State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Monitoring Plan

for

Oyster Bayou Marsh Restoration (CS-0059)

State Project Number CS-0059
Priority Project List #21

August 2019
Cameron Parish

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MONITORING PLAN
FOR THE OYSTER BAYOU MARSH RESTORATION PROJECT CS-0059

The Coastal Protection and Restoration Authority (CPRA) and the National Oceanic and Atmospheric Administration / National Marine Fisheries Service (NMFS) agree to carry out the terms of this Operation, Maintenance, Monitoring and Rehabilitation Plan (hereinafter referred to as the "Plan") of the accepted, completed project features.

The project features covered by this plan are inclusive of and are identified as the Oyster Bayou Marsh Restoration Project (CS-0059). This plan outlines the provisions to monitor the project using standardized data collection techniques and to analyze that data to determine whether the project is achieving the anticipated benefits.

Construction of CS-0059 was authorized by Section 303(a) of Title III Public Law 101-646, the Coastal Wetlands Planning and Restoration Act (CWPPRA) enacted on November 29, 1990 as amended. This project was approved on the 21 Priority Project List.

The construction components associated with this project are located in Cameron Parish just north of Highway 82 and on state water bottoms of the Gulf of Mexico approximately six miles south of the project area.

PROJECT DESCRIPTION, PURPOSE, LOCATION, AND GOALS

Description:
The Oyster Bayou Marsh Restoration Project area is 1105 acres in the Calcasieu Sabine Basin. There was approximately 849 acres of created and nourished marsh with 9,000 linear feet of terraces within the project boundary. The location of the project is west of the Calcasieu Ship Channel, south of the west fork of the Calcasieu River, and less than two tenths of a mile north of the Gulf of Mexico in Cameron Parish (Figure 1).

The CS-59 project area is directly north of the recently completed Cameron Parish Shoreline Nourishment Project (CS-33sf) which strengthened the Gulf of Mexico shoreline immediately south of Highway 82 from the Calcasieu Ship Channel jetties to just east of Holly Beach. The CS-0059 project can synergistically interact with this beach nourishment project to protect the Highway 82 transportation corridor as well as environmentally sensitive interior marsh habitat contiguous to the project area. Extended periods of inundation from high saline water via Calcasieu Lake and wind induced scour from Hurricanes Rita and Ike are the main causes of vegetation loss within the project area. Other factors contributing to habitat degradation in the area are local subsidence, increased tidal exchange, and altered hydrology. These factors have accelerated natural erosive forces causing a rapid conversion from marsh to open water in the project area.

Purpose:
Approximately 133,343 acres (28%) of the Calcasieu Sabine hydrologic basin wetlands were lost to open water from 1932 to 2010 with an average loss rate of -1710 ac/yr (-1.3%/yr) due to subsidence, saltwater intrusion from the Calcasieu Ship Channel, and hurricane damage (Couvillion et al. 2011). Land loss in the project area has been continuous throughout this time frame but was punctuated by high loss rates during the hurricanes of 2005 and 2008. The Calcasieu-Sabine Basin lost 28 square miles (17,920 acres) (4.4%) as a result of Hurricane Rita (Barras et al. 2006). While land was lost in the project area during this event, continued interaction with the Gulf of Mexico via the Calcasieu Ship Channel has also played a large role in land loss. Many of the bayous that connect Calcasieu Lake to the surrounding wetlands have water control structures to prevent the high salinity lake water from damaging interior wetlands. However, Oyster Bayou, which directly impacts the project area via Oyster Lake, is minimally restricted (CPRA Master Plan 2012).

The purpose of the project is to create sustainable emergent marsh through the use of dredged sediments from an offshore brought site in the Gulf of Mexico. The project will restore saline marsh habitat in areas converted to open water primarily by hurricane damage, saltwater intrusion, and tidal scouring. The project will also create 9,000 linear feet of earthen terraces to reduce fetch and slow tidal forces. The project will aid in the prevention of further interior land loss by reinforcing the gulf shoreline, possibly avoiding a breaching event and reducing excessive tidal exchange from the Calcasieu Ship Channel through Oyster Lake and Oyster Bayou into the project and surrounding areas. The benefits provided by the project include the re-creation and nourishment of degraded wetlands that provide important wetland habitat for marine organisms and the enhancement of storm protection for inland areas. The Oyster Bayou Marsh Restoration (CS-0059) project will work in conjunction with other projects in the area to reduce saltwater intrusion, tidal exchange, and erosion within the Calcasieu Sabine Basin; specifically the newly constructed beach nourishment project directly south of the project area.

The created areas will be planted with saline marsh vegetation as needed to accelerate the development and maintenance of vegetative cover and diversity throughout the project life. In order to meet the project goals of a marsh elevation that is comparable to the marsh elevation of nearby healthy marsh, 1.5ft NAVD88 (Geoid 12A) has been identified as the target marsh elevation.

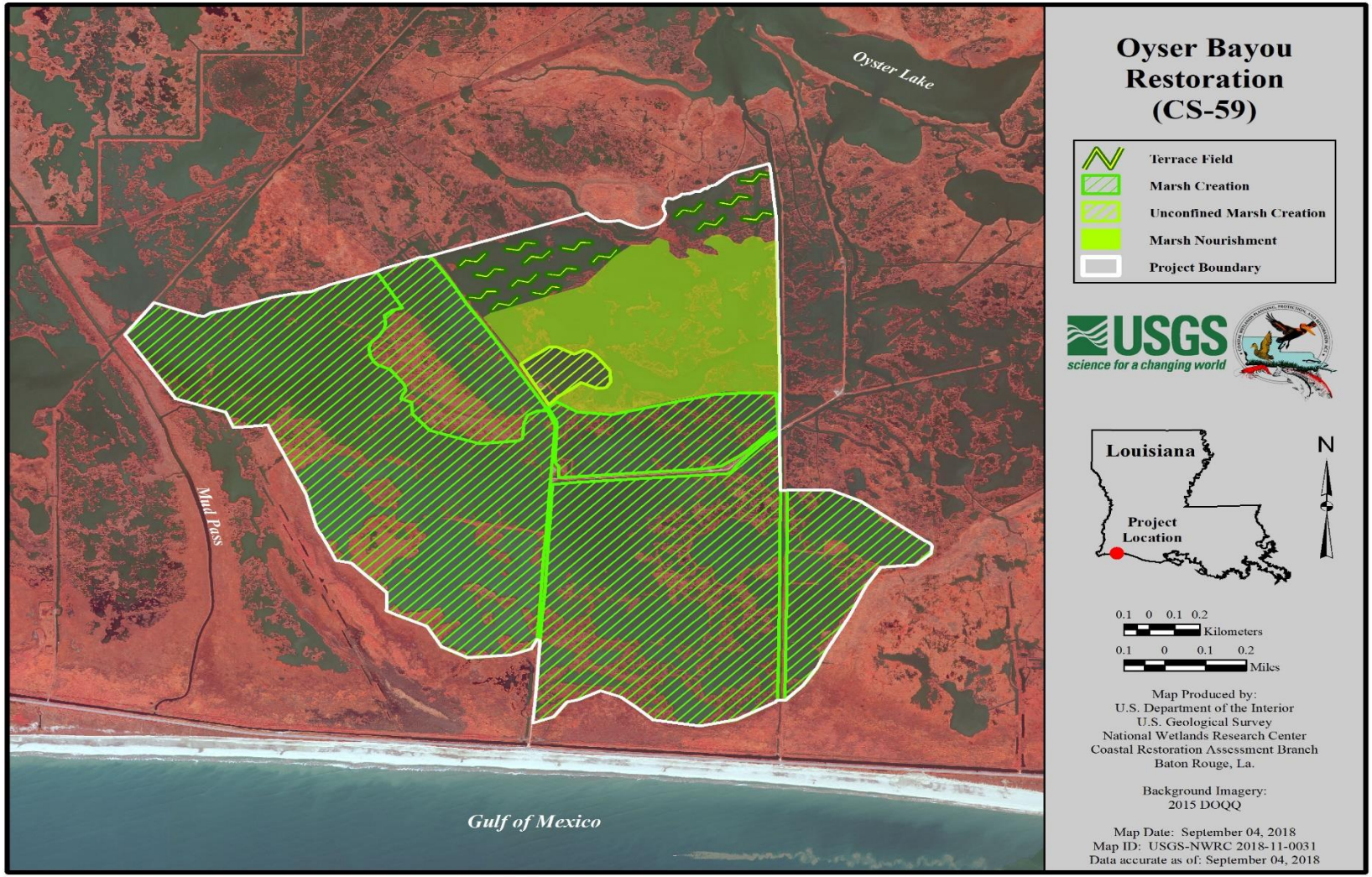

Figure 1. Oyster Bayou Marsh Restoration (CS-0059) project area and features.

Goals:
The specific project goals are:

1. Construct an emergent marsh that is 80% vegetated and contains 849 acres of created marsh and nourished marsh maintaining near 80% of that land area over the life of the project.

2. Construct a marsh that settles to the height predicted by the established settlement curves within the project area and maintains an elevation of 1.5 ft NAVD88 at the end of the project life.

3. Create 9,000 linear feet of terraces to slow tidal exchange and reduce wave and wake erosion within the project area.

4. Construct a marsh that is flooded between 20% and 60% of the year and maintains water levels between 2" above and 6" below the marsh surface after settlement.

Features:
Approximately 6.7 million cubic yards of dredging material is available from a borrow site located approximately six miles offshore in the Gulf of Mexico (Figure 2). Approximately 4.3 million cubic yards of the dredge material was placed into six marsh creation cells north of Highway 82 and the Gulf of Mexico shoreline and south of Oyster Lake, to restore and nourish 849 acres of saline marsh. An additional 96 acres of unconfined marsh were nourished. Approximately 9,000 linear feet of earthen terraces were also constructed between the marsh creation cell and oyster lake to reduce tidal exchange and scour (Figure 3). The borrow site was designed to avoid and minimize impacts to offshore infrastructure and sensitive aquatic habitats. The sediment was transported into the project area from the borrow site under Highway 82 via a permanently installed culvert. The permanent culvert will offer access under the Highway for future projects as a permanent pipeline right of way allowing further restoration of this critical transportation corridor. Tidal creeks and ponds will mimic the preexisting topography of the area as much as possible by using a combination of interior dikes to create pond habitat and the existing water bottom variation allowing trenasses to form during dredge settlement. Retention levees were gapped and/or degraded upon demobilization to support estuarine fisheries access and to achieve a functional marsh. The project would result in approximately 598 net acres of saline marsh over the 20-year project life.

ITEMS REQUIRING MONITORING

The Coastwide Reference Monitoring System (CRMS) - Wetlands is a network of 392 monitoring sites distributed throughout the coastal zone of Louisiana. Hydrographic, vertical accretion, elevation change, vegetation, soils, and aerial photography data are collected at each CRMS site. Although no CRMS monitoring stations are located in the CS-59 project area, there are several

CRMS stations located nearby along with project specific data from the East Mud Lake Hydrologic Restoration Project (CS-20) which can be used as a references to determine project effectiveness.

The following monitoring strategies will provide the information necessary to evaluate the specific goals of restoring/creating and nourishing approximately 849 acres of emergent marsh while establishing 9,000 feet of earthen terraces.

A. **Water Level** - Water level (ft) readings will be recorded hourly at a project specific location and multiple CRMS sites within the vicinity of the project area. Additionally when available, data from the project specific monitoring of the East Mud Lake Marsh Management (CS-20) project will be used to aid in determining if project goals are met. Water level readings will be used to determine the frequency, depth, and duration of flooding in the project area relative to the marsh elevation determined by the fill area surveys. These will be used to assess the goal of maintaining water between 2" above and 6" below marsh and percent time flooded between 20% and 60% of the year.

B. **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 20 sampling stations using a modified Braun Blanquet sampling method as outlined in (Folse et al. 2012). Stations will be established uniformly across the created marsh and the location of the stations will be such that they coincide with at least some of the elevation transects or settlement plates. Twenty stations will be established within the dredged areas. Percent cover, dominant plant heights, and species composition will be documented in 2m x 2m sampling plots marked with two corner poles to allow for revisiting the sites over time. Vegetation data from the relevant CRMS sites within the area will be used as reference stations along with project specific data from CS-20 to compare species composition over time. Vegetation will be monitored post construction in Y1, Y2, Y3, Y5, Y10 and Y14, and Y17.

C. **Aerial Photography** - In order to evaluate land/water ratios in the fill areas, land/water data will be obtained from digital imagery with 1-meter resolution. The photography will be georectified using standard operating procedures described in Steyer et al. (1995, revised 2000), and land/water ratios will be determined. Aerial photography will be captured using the nearest CRMS coastwide flights to Y0 (preconstruction) and postconstruction when coastwide imagery becomes available near Y5, Y14, and at a later date if deemed necessary.

D. **Dissolved Oxygen / Hypoxia Monitoring** - To identify potentially hypoxic conditions within the dredge borrow area, synoptic surveys will record dissolved oxygen (DO), depth, salinity and temperature in the Gulf of Mexico borrow area monthly from May through October (Figure 2). Measurements will be taken in the deepest portion of the borrow area, approximately 2 ft. off of the bottom, and in a reference location approximately 0.25 to 0.50 miles outside of the borrow area. The location of the

reference area will be based on results of the geophysical investigation (CB&I; BAMM 2013). Site visits will be conducted once per month for data collection. During each synoptic event vertical profiles will be taken for depth, temperature, salinity and dissolved oxygen (DO) at each site. Vertical profile data will be collected at three foot intervals. Dissolved oxygen monitoring will be conducted at Y1 and Y2 and Y3 if deemed necessary due to sedimentation fill within the borrow area.

E. **Soil Properties -** Project specific soil cores will be collected at 6 sites, one within each contained site and 2 in the surrounding uncontained deposition sites upon establishment at years Y1, Y2, Y3, Y5, Y10, Y14, and at a later date if deemed necessary. Analysis of soil properties will include but not necessarily be limited to soil pH, salinity (EC), bulk density, moisture, percent organic matter, wet/dry volume, and texture (Particle Size Distribution) analysis.

F. Supplemental data from CRMS sites will also be available and can be used to assess trends and changes in the project area. Those data include hourly salinity, annual vegetation, rates of elevation change, vertical accretion, and shallow subsidence as well as soil composition and aerial photography analysis. Supplemental data will be used in OM&M Reports as needed.

MONITORING BUDGET

The cost associated with the Monitoring of the features outlined above in this plan for the 20 year project life is $305,995 as agreed upon by CPRA and NMFS.

RESPONSIBILITIES – MONITORING

A: CPRA will:

1. Conduct joint site inspections with NMFS after major storm events if determined to be necessary by CPRA and/or NMFS. CPRA will submit to NMFS, a report detailing the condition of the project features.

2. Provide a total contribution equal to the amount outlined in the Memoranda of Agreement for the 20 year life of the project.

3. Coordinate and oversee all monitoring data collection.

4. Ensure that all data goes through quality control procedures.

5. Analyze the data and report on the status of the project.

6. The federal and state representatives appointed above shall meet as necessary to review the reports and discuss the project status.

B. NMFS will:

1. Conduct joint site inspections with CPRA after major storm events if determined to be necessary by CPRA or NMFS.

2. Provide a total contribution equal to the amount outlined in the Memoranda of Agreement for the 20 year life of the project.

3. Review reports submitted by CPRA and provide comments.

NOTES

A.	Implementation	Start Construction: End Construction:	September 2015 January 2019
B.	Monitoring	Initiated:	May 2018
C.	NOAA Project Manager	Donna Rogers	225-636-2095
D.	CPRA Project Manager	Katie Freer	225-342-4635
E.	CPRA Project Engineer	Kodi Guillory	225-342-5175
F.	CPRA Monitoring Manager	Bernard Wood	337-482-0655
G.	CPRA Operations Manager	Stan Aucoin	337-482-0681
H.	Landowners	Westlands Corp Ardion Limited	337-433-0156 337-478-8382

REFERENCES

Barras, J.A., 2006, Land area change in coastal Louisiana after the 2005 hurricanes—A series of three maps: U.S. Geological Survey Open-File Report 2006–1274. (Also available at http://pubs.usgs.gov/of/2006/1274/.)

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Thompson, W. and Borne, B., 2014. *Oyster Bayou Marsh Restoration Project (CS-59) – 30% Design Report.* Baton Rouge, Louisiana Coastal: CB&I Coastal Planning & Engineering, Inc. 45P

Appendix I
Figures
and
Project Monitoring Budget

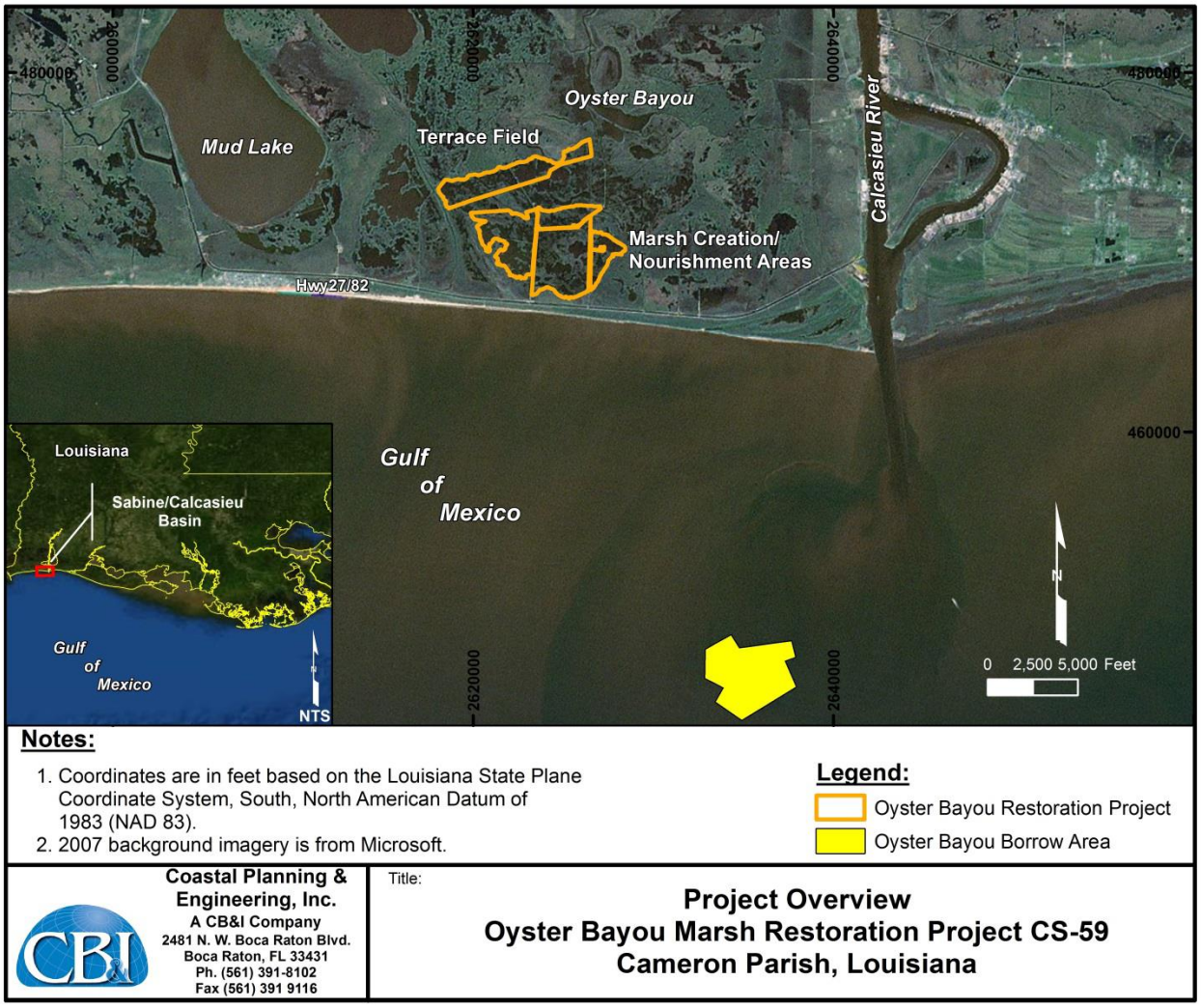

Figure 2. Oyster Bayou Marsh Restoration Project (CS-0059) project borrow area location (from Thompson and Borne 2014).

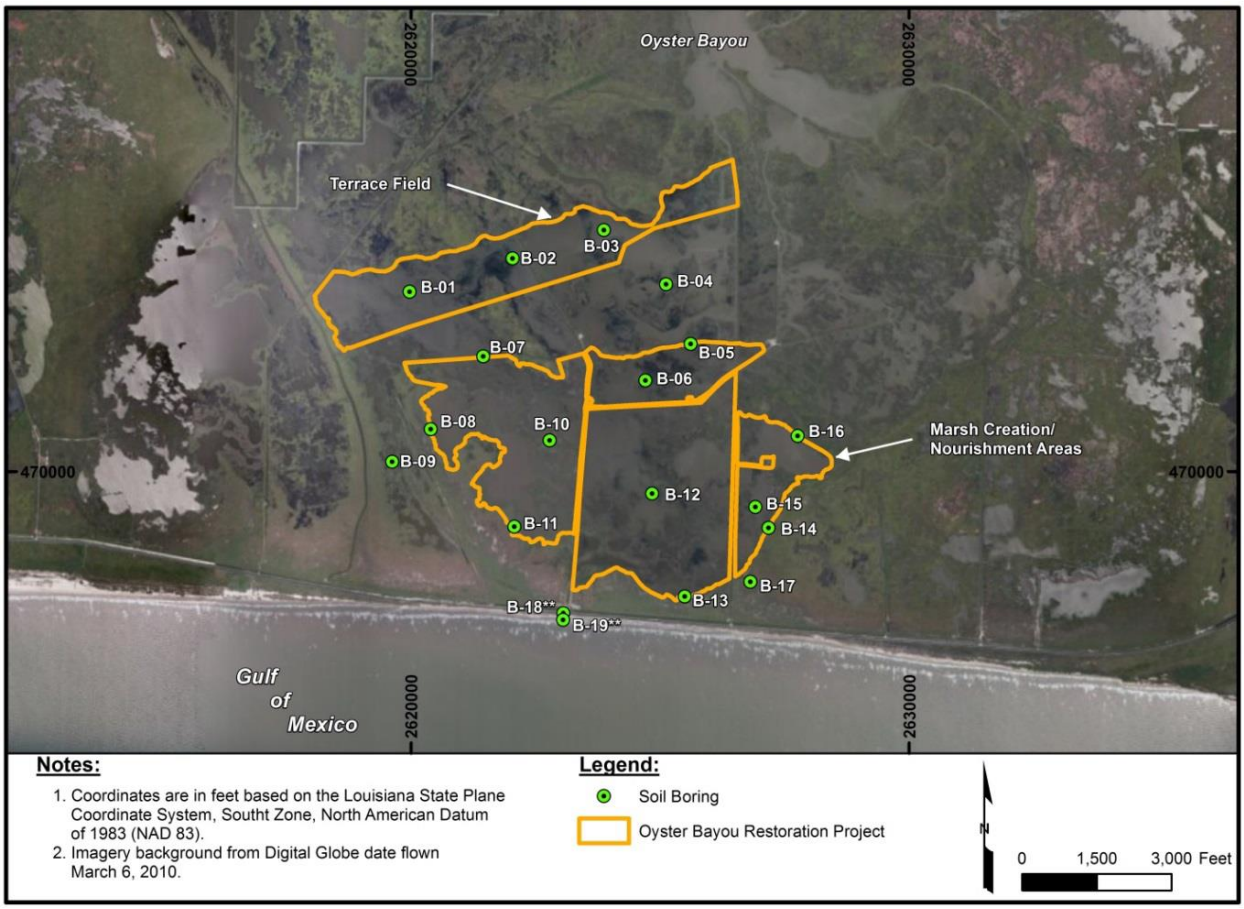

Figure 3. The Oyster Bayou Marsh Restoration Projects (CS-0059) four separate dredge placement locations along with the northern terrace field (from Thompson and Borne 2014).

Oyster Bayou Marsh Restoration

Operation & Maintenance and Monitoring

Project Priority List 21 (ver.070711)

O&M Cost Considerations:

Annual Costs

	Federal	State	TOTAL
Annual Inspections	$3,100	$3,100	**$6,200**
Annual Cost for Operations	$0	$0	**$0**
Preventive Maintenance	$0	$0	**$0**

Specific Intermittent Costs

Construction Items	Quantity	Unit Cost		Year 0	Year 1	Year 2	Year 3	Year 5	Year 10	Year 14	Year 17
Contractor Mobilization/Demobilization											
Gapping Containment Dikes (CY)											
				$0	$0		$0				
	Subtotal			$0	$0	$0	$0		$0		$0
	Subtotal w/ 25% contingency			***$0***	***$0***	***$0***	***$0***		***$0***		***$0***
State Costs											
Engineering Monitoring	0	$0		$0	$0	$0	$0	$0	$0	$0	$0
Aerial Photography	1	$35,000		$15,269	$0	$0	$0	$21,297	$0	$29,929	$0
Data Sonde (stage and salinity)	2	$15,000		$0	$30,000	$30,000	$30,000	$0	$0	$0	$0
Vegetative Analysis	1	$6,500		$0	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500	$6,500
Soil Organic Matter	1	$2,000		$0	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000	$2,000
DO Monitoring (offshore)	1	$5,000		$0	$5,000	$5,000	$5,000	$0	$0	$0	$0
Data analysis/report	1	$15,000		$0	$0	$0	$15,000	$15,000	$15,000	$15,000	$15,000
				$15,269	**$43,500**	**$43,500**	**$58,500**	**$44,797**	**$23,500**	**$53,429**	**$23,500**
Engineering and Design Cost											
Administrative Cost				$4,629	$4,629	$2,400	$6,800		$4,989		$4,389
Eng Survey											
2 days @	$3,606	per day									
Inspection											
4 days @	$1,635	per day									
		Subtotal		***$4,629***	***$4,629***	***$2,400***	***$6,800***		***$4,989***		***$4,389***
Federal Costs											
Administrative Cost				$4,629	$4,629	$2,400	$6,800		$4,989		$4,389
		Subtotal		***$4,629***	***$4,629***	***$2,400***	***$6,800***		***$4,989***		***$4,389***
			Total	**$24,527**	**$52,758**	**$48,300**	**$72,100**	**$44,797**	**$33,478**	**$53,429**	**$32,278**

Annual Project Costs:

Corps Administration	**$1,225**	**annually,**	**plus**	**$1,020**	**in year 20**
Monitoring *	**$0**		*(Dependent upon type of project)*		

** Monitoring is now done through CRMS and is a line item in overall planning budget and not included in individual projects.*

Construction Schedule:

Planning & Design Start	**April-12**	
Planning & Design End	**December-14**	*(Minimum of one year to complete this phase)*
Const. Start	**August-15**	*(Requires 4 months for contracting and advertising)*
Const. End	**July-16**	

	Check Sums						
State	$7,729		$5,500	$9,900		$8,089		$7,489
Federal	$7,729		$5,500	$9,900		$8,089		$7,489
	$15,458		$11,000	$19,800		$16,178		$14,978