State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Monitoring Plan

for

Grand Liard Marsh and Ridge Restoration (BA-0068)

State Project Number BA-0068
Priority Project List 18

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Monitoring Plan for Grand Liard Marsh and Ridge Restoration (BA-0068)

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The Coastal Protection and Restoration Authority of Louisiana (CPRA) and the National Marine Fisheries Service (NMFS) agree to carry out the terms of this monitoring plan for the Grand Liard Marsh and Ridge Restoration project (BA-0068). As outlined in this plan, monitoring data will be collected using standardized data collection techniques and will be analyzed to determine whether the project is achieving the anticipated benefits. Operations, Maintenance, and Monitoring (OM&M) reports will be written to document the condition of the project features, present and interpret monitoring data, and if needed, make recommendations for adaptive management of the project. This monitoring plan, forthcoming OM&M reports, and additional documents pertaining to BA-0068, can be accessed through CPRA's Coastal Information Management System (CIMS) website at *http://cims.coastal.louisiana.gov.*

Construction of the Grand Liard Marsh and Ridge Restoration project 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 18th Priority Project List.

1. PROJECT DESCRIPTION, GOALS, and FEATURES

Description

The Grand Liard Marsh and Ridge Restoration project (BA-0068) is located within lower Plaquemines Parish, Louisiana, immediately adjacent to Bayou Grand Liard (Figure 1). Extensive wetland loss in this area has resulted from a variety of factors including subsidence, salt-water intrusion, a lack of sediment supply, and oil and gas activities (NMFS 2012). Over recent decades, a series of north-south oriented bayous (i.e., Bayou Long, Dry Cypress Bayou) and their associated ridges have deteriorated, resulting in large expanses of open water. The Bayou Grand Liard ridge, which separates the open bays of the Bastian Bay and Grand Liard mapping units, is the most prominent remaining ridge. The Coast 2050 land loss rate from 1983 to 1990 in the Grand Liard mapping unit was -1.7% per year and future land loss in the project area is estimated to be -1.43% per year (NMFS 2011). Projections suggest that the remaining land will be completely converted to open water by 2050.

The Grand Liard Marsh and Ridge Restoration project was designed to re-establish ridge and marsh function in the vicinity of Bayou Grand Liard through dedicated dredging, ridge restoration, and vegetative plantings (NMFS 2012, Langlois 2011). Natural ridges are created by repeated overbank flooding along bayous or former river distributaries, and are considered one of the multiple lines of defense in reducing storm impacts (Lopez 2006). In addition to deflecting storm surge, ridges support woody vegetation which provides valuable habitat for a diversity of wildlife such as neotropical migrant birds. At the time of project design, the remnant ridge along Bayou Grand Liard was mainly at marsh elevation and was expected to be lost to open water in 20 years due to erosion (NMFS 2012).
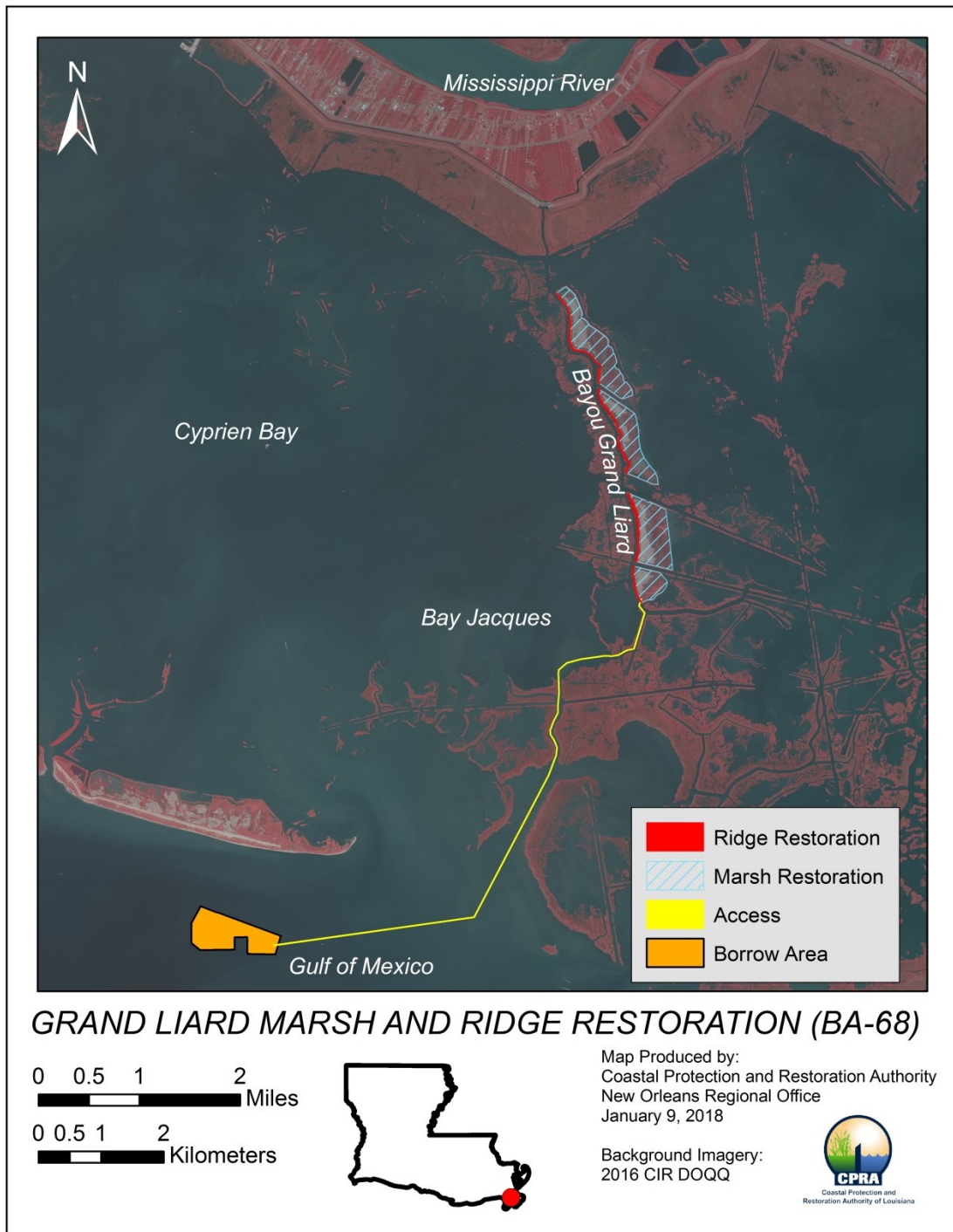
Figure 1. Grand Liard Marsh and Ridge Restoration Project (BA-68) project area and features.

To restore ridge and marsh function in the area, approximately 429 acres of marsh was created and/or nourished using hydraulically dredged sediment from an offshore borrow site, and approximately 28 acres of ridge habitat was created along Bayou Grand Liard using in situ material. The total acreage of the constructed project, including containment dikes, is 492 acres.

Goals

The goals of the project are to restore the eastern ridge of Bayou Grand Liard and to re-establish marsh habitat in the open water areas to the east of Bayou Grand Liard using offshore sediment (NMFS 2012). Native vegetation will be planted after construction to help stabilize the rebuilt marsh and ridge habitat.

Objectives

- Create and nourish approximately 400 acres of saline marshes and associated edge habitat for aquatic species through pipeline sediment delivery;
- Restore the Grand Liard ridge to reduce wave and tidal setup by constructing approximately 16,600 linear ft (over 20 acres) of maritime ridge habitat.

Features

Construction of the BA-0068 project began in July 2014 and was completed in September 2015 (AECOM Technology Services 2016). A total of 28,855 linear ft of earthen containment dikes were constructed around four marsh creation cells using sediment dredged from within the project area. The dikes were constructed to the design template of +4.5 ft crest height, 5 ft crown width and side slopes of 5H:1V. All target fill elevations were relative to NAVD88, ft (Geoid 03).

A total of 15,484 linear ft of earthen ridge was constructed along Bayou Grand Liard using sediment dredged from both Bayou Grand Liard and the marsh creation areas. The ridge was constructed to a crest height of +4.5 ft NAVD88, a crown width of 20 ft and side slopes of 7H:1V. The earthen ridge was designed for an average 20-year target elevation of +3.0 ft NAVD88. Design surveys determined that the crown elevation of the existing remnant ridge ranged from +1.0 to +3.9 ft NAVD88. The 20-year target elevation of +3.0 ft NAVD88 was selected to allow for the ridge to still be above marsh elevation and still function as a ridge at year 20.

Following completion of the earthen ridge and containment dikes, the four marsh creation areas were filled with approximately 2,834,000 y^3 of sediment dredged from the Gulf of Mexico. The target fill elevation was +2.8 to +3.5 ft NAVD88, with average constructed elevations for the four marsh creation cells of 3.3, 2.9, 3.4, and 3.4 ft NAVD88. The marsh fill elevation is expected to settle to intertidal range within three to four years post-construction and remain intertidal for the duration of the 20-year project life. The total acreage of the marsh fill cells based on the as-built topographic survey was 429 acres.

Vegetation will be planted on the ridge once soil salinities and elevations stabilize. Planting plans will depend on final site conditions and species availability. Species to be planted on the ridge are expected to include woody seedlings and saplings, such as *Morella cerifera*

(wax myrtle), *Celtis* sp. (hackberry), *Morus rubra* (red mulberry), *Ilex vomitoria* (yaupon), *Quercus virginiana* (live oak), *Diospyros virginiana* (persimmon) and *Callicarpa* sp. (beautyberry). Additionally, the ridge will be assessed for the presence of the invasive tree *Triadica sebifera* (Chinese tallow). If necessary, *T. sebifera* will be eradicated through the use of chemical spray and manual removal. Planting of the marsh platform with *Spartina alterniflora* (smooth cordgrass) and *Paspalum spp.* (crowngrass) was expected to occur in spring 2018; however, this planting was not necessary as the marsh platform had self-vegetated naturally by that time.

2.   ITEMS REQUIRING MONITORING

The following specific monitoring goals will be used to evaluate the success of the project:

1) Achieve a year-10 average elevation of approximately +1.4 ft NAVD88 within the marsh fill area, and a year-10 average elevation of approximately +3.0 ft NAVD88 on the ridge. Most settlement is expected to occur by year 10; therefore, year-10 elevation targets are nearly identical to year-20 targets.

2) Reduce the "future without project" projected land loss rate of -1.43% per year within the project area.

3) Increase the percent cover and diversity of herbaceous and woody vegetation species in the project area.

The following monitoring elements will provide data to evaluate the success of BA-0068, as based on the project's goals and objectives. Data collected from BA-0068 project-specific stations and Coast-wide Reference Monitoring System-*Wetlands* (CRMS-*Wetlands*) stations surrounding the project area will be used to compare characteristics between the created marsh and local, natural marsh. Operations, Maintenance, and Monitoring (OM&M) reports will be written in 2020, 2026 and 2034. Modifications to the monitoring timeline and procedures are subject to CPRA and NMFS approval.

A.   Vegetation

Marsh

Vegetation data will be used to assess the colonization and transition of vegetation on the marsh platform, to compare the vegetation in the created marsh to local, natural marsh, and to gauge the quality and stability of the vegetative community. Surveys of vegetation will follow CRMS methodology (Folse et al. 2018) and include an assessment of total cover, species present, percent cover of each species, average height of each vegetation layer, and the depth of water on the marsh surface. The salinity, specific conductivity, and temperature of the soil porewater at 10 cm and 30 cm depth are also collected in coordination with the vegetation surveys at each marsh plot. Vegetation surveys on the marsh platform shall occur in years 2019 (Year 4), 2022 (Year 7), 2025 (Year 10), 2029 (Year 14), and 2033 (Year 18).

Monitoring Plan for Grand Liard Marsh and Ridge Restoration (BA-0068)

Ridge

Herbaceous vegetation surveys will be conducted along the earthen ridge following the protocol described in the above "Marsh" section. In addition, monitoring stations (6 m x 6 m) will be established on the ridge to document the development of the understory and overstory communities. These surveys will follow general CRMS methodology (Folse et al. 2018), with adaptations to account for the dimensions of the ridge and the plantings. Ten seedling survivorship transects will be established along the crown of the ridge to assess the survivorship and growth of the planted species throughout the life of the project. Ridge surveys are planned for 2019 (Year 4), 2020 (Year 5), 2022 (Year 7), 2025 (Year 10), 2029 (Year 14), and 2033 (Year 18); however, this schedule may be modified according to the timing of plant installation.

B.   **Sediment Properties**

Sediment data will be used to monitor changes in sediment properties along the ridge over time. Individual soil cores will be collected at 8 monitoring stations on the ridge following CRMS methodology (Folse et al. 2018). Soil properties analyzed include percent organic matter, soil pH, salinity (EC), bulk density, moisture, and wet/dry volume. Soil analyses are scheduled for 2018 (Year 3), 2025 (Year 10), and 2033 (Year 18).

Prior to the ridge planting, additional ridge sediment samples are being collected and analyzed every six months to determine if soil conditions are amenable for planting. These analyses are supported with NMFS funds, follow different protocols, and are supplemental to the monitoring included in this plan.

C.   **Land/Water Analyses**

Analysis of aerial photography will be used to evaluate land to water ratios within the marsh and ridge creation areas over the life of the project. Land to water ratios in the project area will be determined using CRMS aerial photography (Z/I Imaging digital mapping camera) with 1-meter resolution. Aerial photography of the project area was collected in fall 2016 (Year 1) and is tentatively scheduled for 2025 (Year 10) and 2034 (Year 19), dependent on the scheduling of CRMS coast-wide flights which occur approximately every 3 years.

D.   **Topographic Surveys**

Data from topographic surveys will be compared over time to determine if the dredged material is settling at the predicted rate and if the marsh platform and ridge are maintaining elevations that promote healthy marsh and ridge habitat. Post-construction real-time kinematic (RTK) topographic surveys are planned for 2016 (Year 1), 2018 (Year 3), 2025 (Year 10), and 2033 (Year 18). For consistency, these surveys will be conducted along a subset of the as-built survey transects. Seven settlement plates installed along the ridge during construction will also be surveyed.

3.   MONITORING BUDGET

The cost associated with monitoring BA-0068 for its twenty-year project life, as outlined in Section 2, is summarized in Appendix 1.

4.   RESPONSIBILITIES

A.   CPRA will:

1.   Coordinate and oversee all scientific data collection.

2.   Ensure that all data go through quality control procedures and that land-water analysis, sediment and vegetation data are entered into the public database.

3.   Summarize and analyze project data and publish OM&M reports according to the schedule included in this monitoring plan. If the data indicate that the project is not meeting its goals and objectives, adaptive management recommendations will be made to improve the response.

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

B.   NMFS will:

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

2.   Review OM&M reports.

Monitoring Plan for Grand Liard Marsh and Ridge Restoration (BA-0068)

5. REFERENCES

AECOM Technology Services 2016. Grand Liard Marsh and Ridge Restoration (BA-68) Project Completion Report – Final. December 23, 2016, 25 pp.

Folse, T.M., L.A. Sharp, J.L. West, M.K. Hymel, J.P. Troutman, T.E. McGinnis, D. Weifenbach, W.M. Boshart, L.B. Rodrigue, D.C. Richardi, W.B. Wood, and C.M. Miller 2018 (revised from 2008). A Standard Operating Procedures Manual for the Coastwide Reference Monitoring System-*Wetlands*: Methods for Site Establishment, Data Collection, and Quality Assurance/Quality Control. Louisiana Coastal Protection and Restoration Authority. Baton Rouge, LA. 226 pp.

Langlois, S. M. 2011. Ecological Review—Grand Liard Marsh and Ridge Restoration. Coastal Protection and Restoration Authority of Louisiana. Baton Rouge, Louisiana. 27 pp.

Lopez, J. 2006. The Multiple Lines of Defense Strategy to Sustain Coastal Louisiana. Lake Pontchartrain Basin Foundation. Metairie, Louisiana. http://www.saveourlake.org

National Marine Fisheries Service (NMFS) 2011. Grand Liard Marsh and Ridge Restoration (BA-68) Project Information Sheet for Wetland Value Assessment--Final (95%) Design Review Update, September 7, 2011 (DRAFT). 15 pp, plus appendices.

National Marine Fisheries Service (NMFS) 2012. Grand Liard Marsh and Ridge Restoration Project Environmental Assessment, Fed No. BA-68. June 2012. 40 pp, plus appendices.

APPENDIX I

Monitoring Budget for Grand Liard Marsh and Ridge Restoration
(BA-0068)

Project Name			**Grand Liard Marsh and Ridge Restoration**		
Infl. Rate	2.60%		**Monitoring Budget**	$507,476	
Price Level	2015				

	Rates	Expended Dollars	Year 0 2015	Year 1 2016	Year 2 2017	Year 3 2018	Year 4 2019	Year 5 2020	Year 6 2021	Year 7 2022	Year 8 2023	Year 9 2024	Year 10 2025	Year 11 2026	Year 12 2027	Year 13 2028	Year 14 2029	Year 15 2030	Year 16 2031	Year 17 2032	Year 18 2033	Year 19 2034	Year 20 2035
Bathymetry/Topography[1]	45,000.00	As-built	1			1							1								1		
Aerial Photography[2]				16,645.00									$6,878.21									$8,978.00	
Vegetation Survey[3]	16,590.00						1.0	0.7		1.0			1				1.00				1.00		
Soil Analysis[4]	4,000.00					1							1								1.00		
Monitoring Administration[5]	7,104.00		1.0	2.0	0.5	2.0	1.0	1.0	0.5	1.0	0.5	0.5	2.0	0.5	0.5	0.5	1.0	0.5	0.5	0.5	2.0	0.5	0.5
OM&M Report	20,000.00							1						1								1	

	Rates	Expended Dollars	Year 0 2015	Year 1 2016	Year 2 2017	Year 3 2018	Year 4 2019	Year 5 2020	Year 6 2021	Year 7 2022	Year 8 2023	Year 9 2024	Year 10 2025	Year 11 2026	Year 12 2027	Year 13 2028	Year 14 2029	Year 15 2030	Year 16 2031	Year 17 2032	Year 18 2033	Year 19 2034	Year 20 2035
Bathymetry/Topography			As-built 44,949.23			40,723.02							58,168.27								71,427.43		
Aerial Photography				16,645.00									$6,878.21									$8,978.00	
Vegetation Survey							18,383.82	13,203.26		19,855.37			21,444.70				23,763.45				26,332.91		
Soil Analysis						4,320.18							5,170.51								6,349.10		
Monitoring Administration			7,104.00	14,577.41	3,739.11	15,345.29	7,872.13	8,076.81	4,143.40	8,502.26	4,361.66	4,475.06	18,365.66	4,710.79	4,833.27	4,958.94	10,175.74	5,220.15	5,355.88	5,495.13	22,552.02	5,784.59	5,934.99
OM&M Report								22,738.76						26,524.73								32,570.91	
Total			7,104	76,172	3,739	60,388	26,256	44,019	4,143	28,358	4,362	4,475	110,027	31,236	4,833	4,959	33,939	5,220	5,356	5,495	126,661	47,333	5,935
Projected - Running Total			7,104	83,276	87,015	147,403	173,659	217,678	221,821	250,179	254,541	259,016	369,043	400,279	405,112	410,071	444,010	449,230	454,586	460,081	586,743	634,076	640,011
Projected Remaining Budget[6]		$ 507,476	424,200	420,461	360,073	333,817	289,798	285,655	257,297	252,935	248,460	138,433	107,197	102,364	97,405	63,466	58,246	52,890	47,395	(79,267)	(126,600)	(132,535)	
Actual Expenditures				61,066	13,130	65,196																	
Actuals - Running Total		-	-	61,066	74,196	139,392																	
Actual Remaining Budget		$ 507,476		446,410	433,280	368,084																	

[1] As-built survey funded through construction

[2] Aerial photography acquired through CRMS and analyzed using BA-68 funds; year 10 and 18 reflect revised analysis estimate (8/15/19) from USGS

[3] Marsh vegetation survey will include 11-2 m x 2 m survey plots and ridge vegetation survey will include 13 survival transects, 13-2 m x 2 m herbaceous plots, and 8-6 m x 6 m understory/overstory plots, following typical CRMS surveying methodology. Year 5 survey will be of ridge only.

[4] Soil Analysis Rate based on Bayou Dupont for 8 CRMS-like soil cores on the ridge

[5] Monitoring administration covers CPRA hours spent on data collection, QA/QC and analysis of data, site visits, meetings, writing scopes, working with contractors, and general monitoring oversight that falls outside of the time associated with report writing. $7104 is based on cost for 40 hours of work for a Coastal Resources Scientist.

[6] The original fully funded budget only included monitoring items through Year 10; therefore, a budget shortfall is predicted by Year 18. A request will need to be made for additional funds at some point during the project life in order to complete monitoring items in Years 18, 19, and 20.

Monitoring Plan for Grand Liard Marsh and Ridge Restoration (BA-0068)