State of Louisiana

Coastal Protection and Restoration Authority

2014 Monitoring Plan

for

Sabine Refuge Marsh Creation (CS-28) Cycles 1 and 3.

State Project Number CS-28
Priority Project List 8

October 2014
Cameron Parish

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MONITORING PLAN

PROJECT NO. CS-28
SABINE REFUGE MARSH CREATION PROJECT

ORIGINAL DATE: August, 20 2001
REVISED DATES: August 14, 2003; October 22, 2014

Preface

Pursuant to a CWPPRA Task Force decision on August 14, 2003 to adopt the Coastwide Reference Monitoring System (CRMS-*Wetlands*) for CWPPRA, updates were made to this Monitoring Plan to merge it with CRMS to provide more useful information for modeling efforts and future project planning while maintaining the monitoring mandates of the Breaux Act. The implementation plan included review of monitoring efforts on currently constructed projects for opportunities to 1) determine if current monitoring stations could be replaced by CRMS stations, 2) determine if monitoring could be reduced to evaluate only the primary objectives of each project and 3) determine whether monitoring should be reduced or stopped because project success had been demonstrated or unresolved issues compromised our ability to actually evaluate project effectiveness. As a the result of a joint meeting with DNR, USGS, and the federal sponsor, the recommendations for this Monitoring Plan were to maintain it in its current form. Consequently, no revisions were made to this Monitoring Plan.

Project Description

The project area is composed of 3,300 acres located within the Chenier Plain in southwestern Louisiana, in the Calcasieu-Sabine Basin, west of LA Highway 27 and Calcasieu Lake. 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). Most of the soils in the project area are classified as either Clovelly muck, Gentilly muck, or Scatlake mucky clay, which are all level, poorly drained fluid soils (U.S. Department of Agriculture [USDA] 1995). Clovelly muck and Gentilly muck are organic and mineral soils respectively, found in brackish marsh, whereas Scatlake mucky clay, prevalent at the southern end of the project area, is a mineral soil found in saline marshes.

The vegetation in the area was classified as mostly saw grass marsh (*Cladium jamaicense* [saw grass], *Scirpus californicus* [giant bulrush], *Phragmites australis* [roseau cane]), with some fresh marsh (*Panicum hemitomon* [maiden cane], *Sagittaria lancifolia* [bull-tongue]), and intermediate marsh (fresh species plus *Scirpus americanus* [bulrush], and *Spartina patens* [saltmeadow cordgrass]) by O'Neil (1949). The vegetation has been classified as brackish (*S. patens, S. americanus*, *Scirpus robustus* [saltmarsh bulrush], *Ruppia maritima* [widgeon grass]) since at least 1968 (Chabreck and Linscombe 1968, 1978, 1988). Most of the project is currently open water with brackish marsh on the surrounding edges.

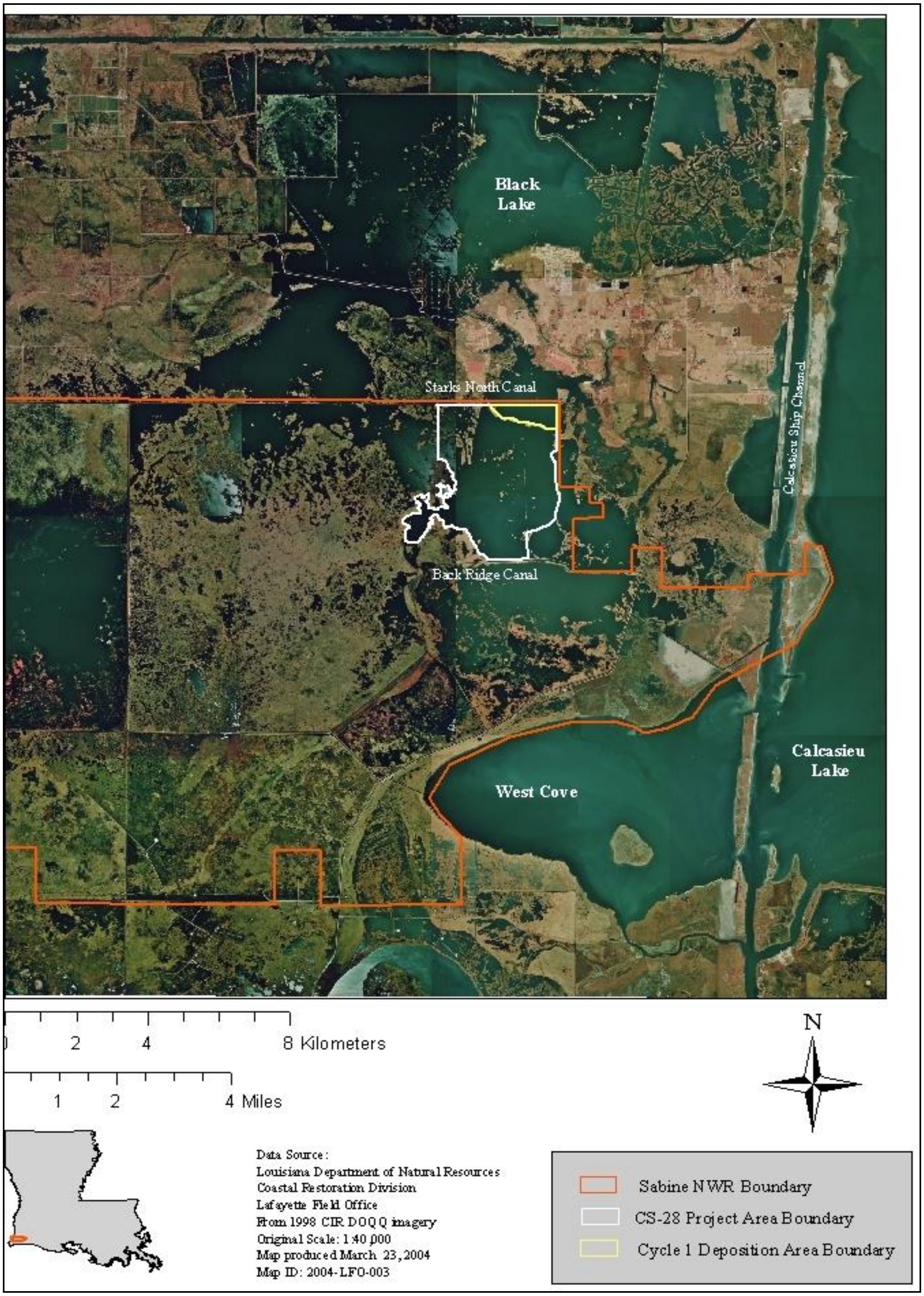

Figure 1. Sabine Refuge Marsh Creation Project (CS-28) project and area boundary.

Most land loss in the area occurred between 1956 and 1978 (United States Department of Agriculture [USDA] 1993) with the highest loss rate around 1965 (Dunbar et. al. 1990). The current land loss rate in the project area is approximately 0.5 square miles per year (United States Army Corps of Engineers [USACE] 2000). One major cause for the land loss is vegetation death caused by hurricanes, oil and gas canals and the subsequent altered hydrology, and saltwater intrusion via large navigation canals acting as conduits for Gulf of Mexico water (USDA 1993). Saltwater from the Calcasieu Ship Channel (CSC) had been introduced from several sources including the GIWW through Alkali Ditch and and probably more importantly through West Cove Canal via Back Ridge Canal (Miller 1997). The combined effects of oil waterlogging and increased salinity may have accellerated marsh loss rates. If the marsh vegetation was stressed by extended inundation periods, or the shift to more salt tolerant vegetation could not keep pace with the death of existing vegetation, then unvegetated mudflat may have resulted. Without vegetation to hold the substrate together or increase accretion, the marsh is more easily deteriorated. When the substrate elevation becomes too low, emergent vegetative growth is prohibited even if favorable salinity conditions return (Turner and Cahoon 1987). Many fishery organisms utilize vegetated intertidal marsh, as indicated by relatively high abundances (Zimmerman and Minello 1984), and the restoration of this habitat would likely lead to greater fishery productivity (Turner 1977). The new higher elevation, and nutrient addition created by the dredge material is expected to allow vegetation to reestablish (Ford et. al. 1998; Turner and Cahoon 1987; Wilsey et. al. 1992).

Dredging on the chip channel takes place every year, but the dredging cycle for the project area will take place every other year beginning in 2005. The initial height of the dredged material (slurry) is to be no more than +4.5 ft Mean Low Gulf (MLG) to settle to a final target elevation of approximately +2.5 ft MLG after initial consolidation. To contain the dredge material initially, perimeter earthen retention dikes will be constructed to a maximum height of + 6.5 ft MLG, with a minimum of 1:3 side slopes, and a 5 ft crown width. Interior earthen dikes will be similar but have a maximum height of + 3.5 to 4.0 ft MLG. The dikes will be allowed to remain until the dredge material has stabilized and been colonized by emergent vegetation. After stabilization, the remaining dikes will be breached to allow fisheries access and sediment distribution into the adjacent marsh (USACE 2000).

The purpose of the project is to create emergent vegetated marsh, and to enhance and protect existing broken marsh. During the 2001 maintenance dredging by the USACE, approximately 1,000,000 cubic yards of sediment were dredged from the CSC and pumped into the Cycle 1 deposition area to create 214 acres of marsh in existing open water within the project area. Cycle 1 was completed in February 2002. During the 2007 maintenance dredging event approximately 829,00 cubic yards of sediment were pumped into the Cycle 3 deposition area to create 232 acres of marsh within the project area. Cycle 3 was completed in March, 2007. Construction of a permanent pipeline to transport dredged material from the Calcasieu Ship Channel to the project area was approved for Cycles 2 and 3. Funds for Cycle 2 included construction of the permanent dredged material pipeline and the pipeline was constructed in April, 2010. Cycle 2 was converted to a state only project and since becoming a state only project with no monitoring budget, biological monitoring will not be conducted in the Cycle 2 deposition area. The Cycle 2 dredge deposition area was filled in July 2011 to create 211 acres.

Cycles 4 and 5 will consist of dredging approximately 1,000,000 yd^3 of material to create 230 acres (93 ha) of emergent marsh per cycle (figure 2). Levee construction for Cycle 4 and Cycle 5 began in September 2014. Dredging for Cycle 4 and Cycle 5 began in February 2015 (figure 3). Aerial photography and vegetation will be monitored in Cycles 4 and 5. Since Cycles 4 and 5 have a separate project budget from the original CS-28 project, Cycles 4 and 5 have their own monitoring plan.

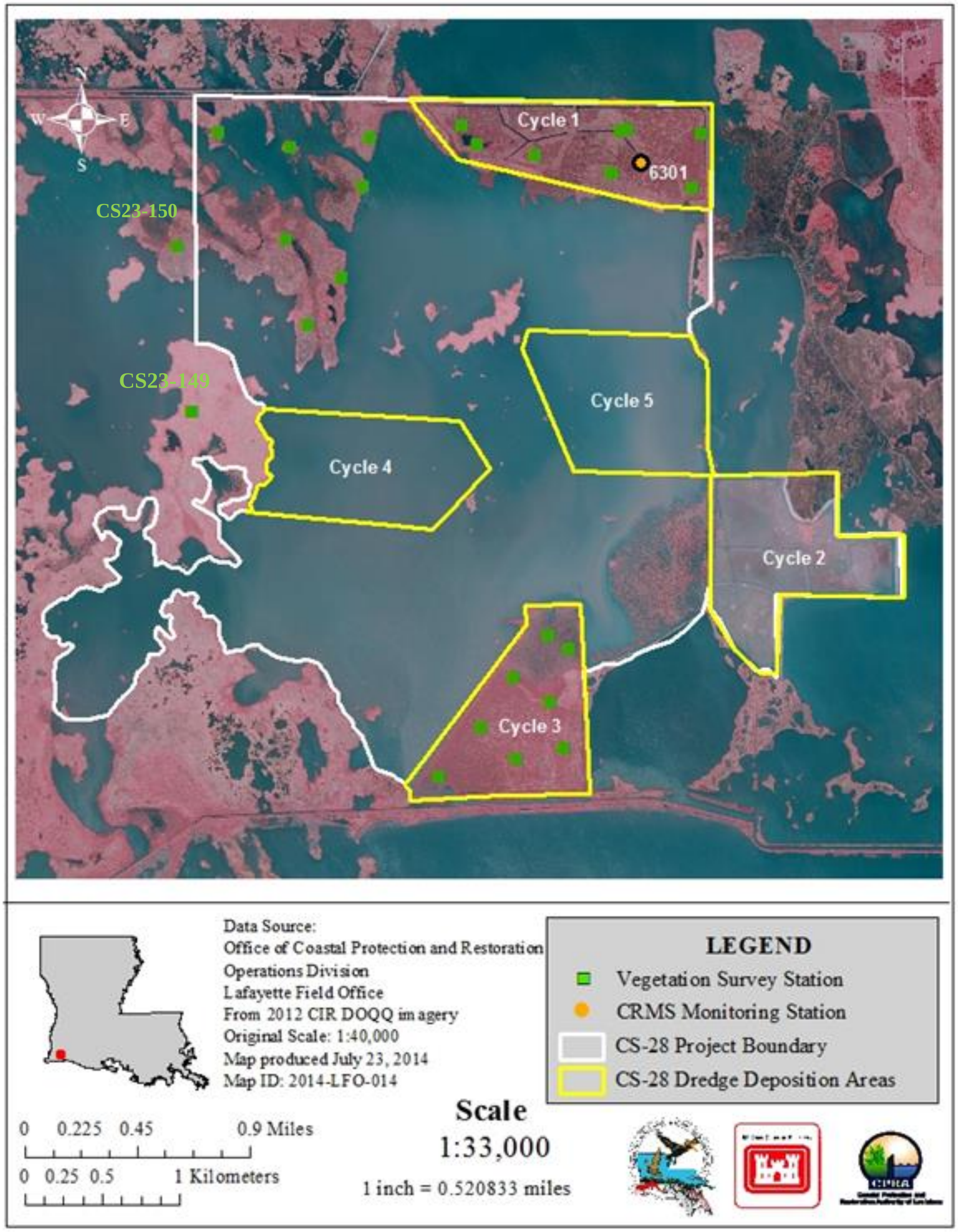

Figure 2. Sabine Refuge Marsh Creation (CS-28) project area boundary, deposition area boundaries, vegetation monitoring stations, and CRMS site.

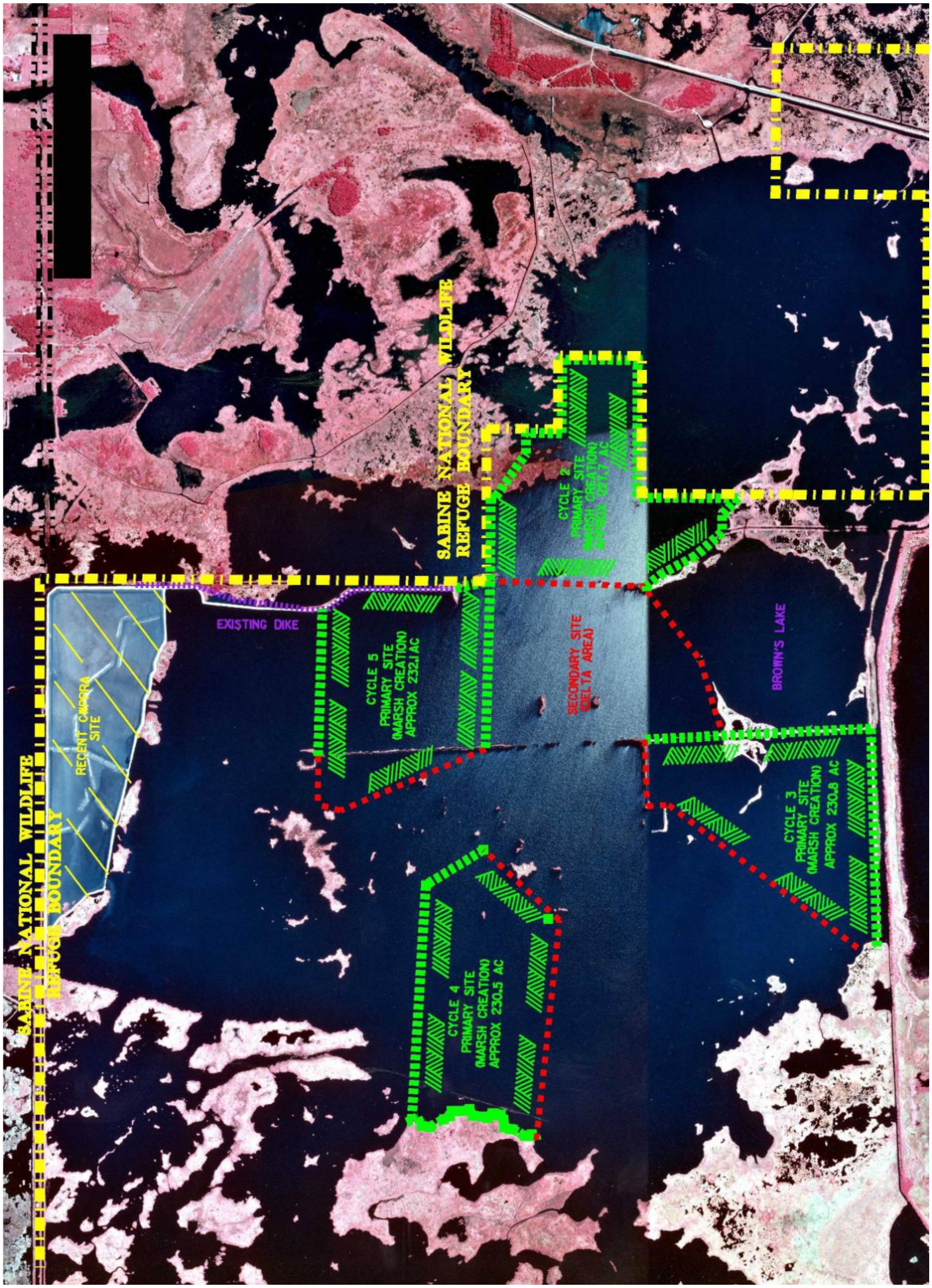

Figure 3. Location of Cycles 1, 2 and 3 dredge placement area and the proposed location of Cycles 4, and 5.

Should the project prove to be effective, the long term coupling of channel dredging and beneficial use of dredged material in the CS-28 project area and surrounding areas will allow for continued marsh creation.

Project Objectives

1. Create new vegetated marsh and enhance and protect existing surrounding marsh vegetation.

Specific Goals

1. Place dredge spoil slurry to a maximum height of 4.5 ft MLG to settle to a height of 2.5 ft MLG, after five years, for each of five dredging cycles
2. Create 214 acres (cycle 1), 227 acres (cycle 2), 232 acres (cycle 3) of emergent vegetated wetland, and approximately 460 total acres (93 ha) of emergent vegetated wetland within cycles four and five.
3. Reduce loss of existing surrounding marshes within the project area

Reference Area

Monitoring appropriate reference areas concurrently with the project allows time controlled evaluation of the project's effectiveness. The main criteria for selecting a reference area are similar soil type, vegetation, hydrology, and proximity to the project area. There are nine vegetation reference stations associated with the CS-28 project area. Seven of the stations were established within CS-28 project area and two of the stations (CS23-149 and CS23-150) are historical vegetation stations used for monitoring the CS-23 project area (Figure 2).

CRMS will provide a pool of reference sites within the same basin and across the coast to evaluate project effects. At a minimum, every project will benefit from basin-level satellite imagery and land:water analysis every 3 years, and supplemental vegetation data collected through the periodic Chabreck and Linscombe surveys. Other CRMS parameters which may serve as reference include Surface Elevation Table (SET) data, accretion (measured with feldspar), hourly water level and salinity, and vegetation sampling. A number of CRMS stations are available for each habitat type within each hydrologic basin to supplement project-specific reference area limitations.

Monitoring Elements

1. **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).

2. **Emergent Vegetation**
To document the condition of the emergent vegetation in the project area over the life of the project, vegetation will be monitored at sampling stations using a modified Braun Blanquet sampling method as outlined in Steyer et al. (1995). Transects will be established uniformly across the created marsh and the associated surrounding existing marsh. The position of the transects will also be such that they coincide with at least some of the elevation transects. Sampling stations will be established uniformly along each transect line to obtain an even distribution of sampling stations throughout the project area. A minimum of eight stations with replicate plots will be established within each dredge placement cycle. Percent cover, dominant plant heights, and species composition will be documented in 2m X 2m sampling plots marked with 2 corner poles to allow for revisiting the sites over time. Descriptive observations of submergent vegetation will be noted during monitoring of emergent vegetation. The location of any plantings that may be installed will be noted to minimize confounding with the created marsh vegetation data. Vegetation will be evaluated the year or year after each cycle is built and every other year thereafter for eight years with a final evaluation before project closeout. 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. Nine reference stations were established in the pre-existing marshes west of Cycle 1. In Cycle 3, eight vegetation stations were established in 2008 and were monitored in 2010, 2012 and 2014 (figure 2). 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 2016, and 2022. Cycle 2 was converted to a state only project and will not be monitored.

3. Elevation Survey

The elevation of the placed dredge material was expected to be documented within the containment sites for each dredging cycle (1, 3, 4 & 5) by an elevation survey. Elevation measurements were supposed to be recorded after one year of consolidation and at an interval of once every other year for each cycle. Thus far elevation data for Cycle 1 includes the contractors report, the as built survey, and elevation change from the Rod Surface Elevation Table (RSET) at the CRMS6301 site. Cycle 3 has the contractors report and a monitoring survey conducted in August 2013. No as-built elevation is available for Cycle 3 and no surveys were conducted after construction in Cycle 2.

Anticipated Analyses

The following describes statistical procedures, and hypothesis tests that will be used to analyze data collected for each monitoring element included in this monitoring plan to evaluate accomplishment of the project goals.

1. Aerial Photography: Descriptive and summary statistics on historical data (for 1956, 1978, and 1988) and data from color-infrared aerial photography collected pre- and post- construction will be used, along with GIS interpretations of these data sets, to evaluate marsh to open water ratios and changes in the rate of marsh loss/gain in the project area. Change in the marsh loss/gain will be determined for the project area with and without the inclusion of the created marsh cells.

   Goal: Increase present (yr 2001) emergent marsh area by 125 acres with the first dredging cycle, reduce the loss rate of existing marsh, and increase emergent marsh area by 230 acres in future dredging cycles

2. Emergent Vegetation: The primary analyses for detecting project impacts on emergent vegetation outside of the marsh creation cells will be an analyses of variance with area (project vs. reference) and time (pre-construction vs. post-construction) as fixed effects. The vegetation within the created marsh cells will be evaluated using descriptive statistics and comparisons among post construction data sets.

   Goal: Increase the cover of emergent vegetation in the actual dredged material placement area and reduce the loss rate of the surrounding marsh within the project area

   Hypothesis[1]:

   H_0: Mean cover of emergent vegetation in the actual dredge containment areas will not be greater after construction than before construction.

H_a: Mean cover of emergent vegetation in the actual dredge containment areas will not be greater after construction than before construction.

Hypothesis[2]*:*

H_0: Loss rate of pre-existing emergent vegetation within the project area will not be less than the loss rate of the emergent vegetation in reference area marshes.

H_a: Loss rate of emergent vegetation in the surrounding marsh within the project area will be less than the loss rate of the emergent vegetation in reference area marshes.

3. Elevation Survey: Descriptive and summary statistics will be used to determine the mean elevation at the times when the target elevations are expected to be attained.

Goal: Place dredge spoil slurry to a maximum height of + 4.5 ft MLG to settle to a height of 2.5 ft MLG after initial consolidation (five years after placement)

Notes

1) Proposed Implementation Schedule

1st cycle	Start Construction End Construction	January 1, 2001 January 20, 2002
2nd cycle	Start Construction End Construction	April, 2010 May, 2010
3rd cycle	Start Construction End Construction	October 25, 2006 May 30, 2007
4th cycle	Start Construction End Construction	September 2014
5th cycle	Start Construction End Construction	September 2014

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5) Sabine NWR manager: Terry Delanie (337) 762-3816

6) The twenty-year monitoring plan development and implementation budget for this project is $160,378. Comprehensive reports on coastal restoration efforts in the Calcasieu-Sabine hydrologic basin will be available in 2005, 2008, 2011, 2014, and 2017. These reports will describe the status and effectiveness of the project as well as cumulative effects of restoration projects in the basin.

7) Available ecological data, including both descriptive and quantitative data, will be evaluated in concert with the statistical analysis to aid in determination of overall project success. This includes ancillary data collected in the monitoring project but not used directly in statistical analysis, as well as data available from other sources (USACE, USFWS, LDNR, LSU, etc.).

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