State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Monitoring Plan

for

Bayou De Cade Ridge Restoration and Marsh Creation (TE-0138)

State Project Number TE-0138
Priority Project List 26

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Terrebonne Parish

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PREFACE

A draft monitoring plan was submitted as part of the 95% design packet for the Bayou De Cade Ridge Restoration and Marsh Creation (TE-0138) project in August of 2018. The draft monitoring plan made assumptions based on when construction was anticipated to be complete. Now that the project has been constructed, the draft monitoring plan has been finalized with updated information. This monitoring plan provides a more realistic time schedule for data collection, analysis, and reporting. The updated monitoring plan works within the framework of the monitoring budget that was approved in January of 2019. This plan is a living document and may be modified in the future as the project changes.

INTRODUCTION

The Coastal Protection and Restoration Authority (CPRA) and the National Oceanic and Atmospheric Administration's National Marine Fisheries Services (NOAA/NMFS) agree to carry out the terms of this Monitoring Plan (hereinafter referred to as the "Plan") of the accepted, completed project features in accordance with the Cost Sharing Agreement. NMFS will be included as part of the Plan as a reviewing federal sponsor.

The project features covered by this plan are inclusive of and are identified as the Bayou De Cade Ridge Restoration and Marsh Creation (TE-0138) project. The intention of the provisions of this plan is to monitor the project using standardized data collection techniques and to analyze those data to determine whether the project is achieving the anticipated benefits. Reports will be generated and recommendations made to adaptively manage the project. There are no requirements that this project function to any standard beyond the twenty (20) year project life, except that it is not left as a hazard to navigation or a detriment to the environment. This monitoring plan, forthcoming Operations, Maintenance and Monitoring (OM&M) reports, and additional documents pertaining to TE-0138 can be accessed through CPRA's Coastal Information Management System (CIMS) website at *http://cims.coastal.louisiana.gov.*

Construction of the Bayou De Cade Ridge Restoration and Marsh Creation (TE-0138) was authorized by Section 303(a) of Title III Public Law 101-646, the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA) enacted on November 29, 1990 as amended. This project was approved on the twenty-sixth (26th) Priority Project List. In January of 2019 the CWPPRA Task Force approved phase II funding for construction, operations and maintenance, and monitoring funds through an electronic vote in lieu of a meeting.

1. PROJECT DESCRIPTION, GOALS, and FEATURES

Description

The Bayou De Cade Ridge Restoration and Marsh Creation (TE-0138) project is located in Terrebonne Parish, Louisiana in the Terrebonne Basin. The Lake Mechant sub-basin resides within this abandoned delta complex in the overlapping portions of the Teche and Lafourche delta complexes, formed approximately 3,000 to 4,000 years before present. The area is currently deprived of freshwater and sediment inputs from the Mississippi River

(Preliminary 30% Design Report, July 2018) and unable to derive benefits of annual freshwater and sediment inputs delivered by the Atchafalaya River to surrounding areas from the Penchant Basin to Lake De Cade (TE-39 EA, NRCS). Estimates of wetland loss rates in the Terrebonne Basin range between 4,500 and 6,500 acres per year and translate to 90,000 to 130,000 acres lost over the next 20 years (CWPPRA Fact Sheet, February 2017).

The Bayou De Cade Ridge Restoration and Marsh Creation (TE-0138) project footprint is bounded by Turtle Bayou to its north and west, Bayou De Cade to its south and Lake De Cade to the east (Figure 1). The project will create or nourish 473 acres of intermediate marsh and restore 11,131 linear feet of ridge habitat. Ridge restoration materials will be mechanically dredged from Bayou De Cade and marsh creation material will be hydraulically dredged from Lake De Cade. The project design provides for marsh creation along the northern bank of Bayou De Cade and adjacent to the western shoreline of Lake De Cade, an area currently made up of 390 acres of open water and 90 acres of broken marsh. The ridge feature will be constructed along the northern bank of Bayou De Cade, which currently exists as a remnant shoreline berm.

Comprehensive monitoring for TE-0138 project is anticipated for the 20-year project life which began with the end of construction, August 2022. The following monitoring goals and objectives and monitoring strategies will provide the information necessary to evaluate specific project goals.

Goals

The goals of the TE-0138 project are to create 390 acres and nourish 90 acres of intermediate marsh adjacent to Lake De Cade and restore 11,133 linear feet of ridge habitat along the northern bank of Bayou De Cade.

The specific project objectives are:

- Create approximately 390 acres of intermediate marsh
- Nourish approximately 90 acres of intermediate marsh
- Restore 11,131 linear feet of ridge along northern bank of Bayou De Cade. The ridge will be 15 acres constructed to a crown elevation of + 5.0 feet NAVD88, 10 feet wide, and will be planted on the crown and slopes.

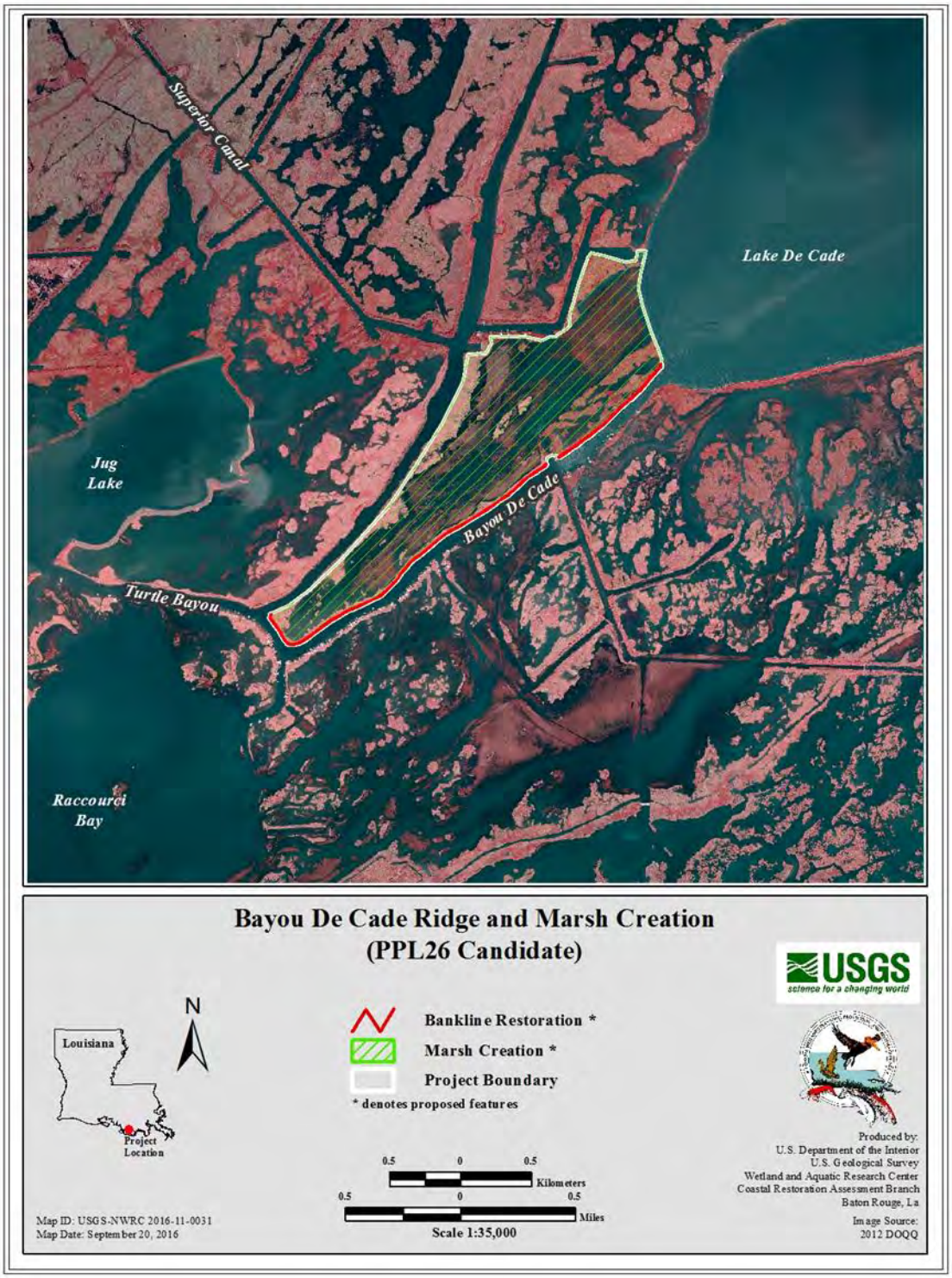

Figure 1. Location and vicinity of the Bayou De Cade Ridge and Marsh Creation (TE-0138) project.

Features

1. The proposed project's primary feature is to restore 11,131 feet of Bayou De Cade northern ridge and create approximately 390 acres and nourish approximately 90 acres of intermediate marsh adjacent to Lake De Cade. The ridge will be 15 acres constructed to a crown elevation of +5.0 feet NAVD88, 10 feet wide, and will be planted on the crown and slopes. The ridge will be constructed by bucket dredging material from Bayou De Cade.
2. Sediment will be hydraulically pumped from a borrow source in Lake De Cade for marsh creation. The borrow area in Lake De Cade is located and designed in a manner to avoid and minimize environmental impacts (e.g., to submerged aquatic vegetation and water quality) to the maximum extent practicable. Containment dikes will be constructed around the marsh creation area to retain sediment during pumping. No later than three years post construction, the containment dikes will be degraded and/or gapped.
3. Construction Year: The goal is to establish low, herbaceous cover before planting hardwood seedlings and/or saplings. Herbaceous cover will add organic material to the soil and help develop favorable environmental conditions for the seedlings. Tall herbaceous cover or woody growth is not desirable as they would compete with newly-planted seedlings. Seashore paspalum and/or other appropriate species will be planted at a rate of 1250 plants/acre. Paspalum plantings and natural recruitment of other species should provide adequate herbaceous cover after one or two years of growth.
4. Year 2: Foliar spray (Arsenal in July-September) of any Chinese tallow seedlings which may have colonized the site.
5. Year 3: Hardwood seedlings will be planted (December-March) on a 10'x10' spacing (435 trees per acre). Species may include live oak, sugarberry, red mulberry, toothache tree, yaupon holly, and other suitable species. Tubex tree protectors will be installed to protect the seedlings from nutria herbivory. Saplings (1000) will also be planted to accelerate canopy cover.
6. Year 5: In case of a complete planting failure, a full replant (seedlings and/or saplings) and Chinese tallow control are included in the budget.
   Years 4, 6, 8, 10, 12, and 14: Chinese tallow tree control until canopy closure occurs.

<u>Construction Notes:</u>

1. Containment dike gapping occurred at the end of construction. Evaluations will be made during the O&M inspections to determine if more gapping is necessary.
2. Concrete articulated mats were installed along the Lake De Cade
3. Ridge plantings occurred in January 2023 instead of during year 3 post-construction.
   a. On January 3, 2023 a Marsh Master was used to cut the Phragmites (Roseau cane) and spray a pre-emergent herbicide.
   b. On January 4 and 5, 2023, 1,119 woody plants were installed along with stakes and protectors. Plantings included:
      i. 373 Wax Myrtle (Morella cerifera)

ii. 373 Yaupon (Ilex vomitoria)
iii. 373 French Mulberry (Callicarpa Americana)

c. Plantings only occurred on the crown of the ridge; there were no plantings on the slopes.
d. There were not herbaceous plants installed on the ridge due to the natural colonization of Phragmites along the entire ridge.

2. Items Requiring Monitoring

Monitoring data collection efforts are centered on the acquisition of aerial imagery which will be used to conduct the land-water analysis. As of this version of the monitoring plan, aerial imagery is planned for every three years with the next acquisition being in 2024. The 2024 imagery will not be used for analysis because a project-specific aerial imagery was acquired in June 2023 which represents the as-built condition. Monitoring will utilize the aerial imagery that will be acquired in 2027, 2033, and 2039. The 2039 represents year 16 of the project. Extending to 2042, which represents year 19 of the project, would not give sufficient time to compose the close-out by the end of the 20 year project life in 2043.

1. To assess the marsh community in the created and nourished area, vegetation data collection will be conducted at several randomly chosen long-term stations. Vegetation stations will be established along transects that will be surveyed for elevation. Data collection will occur in years 4, 10, and 16 of the 20-year project life. Methodology for vegetation data collection will follow the Braun-Blanquet (Muller and Ellenberg, 1974) protocol as outlined in Folse et al. 2020. Species composition, cover data, and stem heights will be documented. CRMS-*Wetlands* data collections utilizing the Braun-Blanquet methodology as outlined in Folse et al. 2020 will occur annually at nearby CRMS stations which will provide valuable reference data.
2. To assess the establishment of woody vegetation along the ridge, data collection will occur after the plantings have had time to grow. Data collection will occur in years 10 and 16 to provide insight as to how this plantings have established, grown, and formed a ridge.
3. Topographic/bathymetric elevation surveys of the marsh creation and nourishment areas and ridge creation area will occur in years 1, 4, 10, and 16 in order to assess performance of the project over its 20-year life. Assessment of each area will determine if the project maintained overall target elevations conducive to sustaining viable healthy marsh.
4. In order to evaluate the number of acres created and nourished, land-water maps will be produced based upon aerial photography captured by CRMS-*Wetlands* coastwide flights for four separate flights, at years 1, 3, 10, and 16 over the 20-year project life.

5. In order to determine the frequency, depth and duration of flooding, as well as salinity in the vicinity of the creation areas, hourly constant recorder data from nearby CRMS-*Wetlands* (CRMS 0398) sites will be utilized.
6. Sediment data will be used to monitor changes in soil properties along the ridge over the course of the project life. Approximately 9 soil cores will be collected along the ridge following CRMS methodology (Folse et al. 2020) to assess percent organic matter, pH, salinity, bulk density, moisture, and wet/dry volume. Soil cores will be collected for these analyses in years 4, 10 and 16 of the project.

3. Monitoring Budget

The costs associated with project-specific monitoring variables outlined in Section 2 of this plan for the twenty (20) year project life is $977,447. Funding for monitoring was approved by the CWPPRA task force when the project was approved for phase II funding in January 2019. Appendix A illustrates the changes from 95% design non-inflated budget submittal to the 95% design inflated budget which was approved, and the July 2023 budget as anticipated moving forward.

4. Responsibilities

A. CPRA will:

1. Coordinate and oversee all scientific data collection.

2. Ensure that all data goes through quality control procedures and is entered into the public database.

3. Analyze the data and report on the status of the project following data collection events. Provide adaptive management recommendations as necessary in accordance with project performance.

4. Review the monitoring plan and budget annually with NMFS to determine that the data is being collected adequately evaluates the project and that funding is adequate to fulfill monitoring requirements.

B. NMFS will:

1. Review the monitoring plan and budget annually with the CPRA to determine that the data being collected adequately evaluates the project and that funding is adequate to fulfill monitoring requirements.

2. Review and provide feedback of data results and reports for adaptive management decisions associated with the project.

References

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Mueller-Dombois, D. and H. Ellenberg. 1974. Aims and Methods of Vegetation Ecology. J. Wiley and Sons, New York, NY. 547 pp.

Appendix A:

Monitoring Cost Breakdown

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
		2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
95% Design Submital - Not Inflated	Land-water Analysis	$ 10,000		$ 10,000							$ 10,000								$ 10,000		
	Vegetative Transects (MC-2 day + RR-1 day)	$ 22,800		$ 22,800		$ 22,800					$ 22,800				$ 22,800				$ 22,800		
	OM&M Report				$ 36,000		$ 36,000					$ 36,000				$ 36,000				$ 36,000	
	Elevation Surveys (MC $50k and RR shoreline $10k)	$ 60,000				$ 60,000					$ 60,000								$ 60,000		
	Monitoring Management	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500
	Yearly Total	*$ 100,300*	*$ 7,500*	*$ 40,300*	*$ 43,500*	*$ 90,300*	*$ 43,500*	*$ 7,500*	*$ 7,500*	*$ 7,500*	*$ 100,300*	*$ 43,500*	*$ 7,500*	*$ 7,500*	*$ 30,300*	*$ 43,500*	*$ 7,500*	*$ 7,500*	*$ 100,300*	*$ 43,500*	*$ 7,500*
	Running Total	*$ 100,300*	*$ 107,800*	*$ 148,100*	*$ 191,600*	*$ 281,900*	*$ 325,400*	*$ 332,900*	*$ 340,400*	*$ 347,900*	*$ 448,200*	*$ 491,700*	*$ 499,200*	*$ 506,700*	*$ 537,000*	*$ 580,500*	*$ 588,000*	*$ 595,500*	*$ 695,800*	*$ 739,300*	*$ 746,800*

95% Design Submital - Inflated	Land-water Analysis	$ 10,987	$ -	$ 11,431	$ -	$ -	$ -	$ -	$ -	$ -	$ 13,130	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 15,384	$ -	$ -
	Vegetative Transects (MC-2 day + RR-1 day)	$ 25,050	$ -	$ 26,062	$ -	$ 27,115	$ -	$ -	$ -	$ -	$ 29,937	$ -	$ -	$ -	$ 32,405	$ -	$ -	$ -	$ 35,076	$ -	$ -
	OM&M Report	$ -	$ -	$ -	$ 41,973	$ -	$ 43,669	$ -	$ -	$ -	$ -	$ 48,214	$ -	$ -	$ -	$ 52,188	$ -	$ -	$ -	$ 56,490	$ -
	Elevation Surveys (MC $50k and RR shoreline $10k)	$ 65,921	$ -	$ -	$ -	$ 71,354	$ -	$ -	$ -	$ -	$ 78,781	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 92,305	$ -	$ -
	Monitoring Management	$ 8,240	$ 8,405	$ 8,573	$ 8,744	$ 8,919	$ 9,098	$ 9,280	$ 9,465	$ 9,655	$ 9,848	$ 10,045	$ 10,245	$ 10,450	$ 10,659	$ 10,873	$ 11,090	$ 11,312	$ 11,538	$ 11,769	$ 11,769
	Yearly Total	*$ 110,197*	*$ 8,405*	*$ 46,065*	*$ 50,718*	*$ 107,388*	*$ 52,767*	*$ 9,280*	*$ 9,465*	*$ 9,655*	*$ 131,696*	*$ 58,259*	*$ 10,245*	*$ 10,450*	*$ 43,064*	*$ 63,061*	*$ 11,090*	*$ 11,312*	*$ 154,303*	*$ 68,259*	*$ 11,769*
	Running Total	*$ 110,197*	*$ 118,602*	*$ 164,667*	*$ 215,385*	*$ 322,773*	*$ 375,540*	*$ 384,820*	*$ 394,285*	*$ 403,940*	*$ 535,635*	*$ 593,894*	*$ 604,139*	*$ 614,590*	*$ 657,654*	*$ 720,715*	*$ 731,805*	*$ 743,117*	*$ 897,419*	*$ 965,678*	*$ 977,447*

		Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
July 2023 using 95% Design Submital Inflated Values; $997,447 as the approved amount for monitoring	Land-water Analysis[1]		$ 10,987			$ 11,431						$ 13,130						$ 15,384				
	Vegetative Transects (MC-2 day)					$ 28,515						$ 34,130						$ 41,907				
	Vegetative Transects (RR-2 day)											$ 34,130						$ 41,907				
	OM&M Report						$ 41,973						$ 43,669						$ 56,490			
	Elevation Surveys (MC $50k and RR shoreline $10k)		As-built	$ 65,921		$ 71,354						$ 78,781						$ 92,305				
	Monitoring Management			$ 8,240	$ 8,405	$ 8,573	$ 8,744	$ 8,919	$ 9,098	$ 9,280	$ 9,465	$ 9,655	$ 9,848	$ 10,045	$ 10,245	$ 10,450	$ 10,659	$ 10,873	$ 11,090	$ 11,312	$ 11,538	$ 11,769	$ 11,769
	Soil Analysis					$ 7,377						$ 8,829						$ 10,841				
	Yearly Total	*$ -*	*$ 10,987*	*$ 74,161*	*$ 8,405*	*$ 8,573*	*$ 127,421*	*$ 50,892*	*$ 9,098*	*$ 9,280*	*$ 9,465*	*$ 9,655*	*$ 178,847*	*$ 53,714*	*$ 10,245*	*$ 10,450*	*$ 10,659*	*$ 10,873*	*$ 213,434*	*$ 67,802*	*$ 11,538*	*$ 11,769*	*$ 11,769*
	Running Total	*$ -*	*$ 10,987*	*$ 85,148*	*$ 93,553*	*$ 102,126*	*$ 229,546*	*$ 280,439*	*$ 289,536*	*$ 298,816*	*$ 308,281*	*$ 317,936*	*$ 496,783*	*$ 550,497*	*$ 560,742*	*$ 571,193*	*$ 581,852*	*$ 592,725*	*$ 806,159*	*$ 873,961*	*$ 885,499*	*$ 897,268*	*$ 909,037*