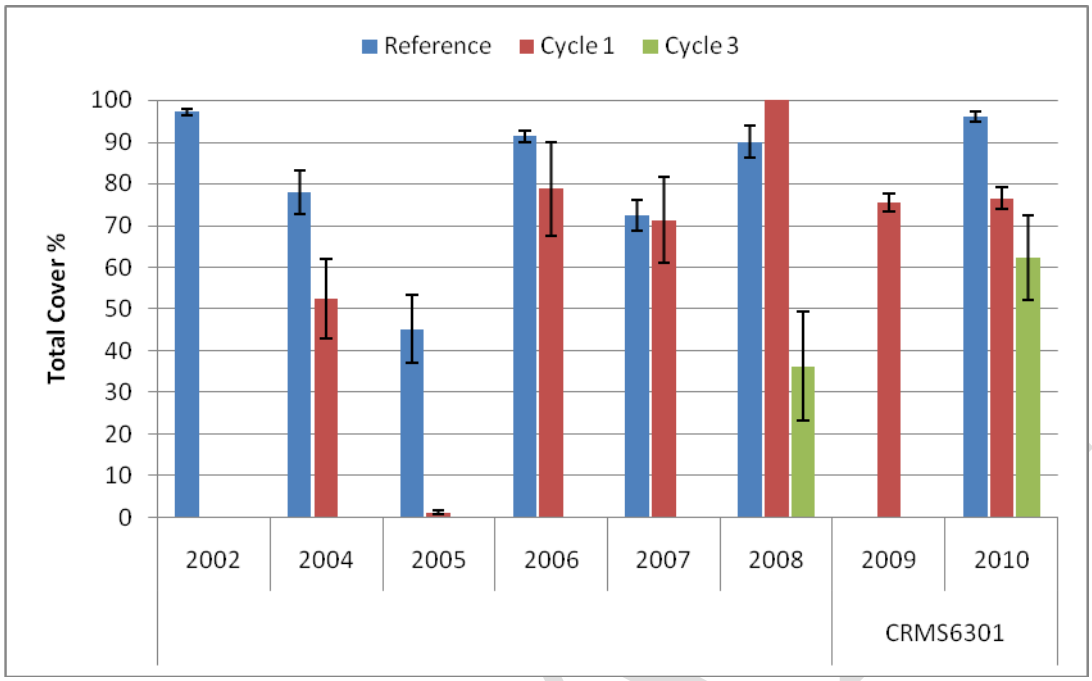

Figure 9. Total percent cover of emergent vegetation in the CS-28 project cycles and reference area. Mean ± SE.

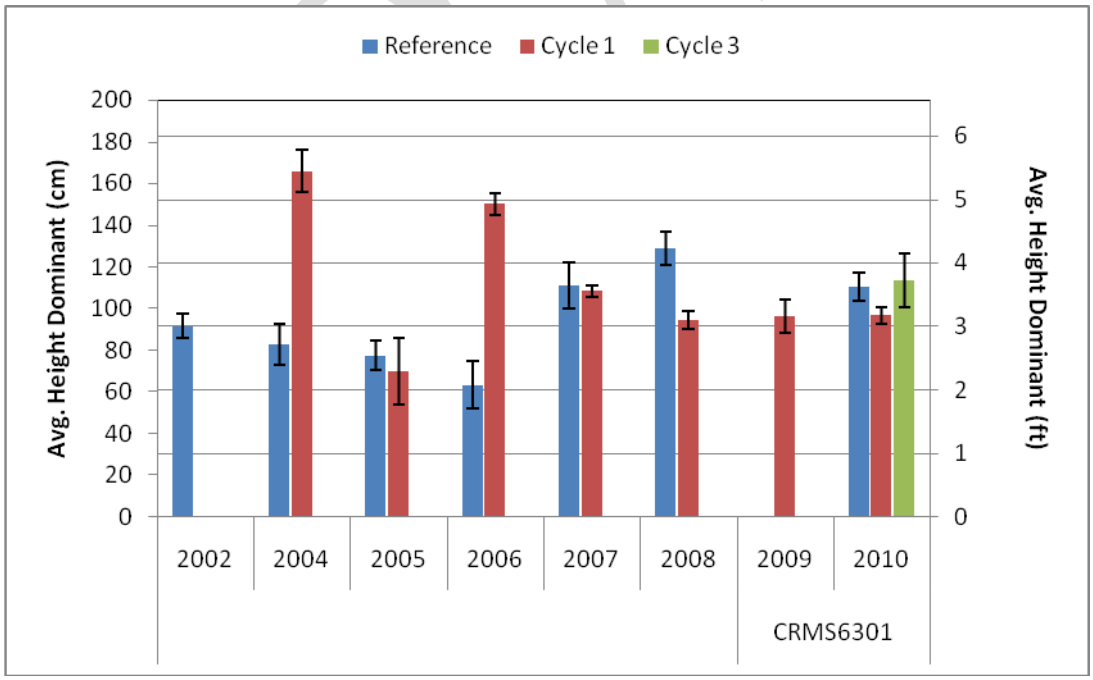

Figure 10. Average height of the dominant species of emergent vegetation in the CS-28 project cycles and reference area. Mean ± SE.

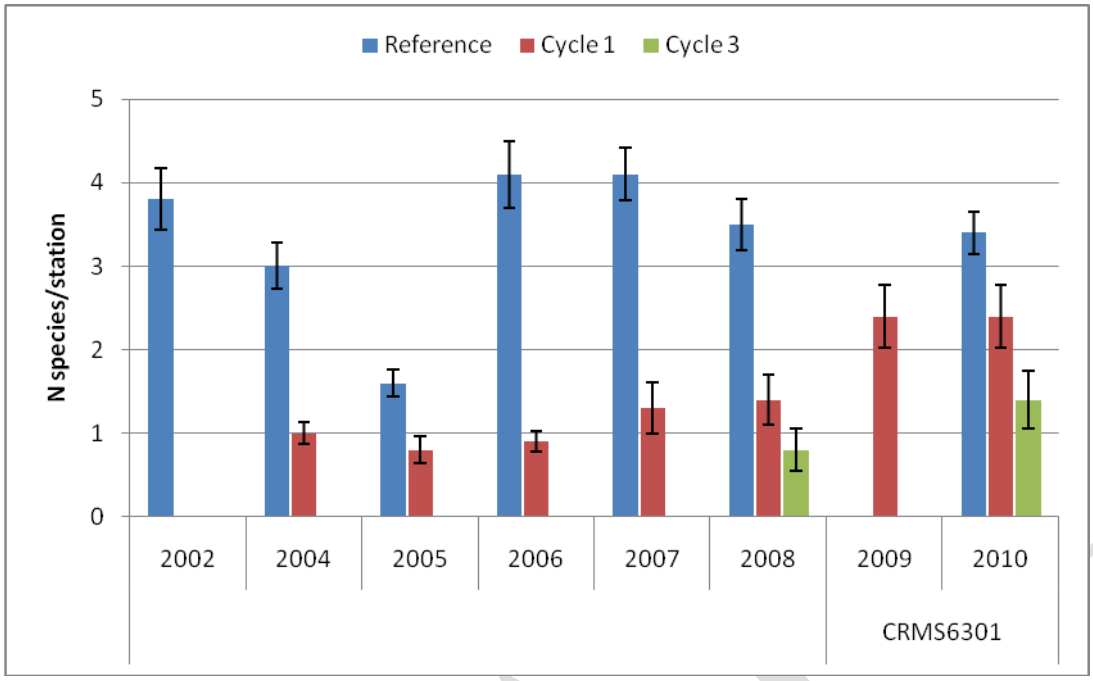

Figure 11. Species richness (n species per station) in the CS-28 project cycles and reference area. Mean ± SE.

Figure 12. Cycle 3 as seen from the air in October 2008.

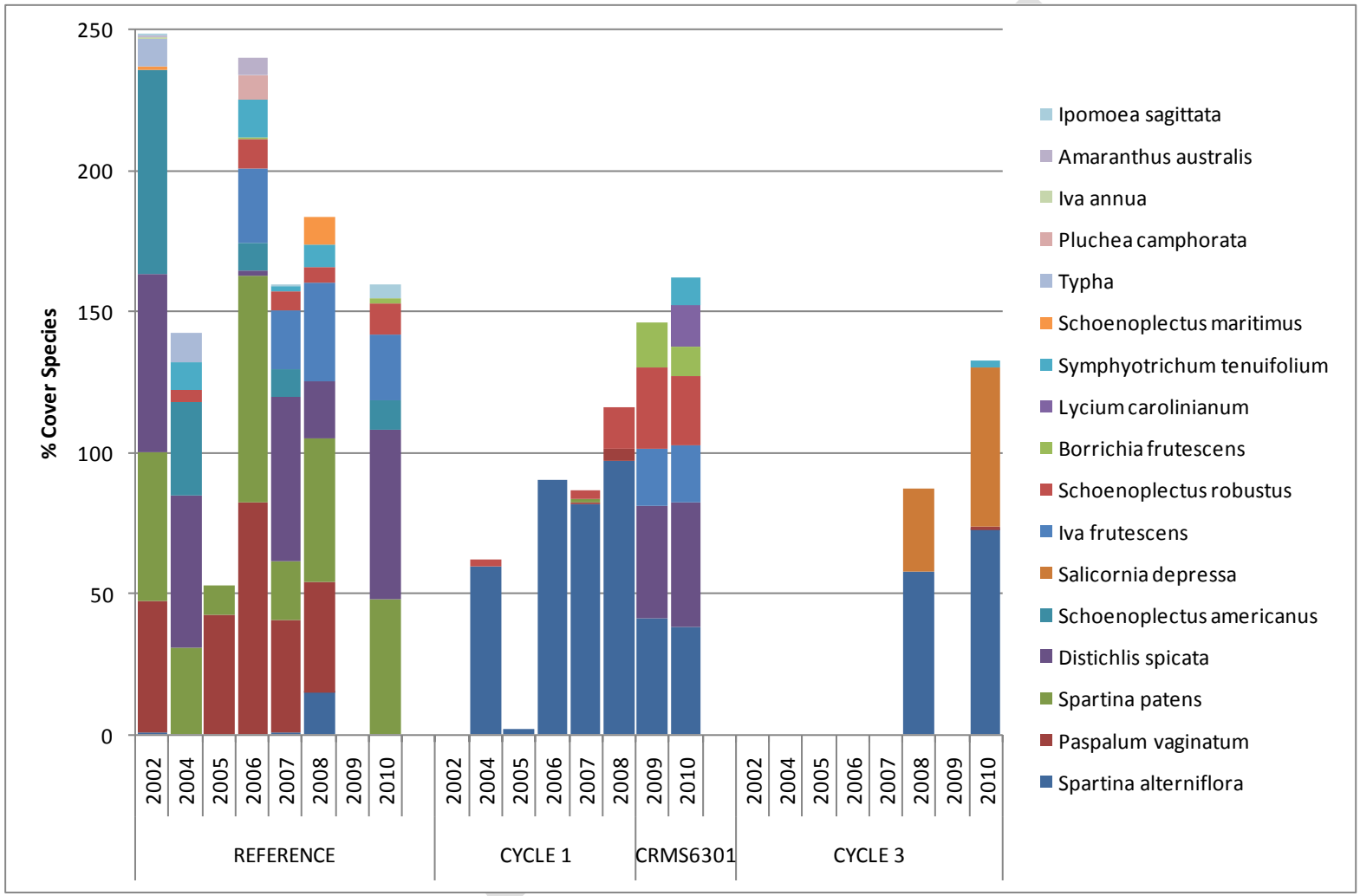

Figure 13. Cover of individual species in the CS-28 project cycles and reference area.

Elevation Survey:

Only as built surveys were conducted. Cycle 1 was pumped to between 4.0 and 4.4 ft MLG. Cycle 3 was pumped to between 2.6 and 4.2 ft MLG. Cycle 2 as built elevations have not been delivered. Low as built elevations in Cycle 3 may create conditions that are too deep for vegetation.

A survey from the establishment of CRMS6301 in Cycle 1 is available (figure 1). That site was surveyed to 1.36' NAVD88 in April 2009. The difference between MLG and NAVD88 was calculated to be 1.3 ft at the Calcasieu Locks as part of a separate exercise conducted by OCPR engineers. No better adjustments are available. If we use the 1.3 ft adjustment, the CRMS survey would be 2.66 ft MLG. The goal of the project was for sediments to settle to 2.5 ft MLG in five years (by 2007). Elevations appear to be close to that goal.

Very preliminary elevation change rates are available from CRMS6301. Elevation change and accretion rate data collected over less than five years should be used very carefully but for the purposes of this report, it appears that elevation has been holding steady or slightly increasing (<1 cm/yr) since 2009 suggesting the dredge in Cycle 1 is no longer settling (figure 14).

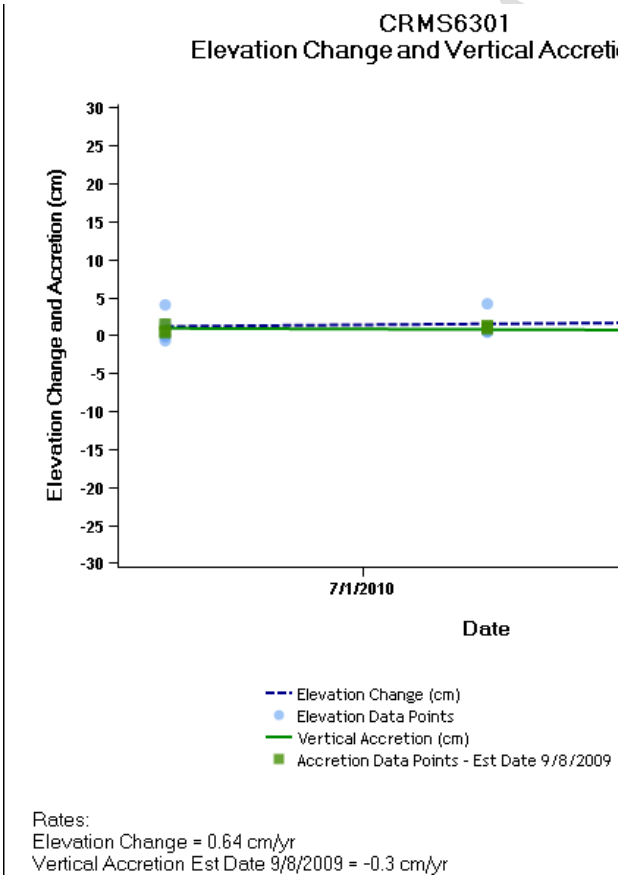

Figure 14. Very preliminary elevation change and accretion rates from CRMS6301 in the Cycle 1 dredge deposition area.

V. Conclusions

a. Project Effectiveness

The major objective of the Sabine Refuge Marsh Creation Project is to create new vegetated marsh and to enhance and protect existing surrounding marsh vegetation. To date 310 acres have been created in Cycles 1 and 3and up to 230 acres have been created in Cycle 2. Each of the Cycles should help protect the area from saltwater intrusion. The specific goals of creating marsh that settles to 2.5 ft MLG, creating land in the dredge cycles, and reducing land loss appear to have been achieved.

b. Recommended Improvements

There are no specific recommended improvements at this time.

c. Lessons Learned

Dredge cells will vegetate without the addition of plantings on the edge. The Cycle 3 area vegetated as quickly as the Cycle 1 area and did so from seed bank alone.

It is not necessary to pre-dig trenasses for tidal ingress and egress. Rather, the track hoe/marsh buggy can be driven over the area where tidal channels are desired approximately one year after pumping to create channels. Pre-digging trenasses is costly and can interfere with the placement of the dredged material.

VI. Literature Cited

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