State of Louisiana

Coastal Protection and Restoration Authority of Louisiana

Monitoring Plan

for

Mississippi River Sediment Delivery System – Bayou Dupont (BA-39)

State Project Number BA-39
Priority Project List 12

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Monitoring Plan for Mississippi River Sediment Delivery System−Bayou Dupont (BA-39)
Priority Project List 12

The Coastal Protection and Restoration Authority of Louisiana (CPRA) and the United States Environmental Protection Agency (EPA) agree to carry out the terms of this monitoring plan for the Mississippi River Sediment Delivery System−Bayou Dupont (BA-39) project, in accordance with the Memorandum of Agreement, effective April 21, 2017. 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 present and interpret the data and recommendations will be made when appropriate to adaptively manage the project. In addition to this monitoring plan and OM&M reports, the ecological review, environmental assessment, and design and construction reports can be accessed through CPRA's Coastal Information Management System (CIMS) website at *http://cims.coastal.louisiana.gov.*

Construction of the Mississippi River Sediment Delivery System−Bayou Dupont (BA-39) 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.

1. PROJECT DESCRIPTION, PURPOSE, GOALS, and FEATURES

Description

The Mississippi River Sediment Delivery System−Bayou Dupont (BA-39) project used sediment hydraulically dredged from the Mississippi River to build a marsh platform in an area that lies within a rapidly eroding and subsiding section of the Barataria Landbridge. Now converted to mostly open water, the degraded condition of marsh in this region is due to a combination of factors that include subsidence, lack of riverine sediment input, (Baumann et al. 1984), the alteration of hydrology resulting from the dredging of oil and gas canals (Sasser et al. 1986) and sea-level rise (Penland and Ramsey 1990). Monitoring of this project is particularly important because it is the first CWPPRA project that has used sediment dredged from the Mississippi River for the purpose of creating marsh.

The BA-39 project area is located on the west bank of the Mississippi River in Jefferson and Plaquemines Parishes, approximately 3.7 miles northwest of the town of Myrtle Grove, LA (Figure 1). The project area is bordered on the east by the Plaquemines Parish flood protection levee and open water, to the north by Cheniere Traverse Bayou, and to the west and south by pipeline canals. The BA-39 project area is nested within the Naomi Outfall Management (BA-03c) project area. Information on this CWPPRA project that is sponsored by the National Resource Conservation Service (NRCS) can be accessed through CPRA's CIMS website.

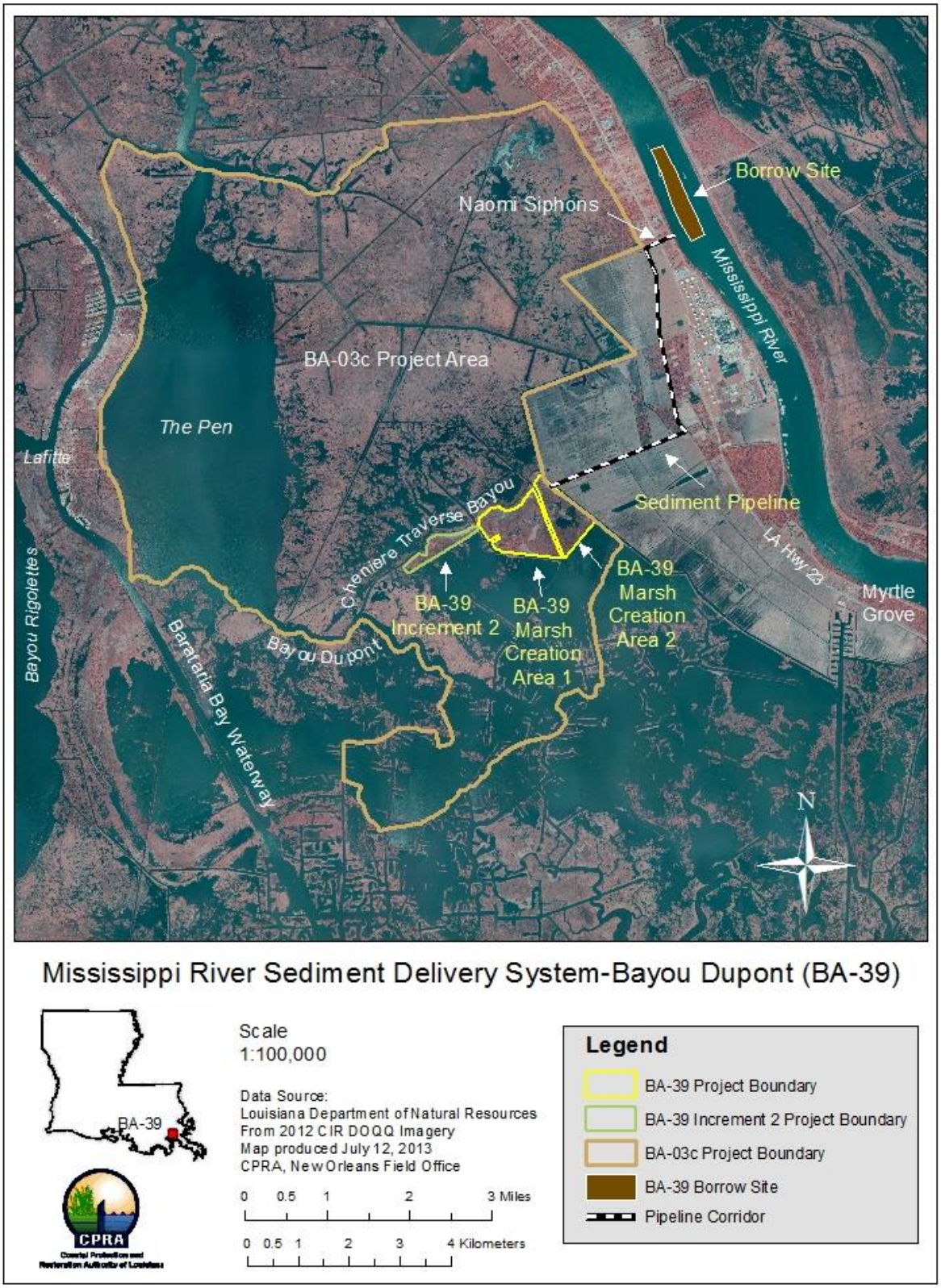

Figure 1. Mississippi River Sediment Delivery System–Bayou Dupont (BA-39) and BA-39 Increment 2 project areas and features.

Construction for BA-39 began in April 2009, with sediment delivery into the project area starting a few months later on November 11, 2009. The final day of sediment delivery was March 15, 2010, and project construction was officially completed on May 10, 2010. Sediment was pumped to approximately +2.0′ ± 0.3′ NAVD88 (Geoid 99) into both of the marsh creation cells (ABMB Engineers, Inc. 2011). This as-built elevation should provide a marsh platform that supports healthy emergent marsh through most of the project's 20-year life, with a projected settlement at year 10 to +1.3′ NAVD88 and at year 20 to +1.2′ NAVD88 (Thompson 2007). Based on observations of nearby healthy natural marsh, an elevation of +1.3′ NAVD88 was determined to be ideal to provide the flooding conditions best-suited for sustaining healthy marsh vegetation in the project area. Colonization and stabilization of the marsh platform by native vegetation was enhanced by plantings of approximately 21,000 *Spartina alterniflora* (smooth cordgrass) plugs and 5,000 *Paspalum vaginatum* (seashore paspalum) plugs between May 4, 2010, and June 3, 2010 (Faust 2010).

During construction, the sediment fill area of BA-39 was expanded to the west through the addition of Increment 2 (Figure 1). Increment 2 was sponsored by the National Oceanographic and Atmospheric Administration (NOAA) and was funded by the American Recovery and Reinvestment Act (ARRA) through a grant administered by NOAA.

Purpose

The purpose of the BA-39 project is to recreate a marsh platform that will support sustainable brackish emergent marsh in an area that was primarily open water and remnant marsh. The anticipated benefits provided by the project include the creation of important wetland habitat, the enhancement of storm protection for inland areas, and a reduction of the marine/tidal influence on inland freshwater marsh (U.S. EPA 2007). Additionally, this project will serve to demonstrate the feasibility of using sediment dredged from the Mississippi River to create sustainable marsh.

Goals

The goals of the BA-39 project are to restore/create approximately 372 acres and nourish approximately 99 acres of emergent marsh in an area that is currently mostly open water (U.S. EPA, LDNR 2007).

The introduction and placement of sediments through the use of dedicated dredging is consistent with Louisiana's Comprehensive Master Plan for a Sustainable Coast (CPRA 2012), specifically, the Barataria Marsh Creation Component.

Features

The project features covered by this monitoring plan are inclusive of and are identified as the Mississippi River Sediment Delivery System−Bayou Dupont (BA-39).

The as-built principal project features include the following, as reported in the project completion report (ABMB Engineers, Inc. 2011):

- Approximately 484 acres of marsh fill (Marsh Creation Area 1 and Marsh Creation Area 2)
- Approximately 25,935 linear feet of containment dikes
- One 95-linear foot, 48-inch diameter casing that was left in place as a crossing under the New Orleans & Gulf Coast Railroad for future use
- One 194-linear foot, 48-inch diameter casing that was left in place under Highway 23 for future use
- Increment 2: approximately 84 acres of marsh fill
- Increment 2: approximately 6241 linear feet of containment dikes

Total acres of marsh fill: 568 acres
Total linear feet of containment dikes: 32,176 linear feet

2. ITEMS REQUIRING MONITORING

Monitoring includes three BA-39 project-specific monitoring sites (BA39-01, BA39-02, and BA39-03) where data are collected to measure project success as based on project goals (Figure 2). Data collected from these sites are compared to data from BA-03c project-specific stations and from Coast-wide Reference Monitoring System-*Wetlands* (CRMS-*Wetlands*) sites surrounding the project area to compare characteristics between the created marsh and local, natural marsh. Monitoring in Increment 2 ended in 2011 and was limited to elevation surveys and vegetation monitoring as outlined below.

A. Land-Water Analysis

Aerial land-water photography is used in conjunction with topographic surveys of the project area to evaluate the project's success of creating a sustainable marsh platform. Land to water ratios in the project area are determined using CRMS aerial photography (Z/I Imaging digital mapping camera) with 1-meter resolution. The photography is georectified using standard operating procedures described in Steyer et al. (2000). The initial aerial photography was collected in November 2012 and the final photography is tentatively scheduled for fall 2021, dependent on the scheduling of CRMS coastwide flights.

B. Elevation (Topographic Surveys)

Data from topographic surveys are compared over time to measure if the dredged material is settling at the predicted rate and if the marsh platform is retaining an elevation that promotes healthy emergent marsh. Post-construction topographic surveys (NAVD88, Geoid99) were conducted in the BA-39 and Increment 2 project areas using Real Time Kinematic (RTK) surveying procedures in 2010 (as-built) and 2011. The 2010 as-built survey was included in the construction budget. Surveys are conducted along transects spaced at intervals of 500 feet with elevation recorded approximately every 50 feet along the transects. The 2014 BA-39 survey was conducted using aerial LiDAR (FLI-MAP 400 system), with supplemental RTK data collection along transects that were known to be inundated. The laser point density of the LiDAR system is 54 points per square meter at 200 m altitude and 20 m/s speed. A final RTK elevation survey is scheduled for 2020.

C. Vegetation

Vegetation data are used to assess how the marsh platform is being colonized by emergent marsh vegetation and to compare the vegetation in the created marsh to local, natural emergent marsh. Surveys of marsh vegetation are conducted at each of the three BA-39 monitoring sites following CRMS methodology (Folse et al. 2014). The sites contain ten replicate 2 m x 2 m stations located along a 288 m transect within a 200 m x 200 m square. Examples of vegetation data collected at each of these stations include total percent cover, species present, percent cover of each species, height of each vegetation layer, and the average height of the dominant species. Vegetation sampling was conducted in 2010, 2011, and 2014 and is scheduled again for 2017 and 2021. Vegetation was also surveyed at six 2 m x 2 m stations in Increment 2 in 2010 and 2011 using funds provided through the ARRA grant.

D. Soil Properties

Soil data are used to monitor changes in soil properties over time and to compare soil properties in the created marsh to those in local, natural marsh. Soil cores were collected and analyzed from each of the three BA-39 monitoring sites in 2010 and 2015 and will be collected a final time in 2021 following CRMS methodology (Folse et al. 2014). Each soil core is taken from the surface down to 24 cm, with three replicate cores collected at each site. The cores are sliced every 4 cm into a total of six sections and soil properties are analyzed for each 4 cm increment (i.e. 0–4 cm deep, 4–8 cm deep…). Soil properties analyzed include percent organic matter, soil pH, salinity (EC), bulk density, moisture, and wet/dry volume.

E. Surface Elevation Change

A rod surface elevation table (RSET) is installed at each of the three BA-39 monitoring sites to measure precise changes in marsh surface elevation over time

relative to a fixed datum, NAVD88 (Cahoon et al. 2002a, 2002b) (Figure 2). Nine pins are extended through the horizontal table to the soil surface. The height that each pin extends above the table is measured during each sampling period to determine the elevation change at the station over time. RSET data have been collected and analyzed bi-annually in the spring and fall since station establishment in September 2010 and will continue to be collected through 2020 following CRMS methodology (Folse et al. 2014).

F. Accretion

Vertical accretion data are collected in conjunction with surface elevation change data at each of the three BA-39 monitoring sites by measuring the accretion of sediment above a white feldspar marker horizon over time. Accretion is determined by extracting cryogenic soil cores from the marsh and measuring the depth from the soil surface to the feldspar layer (Cahoon et al. 1996). New sampling plots continue to be added every two years during the life of a station, due to the eventual degradation of the feldspar marker. The measurement of accretion in conjunction with surface elevation change allows for a differentiation between surface elevation change due to shallow subsidence and surface elevation change due to sediment accretion. Accretion data have been collected biannually in the spring and fall since 2011, and will continue to be measured through 2020 following CRMS methodology (Folse et al. 2014).

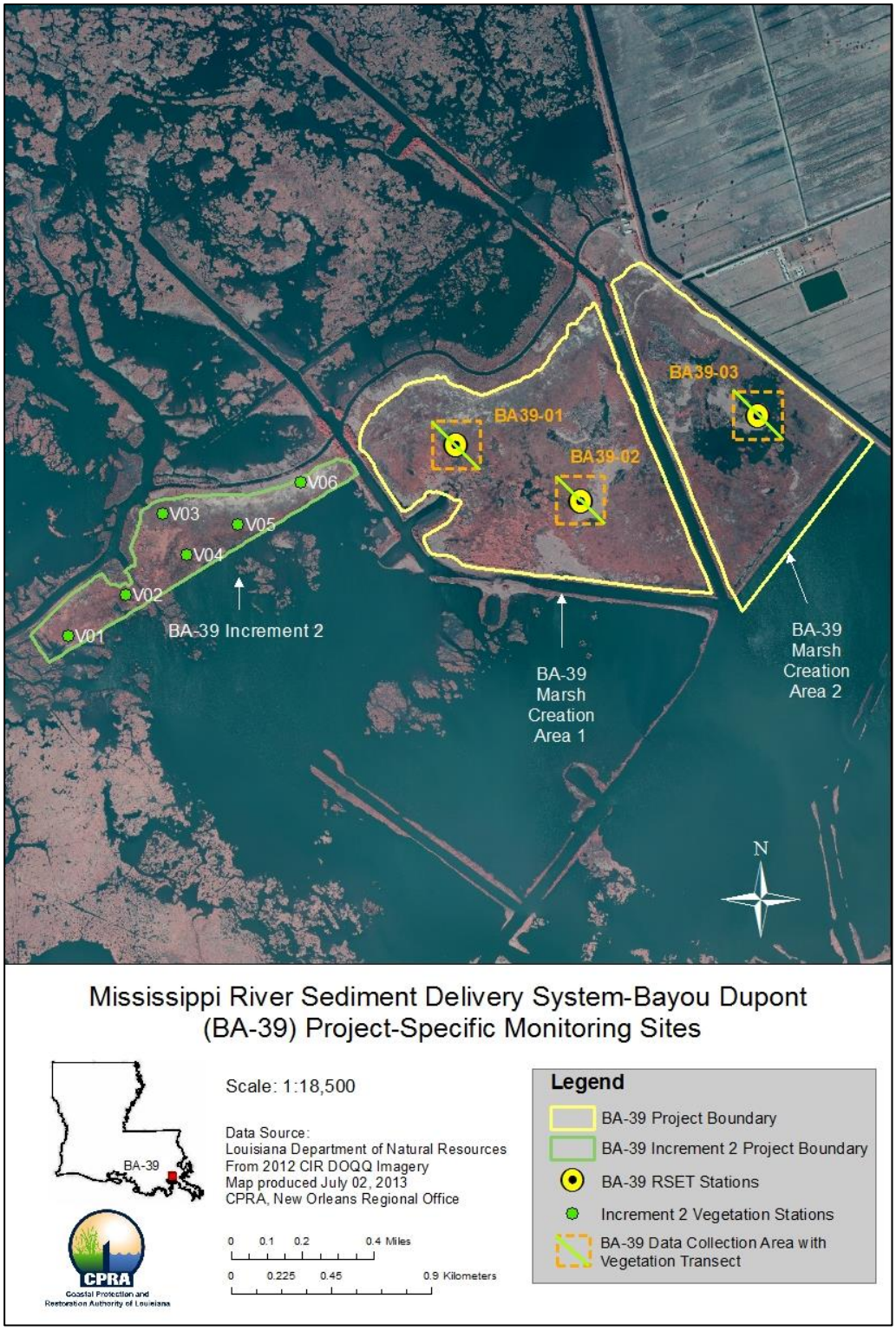

Figure 2. The Mississippi River Sediment Delivery System−Bayou Dupont (BA-39) and BA-39 Increment 2 project-specific monitoring sites. Approximate center of cells: Marsh Creation Area 1: 29°38'59"N and 90°0'57"W, Marsh Creation Area 2: 29°39'40"N and 90°0'26"W, Increment 2: 29°38'51"N and 90° 01'59"W.

3. MONITORING BUDGET

The cost associated with monitoring BA-39 for its twenty-year project life is summarized in the OM&M budget in Appendix I. The Current Approved OM&M Budget (Revised Schedule) represents the modified monitoring schedule based on monitoring that has already occurred and the revised projected years for monitoring events. The year for each monitoring event in the budget corresponds to the expected federal fiscal year (October 1–September 30) the charges will be applied to the budget. Section 2: Items Requiring Monitoring lists the actual scheduled years for monitoring events.

Costs for operations, maintenance and monitoring were combined into one budget for BA-39; therefore, a few operations and maintenance items listed in the budget are not addressed in the monitoring plan. These items include Survey-Borrow Area, Geotechnical Instrumentation for Monitoring Hydraulically Dredged Fill Material, and State O&M (annual maintenance inspections). Monitoring Site Installation, Construction, and Survey O&M cover the initial costs for building and surveying the monitoring stations. The line items USACE Administration and Federal S&A cover federal administrative costs.

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, vegetation, soil, RSET, and accretion data are entered into the public database.

3. Analyze the data and publish OM&M reports according to a schedule agreed upon by EPA and CPRA**.** 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 EPA to determine that the data being collected adequately evaluate the project.

B. EPA will:

1. Review the monitoring plan and budget annually to determine that the data being collected adequately evaluate the project.

2. Review OM&M reports.

5. REFERENCES

ABMB Engineers, Inc. 2011. Project Completion Report: Mississippi River Sediment Delivery System, Bayou Dupont, State Project No. BA-39. 15 pp. plus appendices.

Baumann, R.H., J.W. Day, and C.A. Miller. 1984. Mississippi deltaic wetland survival-sedimentation versus coastal submergence. *Science* 224: 1093−1095.

Cahoon, D.R., J.C. Lynch, P. Hensel, R. Boumans, B.C. Perez, B. Segura, and J.W. Day, Jr. 2002a. A device for high precision measurement of wetland sediment elevation: I. Recent improvements to the sedimentation-erosion table. *Journal of Sedimentary Research* 72: 730–733.

Cahoon, D.R., J.C. Lynch, B.C. Perez, B. Segura, R. Holland, C. Stelly, G. Stephenson, and P. Hensel. 2002b. A device for high precision measurement of wetland sediment elevation: II. The rod surface elevation table. *Journal of Sedimentary Research* 72: 734–739.

Coastal Protection and Restoration Authority of Louisiana. 2012. *Louisiana's Comprehensive Master Plan for a Sustainable Coast*. Coastal Protection and Restoration Authority of Louisiana. Baton Rouge, LA.

Faust. S. 2010. Bayou Dupont Vegetative Planting Project (BA-39) Project Completion Report. Louisiana Office of Coastal Protection and Restoration. Baton Rouge, LA. 2 pp.

Folse, T.M, L.A. Sharp, J.L. West, M.K. Hymel, J.P. Troutman, T.E. McGinnis, D. Weifenbach, L.B. Rodrigue, W.M. Boshart, D.C. Richardi, W.B. Wood, and C.M. Miller. 2008, revised 2014. 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. 228 pp.

Holm Jr. G.O., B.C. Perez, and R.C. Raynie. 2015. Soil development and carbon accumulation of created wetlands in coastal Louisiana. Coastal Protection and Restoration Authority of Louisiana. 35 pp.

Penland, S. and K.E. Ramsey. 1990. Relative sea-level rise in Louisiana and the Gulf of Mexico: 1908–1988. Journal of Coastal Research 6(2): 323–342.

Sasser, C.E., M.D. Dozier, and J.G. Gosselink. 1986. Spatial and temporal changes in Louisiana's Barataria Basin marshes, 1945−1980. *Environmental Management* 10(5): 671−680.

Steyer, G.D., R.C. Raynie, D.L. Steller, D. Fuller, and E. Swenson. 2000. Quality management plan for the Coastal Wetlands Planning, Protection, and Restoration Act monitoring program. Open-file series no. 95-01. Baton Rouge: Louisiana Department of Natural Resources, Coastal Restoration Division. 97 pp.

Thompson, W.C. 2007. Final Design Report: Mississippi River Sediment Delivery System-Bayou Dupont (BA-39). Louisiana Department of Natural Resources Coastal Engineering Division. Baton Rouge, LA. 37 pp. plus appendices.

U.S. Environmental Protection Agency. 2007. Environmental Assessment for the Coastal Wetlands Planning, Protection and Restoration Act, Bayou Dupont (BA-39) Mississippi River Sediment Delivery System Project. 31 pp.

U.S. Environmental Protection Agency and Louisiana Department of Natural Resources. 2007. Mississippi River Sediment Delivery System–Bayou Dupont (BA-39): Project Information Sheet for Wetland Value Assessment. 17 pp.

APPENDIX I

Operations, Maintenance and Monitoring (OM&M) Budget

Mississippi River Sediment Delivery System - Bayou Dupont BA-39
Federal Sponsor: USEPA
Construction Completed : 2010
PPL 12
Budget in federal fiscal years (October 1-September 30)

Current Approved OM&M Budget	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
	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
State O&M (inspections)	$6,809	$3,197	$5,612	$3,326	$5,267	$3,726	$3,529	$3,600	$4,442	$3,900	$3,777	$4,152	$3,930	$4,008	$4,089	$4,170	$4,254	$4,339	$4,426	$4,514
USACE Administration	$785	$801	$817	$834	$850	$867	$885	$902	$921	$939	$958	$977	$996	$1,016	$1,037	$1,057	$1,079	$1,100	$1,122	$1,145
Federal S&A	$6,809	$3,197	$5,612	$3,326	$5,267	$3,726	$3,529	$3,600	$4,442	$3,900	$3,777	$4,152	$3,930	$4,008	$4,089	$4,170	$4,254	$4,339	$4,426	$4,514
Total O&M	$14,403	$7,195	$12,041	$7,486	$11,384	$8,319	$7,943	$8,102	$9,805	$8,739	$8,512	$9,281	$8,856	$9,032	$9,215	$9,397	$9,587	$9,778	$9,974	$10,173
Monitoring																				
Aerial Photography			$14,167						$15,957											
Survey - Project Area and Settlement Plates	$52,325		$54,495		$56,638															
Survey - Borrow Area	$41,860																			
Geotechnical Instrumentation for Monitoring Hydraulically Dredged Fill Material	$37,608																			
Monitoring Site Installation, Construction, and Survey O&M	$36,628																			
Vegetation	$7,849		$8,174			$8,674			$9,205			$9,769								
Soil Samples	$4,252				$4,602					$5,086										
RSET	$1,125	$1,149	$1,172	$1,195	$1,219	$1,243	$1,268	$1,294	$1,319	$1,346										
Total Annual Monitoring	$181,647	$1,149	$78,008	$1,195	$62,459	$9,917	$1,268	$1,294	$26,481	$6,432	$0	$9,769	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual OM&M	$196,050	$8,344	$90,049	$8,681	$73,843	$18,236	$9,211	$9,396	$36,286	$15,171	$8,512	$19,050	$8,856	$9,032	$9,215	$9,397	$9,587	$9,778	$9,974	$10,173
Total Budget Amount	**$568,841**																			

Current Approved OM&M Budget (Revised Schedule)	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
	FY11	FY12	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30
State O&M (inspections)	$6,809	$3,197	$5,612	$3,326	$5,267	$3,726	$3,529	$3,600	$4,442	$3,900	$3,777	$4,152	$3,930	$4,008	$4,089	$4,170	$4,254	$4,339	$4,426	$4,514
USACE Administration	$785	$801	$817	$834	$850	$867	$885	$902	$921	$939	$958	$977	$996	$1,016	$1,037	$1,057	$1,079	$1,100	$1,122	$1,145
Federal S&A	$6,809	$3,197	$5,612	$3,326	$5,267	$3,726	$3,529	$3,600	$4,442	$3,900	$3,777	$4,152	$3,930	$4,008	$4,089	$4,170	$4,254	$4,339	$4,426	$4,514
Total O&M	$14,403	$7,195	$12,041	$7,486	$11,384	$8,319	$7,943	$8,102	$9,805	$8,739	$8,512	$9,281	$8,856	$9,032	$9,215	$9,397	$9,587	$9,778	$9,974	$10,173
Monitoring																				
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RSET	$1,125	$1,149	$1,172	$1,195	$1,219	$1,243	$1,268	$1,294	$1,319	$1,346										
Total Annual OM&M	$129,322	$61,648	$15,339	$1,195	$64,388	$5,845	$1,268	$10,499	$1,319	$1,346	$56,638	$30,812	$0	$0	$0	$0	$0	$0	$0	$0
Total Annual OM&M	$143,725	$68,843	$27,380	$8,681	$75,772	$14,164	$9,211	$18,601	$11,124	$10,085	$65,150	$40,093	$8,856	$9,032	$9,215	$9,397	$9,587	$9,778	$9,974	$10,173
Total Budget Amount	**$568,841**																			

The Current Approved OM&M Budget (Revised Schedule) represents the modified monitoring schedule based on monitoring that has already occurred and the revised projected years for monitoring events. Note: the year for each monitoring event in the budget corresponds to the expected year the charges will be applied to the budget. See section II. Items Requiring Monitoring (p. 4) for the actual years the monitoring events are scheduled to occur.