

Grand Liard Marsh and Ridge Restoration (BA-68) Project Completion Report - Final



Prepared for:

Coastal Protection and Restoration
Authority



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Coastal Wetlands Planning,
Protection and Restoration Act



National Oceanic and
Atmospheric Association –
National Marine Fisheries Service



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December 23, 2016

Prepared by:



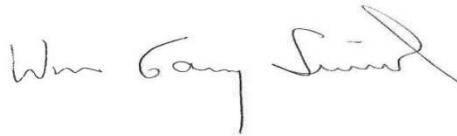
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Appendices (On Project CD/DVD)

- Appendix A. Construction Design Plans and Specifications
- Appendix B. Construction Permits and Permit Modifications
- Appendix C. Construction Change Orders
- Appendix D. Weeks Marine (Contractor) Construction Daily Progress Reports
- Appendix E. AECOM and Digital (Observer) Daily Progress Reports
- Appendix F. Aerial Photographs
- Appendix G. Construction Observation Photos
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- Appendix I. Construction Contractor Progress Surveys
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PROJECT COMPLETION REPORT

PROJECT NAME: Grand Liard Marsh and Ridge Restoration

STATE PROJECT NO.: BA-68

REPORT DATE: December 23, 2016

BY: AECOM Technical Services

1. Project Manager, Engineers, and Contractors

1.1 Agency Acronyms

CPRA: Coastal Protection and Restoration Authority

NOAA-NMFS: National Oceanic and Atmospheric Association – National Marine Fisheries Service

1.2 Key Personnel

CPRA Project Manager: Jason Curole, Ph.D.	(225) 342-4525
CPRA Project Engineer: Tye Fitzgerald, P.E.	(225) 342-6507
CPRA Construction Project Manager: Barry Richard, P.E.	(504) 280-4059
NOAA-NMFS Project Manager: Kimberly Clements and Donna Rodgers	(225) 389-0508 ext. 204 (225) 922-5700
AECOM Project Manager: Gary W Smith, P.E.	(214) 478-4754
AECOM Project Engineer: Matt Salmon, P.E.	
Weeks Marine Project Manager(s):	(985) 237-5026
Gary Johnson,	(504) 858-5308
Richard Roth,	(985) 237-5063
Jimmy Rude	

2. Introduction and Background

This report documents the as-built conditions of the Grand Liard Marsh and Ridge Restoration project (hereinafter Project) BA-68. The primary features of the Project include construction of an earthen ridge and tidal marsh. Project construction occurred during July 2014 to September 2015.

The Project goals were to re-establish historical Bayou Grand Liard earthen ridge and marsh characteristics. Important benefits (functions) of the constructed Project include:

- Reduction of water level setup and wave fetch, and
- Re-establishment of a portion of a historic land barrier to reduce east to west sediment transport.

The Coastal Wetlands Planning, Protection, and Restoration Act (CWPPRA) Task Force approved BA-68 for construction in January 2013 with funding approved through CWPPRA and the Louisiana Wetlands Conservation and Restoration Fund. The National Oceanic and Atmospheric Administration - National Marine Fisheries Service (NOAA-NMFS) is the federal sponsor and the Coastal Protection and Restoration Authority of Louisiana (CPRA) is the local sponsor and construction manager. CPRA completed all engineering and design work for the Project.

Weeks Marine (Contractor) was awarded the contract for construction of the Project. AECOM with subcontractor Digital Engineering performed on-site observation and assisted CPRA with construction management.

3. Project Location and Description

The Project is located within the Barataria Basin of Plaquemines Parish, Louisiana, to the west of the community of Venice and southwest of the community of Boothville, and on the West Bank of the Lower Mississippi River, as shown in Figure 1. The areas within the Grand Liard mapping units were historically formed by a series of natural north-south oriented bayous and associated earthen ridges. Over a period of time, these bayous and earthen ridges have eroded. Figure 2 shows the historical bayou and ridge conditions in 1998, 2010, and 2015 at time of Project completion. Overlays of the Project's marsh creation areas (MCAs) are shown on each figure to show perspective.



Figure 1: Grand Liard (BA-68) Vicinity Map

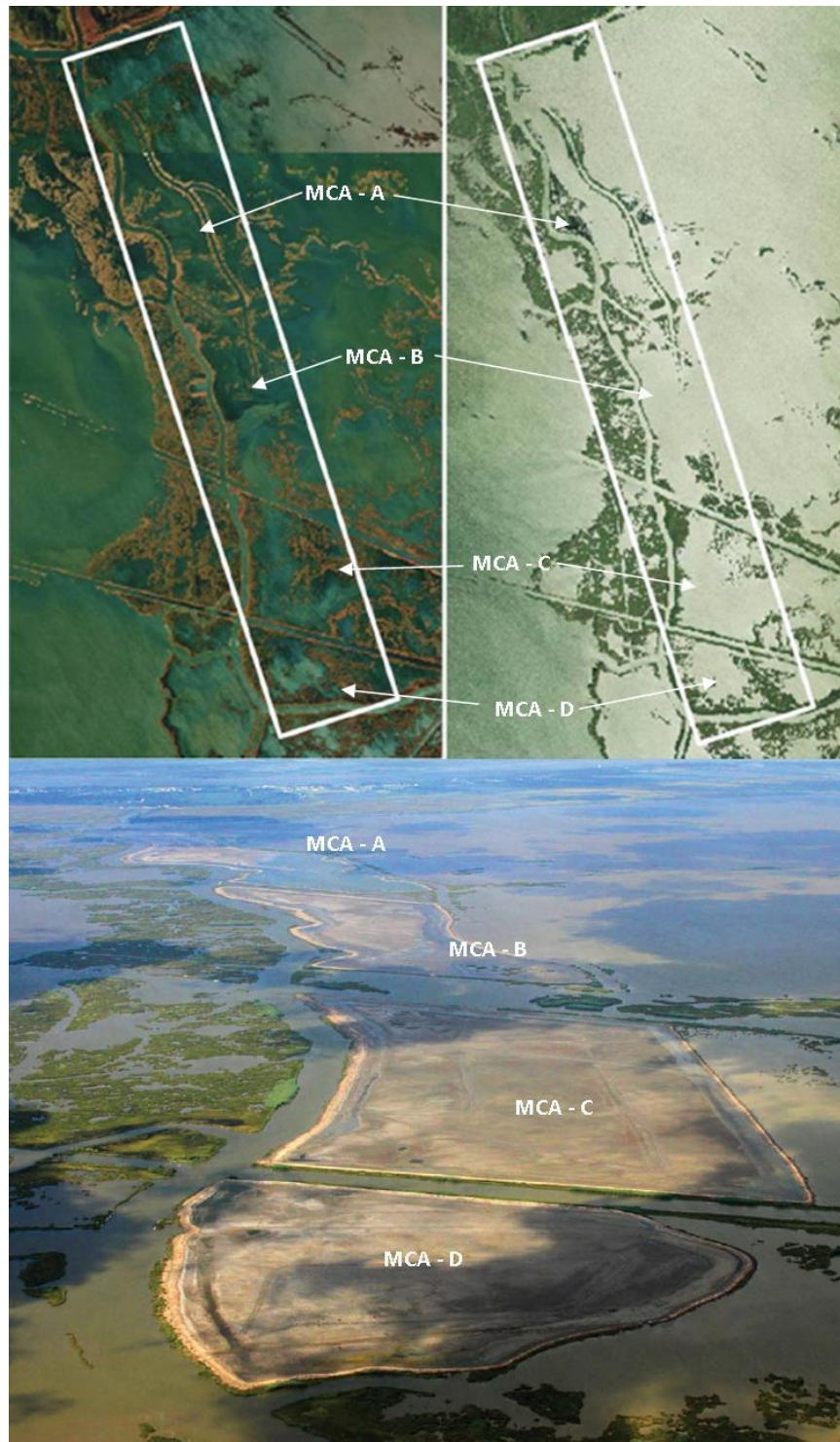


Figure 2: Grand Liard Aerials, 1998 (upper left), 2010 (upper right), and 2015 (below)

4. Construction Challenges and Design Changes

Construction of the Project involved dredging an access channel (where required) from the Gulf of Mexico to Bayou Grand Liard to provide equipment access to the site, abandoned pipeline removal, earthen ridge and dike construction for marsh fill containment, sheet pile wall installation to close large gaps along the ridge and dike, and hydraulic marsh fill. The challenges and changes to the aforementioned design features encountered during Project construction are discussed below. Design plans and specifications are shown for reference in Appendix A.

4.1 Access Channel Temporary Spoil Material Placement Elevation

During the access channel pre-construction survey, the Contractor noted that the permitted temporary spoil berm had a maximum placement elevation of -4.5 feet NAVD88 GEOID 03 (2004.65). They requested the maximum berm elevation be variable based on site specific conditions. Subsequently, a modification was approved as shown in Figure 3 (Figure 1 from Coastal Zone Consistency determination issued by the Louisiana Department of Natural Resources Office of Coastal Management) and documented with consistency determination modification 5 as shown in Appendix B.

4.2 Hydraulic Dredge Booster Pump Location

During design, CPRA assumed the hydraulic dredge booster pump could be located within the designed Access Channel. The Contractor indicated the designed Access Channel was not of sufficient width to simultaneously provide construction equipment access and booster pump operation. Permit modification number 4 was approved to locate the booster pump adjacent to the Access Channel at approximately station 170+00 (see plan sheet 69). Subsequently, the booster pump was installed at approximately Access Channel Station 174+00 (see plan sheet 69) and a Department of the Army permit modification was issued by the U.S. Army Corps of Engineers (USACE). The modified location is shown in Figure 4 and the permit modification is shown in Appendix B.

4.3 Sheet Pile Closure Realignment

Based on agreement between CPRA and the Contractor, sheet pile closures (SCs) were realigned during construction and moved towards and into the MCAs. Additionally, the sand fill template was modified to increase the crest height to enhance horizontal sheet pile stability. The result was that sand fill contract volumes did not change, but the volume of in-situ sediment needed to cover the SCs was substantially reduced.

4.4 Earthen Ridge and Earthen Containment Dike Modifications

4.4.1 Marsh Creation Area A Secondary Drain

The Contractor experienced difficulty constructing the Area A Earthen Containment Dike from approximately station 74+50 to 78+63 (i.e., the southwest corner see plan sheet 25). Underlying sediments were of poor quality, requiring the Contractor to construct the dike slowly, allowing time for both the underlying and new surface dike sediments to stabilize. In addition, as the Contractor placed hydraulic marsh fill in Area A, excess water pooled behind the dike resulting in dike instability. To maintain dike stability, three steel pipes (each approximately 6 inches in diameter) were temporarily installed to drain water that pooled behind the dike. After the second lift of marsh fill was placed in Area A the pipes were removed.

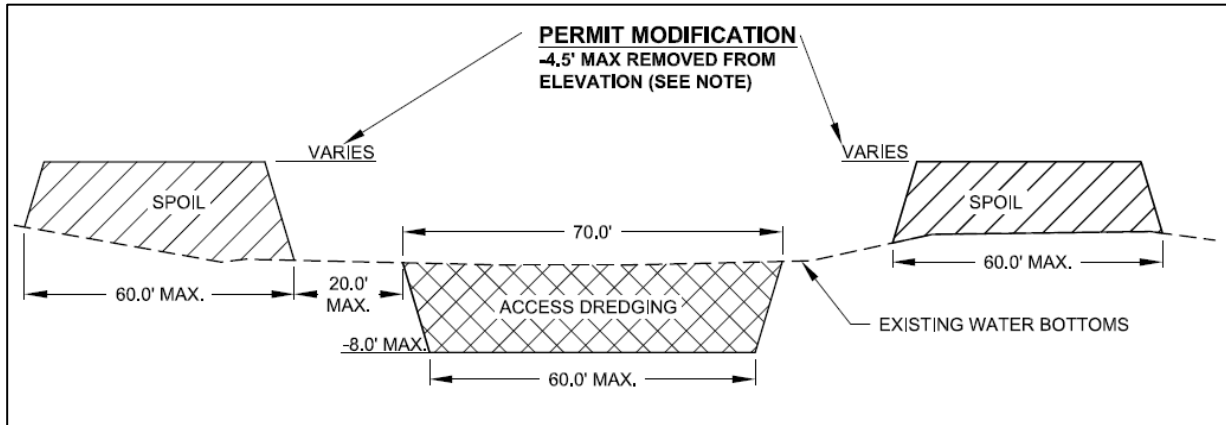


Figure 3: Access Channel Temporary Spoil Template Modification

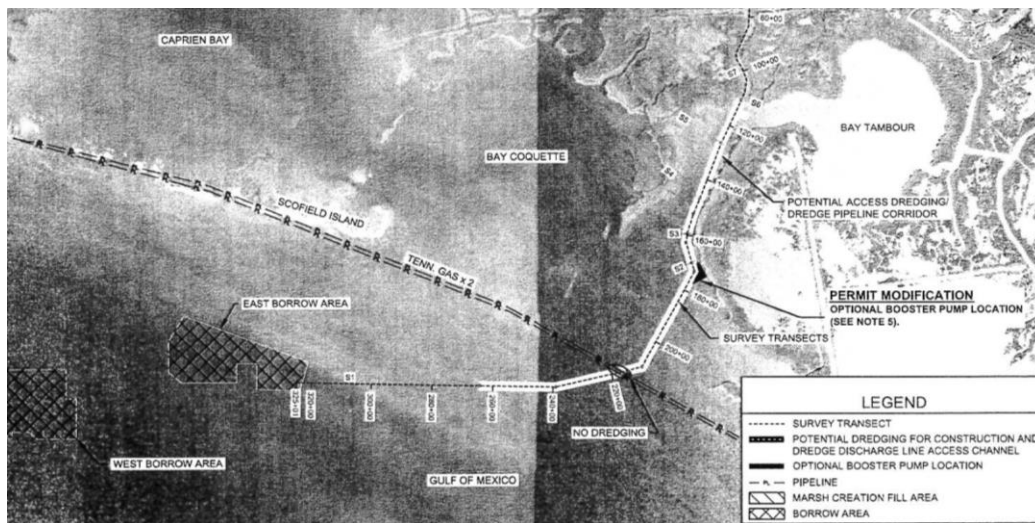


Figure 4: Modified Booster Pump Location

4.4.2 Marsh Creation Area C Sheet Pile Closure #19

The design bathymetric surveys omitted a deep gap located along the north side of MCA C Earthen Containment Dike approximately from station 10+75 to 12+50 (see plan sheet 27). The Contractor attempted to close the gap using in-situ sediment, but was not successful. Upon request from the Contractor, CPRA labeled the gap SC #19 and approved placement of sand fill to stabilize the SC. Sand fill was approved for placement by CPRA using the following criteria:

- Placement to a maximum crest elevation of +3 feet NAVD88.
- Placement to a minimum base elevation of -6 feet NAVD88.
- Crest width of 5 feet (i.e., 2.5 feet on each side of the SC centerline).
- Side slopes of 5:1 (horizontal: vertical) extending from the crest, including tolerance, to the sediment surface.
- Payable over placement tolerance of 0.5 feet above crest elevation (i.e., an elevation of +3.5 feet NAVD88) continuing design side slopes.

Approximately 1,045 CY of sand was placed within the SC #19 design template. However, construction of SC #19 did not increase contract sand volume because the Contractor did not place the full contracted volume in the other SCs.

4.4.3 Marsh Creation Area D Ridge at Gulf South Pipeline

The Gulf South Pipeline running through MCA D created a large gap along the earthen ridge from station 5+50 to 7+00 (see plan sheet 28). Initial design assumed the gap was not significant, but due to design constraints (i.e., no dredging within 50 feet of an active pipeline) and limited in-situ sediment, CPRA allowed the Contractor to relocate the ridge centerline towards the marsh fill area at a shallower depth avoiding this area.

4.4.4 Marsh Creation Area D Earthen Containment Dike Destabilization

During placement of the first hydraulic dredge lift in MCA D, the earthen containment dike at the Gulf South Pipeline from approximately station 16+50 to 17+50 (see plan sheet 28) destabilized and began sliding horizontally. The fill elevation when horizontal motion occurred was at approximately +3.0 feet NAVD88, with design elevation of +3.5 feet NAVD88. The Contractor immediately stopped filling Area D and informed CPRA. Additional time was allowed for the earthen containment dike to consolidate and stabilize. Subsequently, fill placement to reach the design requirements in Area D did not result in any further earthen containment dike destabilization.

4.5 Schedule Delays

4.5.1 Access Channel Pipeline

On August 16, 2014, the Contractor reached an exposed highly volatile liquid (HVL) pipeline at access channel station 27+00 (see plan sheet 69). The pipeline Owner (Chevron) did not provide approval to cross the pipeline because of insufficient water depths to allow for safe clearance of the HVL submerged pipeline with Contractor's floating equipment. CPRA requested the Owner lower the pipeline elevation to provide adequate clearance. On September 16, 2014, the Owner lowered the pipeline and gave the Contractor approval to cross over the pipeline. CPRA added 11 days to the contract to account for construction stoppage as part of change order 2.

4.5.2 Marsh Creation Area Settlement and 60-Day Settlement Work Stoppage

The Contractor completed placing the first lift of hydraulic fill in each marsh cell more quickly than anticipated during design, except in area D which was discussed in Section 4.4.4. Hydraulic fill was placed faster than anticipated because the Contractor was using a newer hydraulic dredge (i.e., more horsepower) than assumed during design.

In order to achieve design sediment settling criteria, CPRA and the Contractor agreed to stop work for a minimum of 60 days prior to placing the second lift of hydraulic fill. The Contractor demobilized on May 26, 2015 and remobilized to resume construction on July 15, 2015. CPRA added 60 days to the contract as part of change order 5.

5. Final As-Built Features

The Project consists of an earthen ridge and marsh restoration constructed to achieve a typical 20-year design life. Key features of Project construction include:

- Access channel
- Earthen Ridge and Marsh containment construction including:
 - Abandoned pipeline removal,
 - Sheet pile closures,
 - Earthen ridge, and
 - Earthen containment dike
- Marsh construction including:
 - Gulf of Mexico borrow area, and
 - Hydraulic marsh fill

Construction activities were documented with daily field reports by the Contractor (Appendix D) and construction observers (Appendix E). Additionally, construction was documented via photographs by the Contractor (Appendix F) and construction observers (Appendix G). CPRA and NOAA-NMFS observed and documented progress during bi-weekly meetings (Appendix H).

5.1 Access Channel

The access channel was the designed and permitted pathway for all equipment and supplies to access the Project. The access channel was constructed to a final elevation ranging between -5 and -8 feet NAVD88, depending on location, with a consistent bottom width of 60 feet. The access channel also included a 250-by-100 foot area near station 174+00 (see plan sheet 69) for the hydraulic dredge booster pump. Navigation hazard markers and lights were installed adjacent to the channel and maintained during construction. A photograph of an access channel navigation marker and spoil material pile is shown in Figure 5. At the end of the Project, the Access Channel was backfilled to existing grade and all navigation hazard markers were removed. The Contractor tracked and verified construction through progress surveys shown in Appendix I. Additionally, all as-built features are shown in Appendix J.



Figure 5: Access Channel Photograph

5.2 Earthen Ridge and Containment Dikes

The earthen ridge and marsh containment included all activities necessary to construct the earthen ridge and prepare each MCA for dredge fill placement. These construction activities included removing abandoned pipelines, installing SCs, and constructing of the earthen ridge and containment dikes. The earthen ridge also provides habitat for woody species which will be planted during a future O&M event.

5.2.1 Abandoned Pipeline Removal

Three abandoned oil and gas pipelines permitted for removal by two Coastal Use Permits (CUPs) were removed from within the Project footprint. The three pipelines and associated CUPs were:

1. CUP 19860021
 - a. 4" Louisiana State Gas Corporation pipeline located in MCA B extending 677 feet from the west side of the MCA to the center.
2. CUP 19841123
 - a. 2.5" Gulf South Pipeline extending 1,111 feet from the south end of MCA A to the north end of MCA B.
 - b. 3.5" unknown pipeline owner extending 1,363 feet from the south end of MCA A to the north end of MCA B.

A third permit (CUP 19850368) identified another pipeline within the Project footprint, but no pipeline associated with this permit was found during construction.

5.2.2 Sheet Pile Closures

Nine sheet pile closures (SCs) were constructed to close large gaps along earthen ridge and earthen containment dike alignments. The SCs constructed were labeled SC 11, 12, 13, 14, 15, 16, 17, 18, and 19¹. SCs were constructed with a combination of sand fill to provide for sheet pile stability and steel sheet piles. Construction of sand fill at SC 11 to 18 was implemented using the following design template criteria²:

- Placement to a crest elevation of +2 feet NAVD88.
- Payable over placement tolerance of 0.5 feet above crest elevation (i.e., an elevation of +2.5 feet NAVD88).
- Crest width of 8 feet (i.e., 4 feet on each side of the SC centerline).
- Side slopes of 5:1 (horizontal: vertical) extending from the crest to the sediment surface.

Sand fill template criteria for SC 19 include:

- Placement to a maximum crest elevation of +3 feet NAVD88.
- Payable over placement tolerance of 0.5 feet above crest elevation (i.e., an elevation of +3.5 feet NAVD88).
- Crest width of 5 feet (i.e., 2.5 feet on each side of the SC centerline).
- Side slopes of 5:1 (horizontal: vertical) extending from the crest, including tolerance, to the sediment surface.

Each sheet pile was installed with a top elevation of +3 feet NAVD88 and various bottom of sheet pile (i.e., tip) elevations based on the geotechnical analysis at each closure (SC 19 excluded). During construction of the SCs, 13,500 CY of sand was placed and 45,152 square feet of sheet pile was

¹ SC 19 was added as part of Change Order 3 to close a large gap on the north side of MCA C that was not identified during design or pre-construction surveys.

² SC sand berm design template was modified during construction and does not match original design documents.

installed. Table 1 and Table 2 show the amount of materials used to construct each SC. A photograph of a fully constructed SC showing sand fill and steel sheet piles is shown in Figure 6.

Table 1: Sheet Pile Closure Sand Fill Volume

Sheet Pile Closure	As-Built Sand Volume (CY)
SC 11	0
SC 12	189
SC 13	1,442
SC 14	317
SC 15	4,946
SC 16	715
SC 17	4,487
SC 18	359
SC 19	1,045
Total	13,500

Table 2: Sheet Pile Closure and Sand Areas

Sheet Pile Closure	Sheet Pile Closure Width (Feet)	Individual Sheet Pile Length (Feet)	Sheet Pile Area (Square Feet)	Tip Installation Elevation (Feet NAVD88)
SC 11	98.2	20	1,964	-17.0
SC 12	124.0	20	2,480	-17.0
SC 13	175.0	25	4,375	-22.0
SC 14	137.1	20	2,742	-17.0
SC 15	437.0	35	15,295	-32.0
SC 16	199.7	21	4,194	-18.0
SC 17	456.0	25	11,400	-22.0
SC 18	135.1	20	2,702	-17.0
SC 19	Sand only closure			
Total	1,762	-	45,152	-



Figure 6: Sheet Pile Closure Photograph

5.2.3 Earthen Ridge

A total of 15,484 linear feet of earthen ridge was constructed along Bayou Grand Liard. The earthen ridge was constructed to the design template of +4.5 feet minimum crest height, 20-foot crest width, and side slopes of 7H:1V. Throughout construction the Contractor maintained and repaired the earthen ridge to maintain the design template.

Seven settlement plates were installed along the earthen ridge to track vertical consolidation of underlying soils. One plate was installed in Areas A, B, and C and four plates in Area D for a total of 7 settlement plates. During construction, the earthen ridges in Area A, B, C, and D settled approximately 0.6, 1.2, 2.2, and 2.8 feet, respectively. Settlement was recorded on a weekly basis and all results are shown in Appendix K. Figure 7 shows a photograph of a settlement plate along the earthen ridge.

Table 3: Earthen Ridge Settlement

Settlement Plate	Total Settlement (Feet)	Time Period of Settlement (Days)
S1 (Area A)	0.6	189
S3 (Area B)	1.2	189
S5 (Area C)	2.2	253
S8 (Area D)	2.6	295
S9 (Area D)	2.9	295
S10 (Area D)	3.1	295
S11 (Area D)	2.5	295



Figure 7: Earthen Ridge and Settlement Plate Photograph

5.2.3.1 Earthen Ridge Borrow Sources

Earthen ridge sediment was predominately sourced from Bayou Grand Liard and where insufficient material was available, sediment from inside the marsh creation area was used. The interior borrow area inside each MCA consisted of a channel dredged, as necessary, to an elevation of -12 feet NAVD88 with variable widths. The interior borrow channel was constructed a minimum of 20 feet from the area A and C earthen ridge toe, and 35 feet for area B and D earthen ridge toes per design to provide for ridge soil stability. The interior borrow area inside each MCA consisted of a channel dredged to an elevation of -12 feet NAVD88 with variable widths as needed depending on location. The interior borrow channel of each MCA was constructed a minimum of 20 feet from all earthen ridge toes to provide for ridge soil stability.

5.2.4 Earthen Containment Dike

A total of 28,855 linear feet of earthen containment dike was constructed to contain hydraulic marsh fill. The earthen containment dike was constructed to the design template of +4.5 feet NAVD88 crest height, 5 feet crest width, and side slopes of 5H:1V.

Earthen containment dike construction used sediment removed from the MCA borrow channel as described above. Area A also used material from an exterior borrow source within a channel on the eastern side of the fill area. Additionally, the exterior borrow location was dredged to provide equipment access to construct SCs #11, #12, #13, and #14. The channel was dredged to an approximate elevation of -6 feet NAVD88 and width of 50 feet. The channel was constructed at a minimum of 40 feet from the earthen containment dike to provide for dike soil stability. Throughout construction the Contractor maintained the earthen containment dike by adding sediment to raise low areas and repair any areas damaged by construction equipment and erosion due to wave fetch (i.e., eastern earthen dike of MCA B). Figure 8 shows a photograph of a completed earthen dike section.



Figure 8: Earthen Containment Dike Photograph

5.3 Marsh Construction

Marsh construction involved hydraulically dredging sediment from the Gulf of Mexico East Borrow Area (See Figure 4) and placing it in 2 lifts (3 lifts in Area D) within each MCA. The Contractor installed 5 spill boxes in each MCA to assist with dewatering hydraulically dredged sediment during marsh cell filling.

5.3.1 Gulf of Mexico East Borrow Area

All marsh fill was dredged using the hydraulic dredge CR McCaskill. The CR McCaskill is a cutter suction dredge equipped with a 30" discharge pipeline. The hydraulic dredge pipeline was installed in the access channel and extended approximately 32,536 feet to the southern edge of the marsh fill area. A hydraulic booster pump was installed at approximately station 174+00 (see plan sheet 69) to assist with pumping fill. 2,834,000 CY of borrow material was dredged from the East Borrow Area to fill all four Grand Liard MCAs.

5.3.2 Marsh Creation

The Project constructed approximately 450 acres of tidal marsh within four MCAs. The four MCAs (A, B, C, and D) and were constructed to average elevations of 3.3, 2.9, 3.4, and 3.4 feet NAVD88, respectively.

In order to track vertical consolidation of underlying sediments during and after construction, four settlement plates were installed; one in each MCA. Immediately after construction MCAs A, B, C, and D experienced approximately 0.3, 0.2, 0.5, and 0.3 feet of settlement, respectively. Detailed weekly marsh creation settlement is shown graphically in Appendix K. Figure 9 shows a photograph of a finished MCA.

Table 4: Marsh Creation Area (MCA) Settlement

Settlement Plate	Total Settlement (Feet)	Time Period of Settlement (Days)
S2 (Area A)	0.3	126
S4 (Area B)	0.2	126
S6 (Area C)	0.5	126
S7 (Area D)	0.3	126



Figure 9: Marsh Creation Area Photograph

After construction of each MCA, the Contractor gapped the earthen containment dike of each area. The gap was constructed to a width of approximately 20 feet and to an elevation of approximately +3 feet NAVD88 (i.e., 0.5 feet below the marsh fill elevation). Gaps were constructed to allow controlled tidal exchange to prevent water ponding. Figure 10 shows a photograph of a MCA gap.

5.4 Marsh Sediment Construction Cut-to-Fill Ratios

In-situ sediment typically has greater density per unit of area (i.e. less mass per unit volume of material) than after it is dredged due to a change of a number of factors, including moisture content, air content, vertical and horizontal pressures. The comparison of these two volumes is referred to as a cut-to-fill ratio, which quantifies the amount of bulking that occurred during sediment dredging. During construction, the Contractor removed 2,834,000 CY of material from the East Borrow Area and the measured volume of placed material was approximately 3,057,000 CY. Thus the calculated bulking factor for this sediment, immediately following construction, was approximately 1.08. As this cut to fill ratio was calculated immediately following construction, water and suspended sediment was included in this estimate. To calculate the cut to fill for comparison to the design cut to fill, volumes at approximately target year 5-10 should be used.

5.5 Demobilization

On September 14, 2015, CPRA and NOAA-NMFS representatives visited the site to perform a final inspection. No construction-related issues were found and the Project was approved for final acceptance. On September 16, 2015 the Contractor demobilized all equipment and removed all trash from the project site. The Contractor left all 11 settlement plates in place for the purpose of long-term monitoring. On October 21, 2015, CPRA issued the Contractor the Notice of Acceptance which confirmed all contractual obligations had been met.



Figure 10: Earthen Containment Dike Gap Photograph

6. Davis-Bacon Act Compliance

During construction, compliance with the Department of Labor Davis-Bacon Act requirements were monitored and verified. The primary purpose of the Davis-Bacon Act is to require that local prevailing wages are paid for public works projects for laborers and mechanics. Compliance monitoring and verification included certifying weekly payrolls submitted by the Contractor and confirming payrolls through employee interviews. The Project remained in compliance with the Davis-Bacon Act throughout its duration. Certified weekly payrolls and employee interviews are shown in Appendix M.

7. Construction Contractors and Consultants

7.1 Prime Construction Contractor

Weeks Marine, Inc.

304 Gaille Drive, Innwoods Business Park
Covington, Louisiana 70433

7.2 Construction Sub-Contractors

Air Boat Inc.

39128 Boothville Rd.
Venice, Louisiana 70091

Activity: Airboat rental.

HydroTerra Technologies, LLC

202 Jacobs Run
Scott, Louisiana 70583

Activity: Hydrographic and topographic surveys.

Whitetail Oilfield Services

523 Jump Basin Road
Venice, Louisiana 70091

Activity: Abandoned pipeline removal.

Wilco Marsh Buggies & Draglines, Inc.

1304 Mac Arthur Ave
Harvey, Louisiana 70058

Activity: Marsh buggy and operator rental.

Quality First Marine.

Madisonville, Louisiana 70447

Activity: Sand placement and sheet pile installation.

7.3 Construction Administration and Observation Consultant

AECOM Technology Services, Inc.

7389 Florida Blvd, Suite 300
Baton Rouge, Louisiana 70806

Digital Engineering and Imaging Inc.

527 West Esplanade Avenue, Suite 200
Kenner, Louisiana 70065

8. Project Costs

Construction and construction observation related costs are shown in Table 5 and Table 6, respectively. Final construction costs and payment recommendations documented during construction are shown in Appendix L.

Table 5: Construction Costs and Duration

Construction Contract Adjustments	Amount	Days
Original Construction Contract	\$ 33,556,022.60	400
Change Order 1	(\$ 26,583.50)	0
Change Order 2	\$ 88,837.00	11
Change Order 3	\$0.00	11
Change Order 4	\$ 20,836.00	0
Change Order 5	\$0.00	60
Change Order 6	\$211,306.00	0
Change Order 7	(\$ 4,084,282.00)	49
Over/Under Runs	\$ 0.00	0
Final Construction Contract Costs	\$ 29,766,136.10	531

Table 6: Construction Observation Services Cost

Construction Contract Adjustments	Amount
Original Construction Services Contract	\$ 669,301
Over/Under Runs	\$ 0.00
Final Construction Services Contract Costs	\$ 669,301

9. Items of Work

Item No.	Description	Unit	Estimated Quantity	Bid Unit Price	Bid Price	Final Quantity	Final Amount	Increase/Decrease (+/-)	% Over/Under (+/-)
1	Mobilization and Demobilization	LS	1	\$ 4,750,000	\$ 4,750,000.00	1	\$ 4,750,000.00	\$ 0.00	0%
2	Clearing and Grubbing	LS	1	\$ 200,000	\$ 200,000.00	1	\$ 200,000.00	\$ 0.00	0%
3	Marsh Creation and Hydraulic Dredging	CY	3,442,824	\$ 6.15	\$ 21,173,367.60	2,834,254	\$ 17,430,662.10	(\$ 3,742,705.50)	-18%
4	Earthen Containment Dikes	LF	29,275	\$ 55.00	\$ 1,610,125.00	28,855	\$ 1,587,025.00	(\$ 23,100.00)	-1%
5	Earthen Ridge	LF	16,780	\$ 55.00	\$ 922,900.00	15,484	\$ 851,620.00	(\$ 71,280.00)	-8%
6	Construction Surveys	LS	1	\$ 425,000	\$ 425,000.00	1	\$ 425,000.00	\$ 0.00	0%
7	Steel Sheet Piling	SF	45,626	\$ 50.00	\$ 2,281,300.00	45,152	\$ 2,257,600.00	(\$ 23,700.00)	-1%
8	Sand Fill	CY	15,769	\$ 98.50	\$ 1,553,247.00	13,500	\$ 1,329,750.00	(\$ 223,496.50)	-14%
9	Settlement Plates	EA	11	\$ 3,500	\$ 38,500.00	11	\$ 38,500.00	\$ 0.00	0%
10	Access Dredging	LS	1	\$ 350,000	\$ 350,000.00	1	\$ 350,000.00	\$ 0.00	0%
11	Pipeline Removal	LS	1	\$ 225,000	\$ 225,000.00	1	\$ 225,000.00	\$ 0.00	0%
12	Change Order 2	LS	1		\$ 88,837	1	\$ 88,837.00	\$ 0.00	0%
13	Change Order 3	LS	1		\$ 20,836	1	\$ 20,836.00	\$ 0.00	0%
14	Change Order 4	LS	1		\$ 221,306	1	\$ 221,306.00	\$ 0.00	0%
Total					\$ 33,860,418.10	-	\$ 29,776,136.10	(\$ 4,084,282.00)	-12%

Acronyms: CY – Cubic Yards, EA – Each, LF – Linear Foot, LS – Lump Sum, SF – Square Foot

10. Major Equipment Used

Table 7 contains a list of all major equipment used during construction of the Project and a description of the equipment's construction task(s).

Table 7: Construction Equipment

Equipment Type	Equipment Name	Construction Task
<u>Water-borne Equipment</u>		
Airboat	<i>Airboat Inc. #1</i>	Marsh Creation
Anchor Barge	<i>BT 237, BTB 138, Weeks 585, Weeks 590, Weeks 592, Weeks 594, Weeks 595</i>	Marsh Creation
Crew Boat	<i>Bayou Blue, Bayou Teche, BTB 125, Captain Pete, Kristy, Olivia, Wave Runner, WMI 14097, WMI 14168,</i>	All
Deck Barge	<i>EWRS-16, Weeks 57, WMI 173</i>	Marsh Creation
Derrick Barge/Crane	<i>COVI 11, RG 297, WMI 229, WMI 173, WMI 622, WMI 637</i>	Marsh Creation, Sheet Pile Closure, and Pipeline Removal
Hydraulic Booster	<i>WMI 3302</i>	Marsh Creation
Hydraulic Dredge	<i>CR McCaskill (Cutter Suction Dredge)</i>	Marsh Creation
Mechanical Dredge	<i>Crosby #11, J.C. Deville, Weeks 6401</i>	Access Channel, Earthen Ridge, and Earthen Containment Dike
Quarter Boat	<i>Carla Jean, WMI 213</i>	Marsh Creation
Survey Vessel	<i>BTB 512, WMI 14060, WMI 14109, WMI 14112, WMI 14113, WMI 14117, WMI 14119, WMI 14166</i>	All
Tug Boat	<i>Candace, Captain Aaron, Charlie Cenac, Jane, Janice S., Joan Cenac, Johnson F., KJ LeBouef, Leslie D., Lisa Lynn, Michael T., Mr. Nelson, Mud Tug 12, Paddy Guidry, Pat Cenac, Richard B., Robert B., Trevor, Portier 1, Sea Wolf</i>	Marsh Creation
<u>Land Based Equipment</u>		
Excavator	<i>Marsh Buggies (6 ea.)</i>	Clearing and Grubbing, Earthen Ridge and Dike Construction, Marsh Creation.

11. Significant Construction Dates

Table 8 provides a summary of all significant construction dates. A detailed description of construction dates and activities is provided in Section 12.

Table 8: Significant Construction Dates

Description	Date
Bid Opening	February 6, 2014
Construction Contract Awarded	March 18, 2014
Notice to Proceed	March 24, 2014
Pre-Construction Conference	April 3, 2014
Mobilization (Mechanical Dredge ³) and Construction Start (Access Channel)	July 22, 2014
Construction Stop at Chevron Pipeline (Access Channel)	August 16, 2014
Mobilization and Construction Start (Pipeline Removal)	August 20, 2014
Construction Completion (Access Channel)	August 26, 2015
Construction Start (Earthen Ridge and Containment Dike)	August 27, 2014
Construction Completion and Demobilization (Pipeline Removal)	August 30, 2014
Mobilization and Construction Start (Sheet Pile Closure)	September 4, 2014
Construction Completion and Demobilization (Sheet Pile Closure)	October 29, 2014
Mobilization and Construction Start (Sheet Pile Closure #19)	February 6, 2015
Construction Completion and Demobilization (Sheet Pile Closure #19)	February 9, 2015
Mobilization (Hydraulic Dredge and Marsh Creation Equipment)	March 17, 2015
Construction Start (Marsh Creation)	March 18, 2015
Construction Completion (Earthen Ridge and Containment Dike)	March 24, 2015
Demobilization (Mechanical Dredge)	March 31, 2015
Construction Completion (Marsh Creation)	July 31, 2015
Demobilization (Hydraulic Dredge)	August 1, 2015
Mobilization and Construction Start (Access Channel Backfill)	August 27-2015
Demobilization (Marsh Creation Equipment)	September 5, 2015
Final Inspection Site Visit of Marsh Creation	September 11, 2015
Final Acceptance of Marsh Creation	September 15, 2015
Construction Completion (Access Channel Backfill)	September 16, 2015
Notice of Acceptance	October 21, 2015

³ Mechanical dredge completed construction of the Access Channel, Earthen Ridge and Earthen Containment Dike.

12. Construction Sequences and Activities

Below is the sequence of activities and events which took place during Project construction.

2-6-2014 – Bid Opening
3-18-2014 – Contract awarded to Weeks Marine
3-24-2014 – Notice to Proceed given to Weeks
4-3-2014 – Pre-Construction conference
5-5-2014 – Pre-Construction surveys began
5-27-2014 – Construction Update Meeting #1
6-27-2014 – Construction Update Meeting #2
7-16-2014 – Bi-Weekly Construction Update #1
7-22-2014 – Mechanical dredge J.C. Deville mobilized and Access Channel construction began
7-30-2014 – Bi-Weekly Construction Update #2
8-13-2014 – Bi-Weekly Construction Update #3
8-16-2014 – Clearing and Grubbing equipment mobilized; Access Channel dredging stopped because dredge was unable to cross Chevron Pipeline at station 27+00 (see plan sheet 69).
8-17-2014 – Clearing and Grubbing of Earthen Ridge and Containment Dike began
8-20-2014 – Abandoned pipeline removal equipment mobilized and removal began
8-27-2014 – Bi-Weekly Construction Update #4; Earthen Ridge and Containment Dike construction began
8-30-2014 – Abandoned pipeline removal completed and equipment demobilized
9-4-2014 – Sand fill equipment mobilized and placement of sand fill began
9-10-2014 – Bi-Weekly Construction Update #5
9-2-2014 – Chevron mobilized equipment to bury pipeline at Access Channel station 27+00 (see plan sheet 69).
9-15-2014 – Sheet pile driving equipment mobilized.
9-16-2014 – Chevron finished burying pipeline at Access Channel station 27+00 (see plan sheet 69) and demobilized equipment.
9-22-2014 – Steel sheet pile installation began
9-24-2014 – Bi-Weekly Construction Update #6
10-8-2014 – Bi-Weekly Construction Update #7
10-13-2014 – Placement of sand fill finished
10-20-2014 – Execution of Change Order 1. Change order included reduced sand volume to match the volume installed by the contractor.
This resulted in a cost reduction of \$26,583.50.
10-22-2014 – Bi-Weekly Construction Update 8
10-29-2014 – Steel sheet pile installation finished and all equipment demobilized
11-5-2014 – Bi-Weekly Construction Update #9
11-19-2014 – Bi-Weekly Construction Update #10
12-3-2014 – Bi-Weekly Construction Update #11
12-17-2014 – Bi-Weekly Construction Update #12
1-14-2015 – Bi-Weekly Construction Update #13
1-21-2015 – Mechanical dredge JC Deville demobilized; Mechanical dredge 6401 mobilized
1-27-2015 – Connection and installation of hydraulic marsh creation pipeline began
1-28-2015 – Bi-Weekly Construction Update #14
1-29-2015 – Local notice to mariners submitted for CR McCaskill hydraulic dredge
2-2-2015 – Execution of Change Order 2. Change order included additional standby time of 11 days added to contract schedule and increased costs of \$88,837.00 to account for a standby time caused by an 8 inch Chevron Pipeline located in the Access Channel which impeded construction.

2-11-2015 – Bi-Weekly Construction Update #15

2-24-2015 – Execution of Change Order 3. Change order included additional time of 11 days to place sand to fill a gap along the northern Earthen Containment Dike of MCA C. No additional costs were incurred.

2-25-2015 – Bi-Weekly Construction Update #16

3-11-2015 – Bi-Weekly Construction Update #17

3-16-2015 – Booster pump 3302 mobilized and installed in Access Channel

3-18-2015 – Dredge CR McCaskill mobilized to East Offshore Borrow Area in Gulf of Mexico and Area D first hydraulic marsh creation lift began

3-24-2015 – Earthen Ridge and Containment Dike construction completed; Mechanical dredge 6401 demobilized

3-25-2015 – Bi-Weekly Construction Update #18; Area D Earthen Containment Dike at Gulf South Pipeline observed sliding and hydraulic filling of Area D stopped; Area C first hydraulic marsh creation lift began

4-8-2015 – Bi-Weekly Construction Update #19; Area B first hydraulic marsh creation lift began

4-22-2015 – Bi-Weekly Construction Update #20; Area A first hydraulic marsh creation lift began

5-6-2015 – Bi-Weekly Construction Update #21

5-6-2015 – Execution of Change Order 4. Change order included additional cost of \$20,836.00 for removal of an additional abandoned pipeline found in MCA B.

5-8-2015 – Area D second hydraulic marsh creation lift began

5-12-2015 – Construction stoppage to begin 60 days of settlement; Weeks demobilized most of their equipment

5-20-2015 – Bi-Weekly Construction Update #22

5-27-2015 – Execution of Change Order 5. Change order included additional time of 60 days to allow for designed Marsh Fill Cell settlement time.

6-3-2015 – Bi-Weekly Construction Update #23

7-1-2015 – Bi-Weekly Construction Update #24

7-13-2015 – Construction resumes on marsh creation after 60 days of settlement; Weeks mobilized equipment

7-15-2015 – Bi-Weekly Construction Update #25; Area B second hydraulic lift began

7-20-2015 – Area A second hydraulic lift began

7-27-2015 – Area C second hydraulic lift began

7-29-2015 – Bi-Weekly Construction Update #26

7-30-2015 – Area D third hydraulic lift began

7-31-2015 – Marsh creation construction complete

8-1-2015 – Hydraulic dredge (CR McCaskill) demobilized

8-12-2015 – Bi-Weekly Construction Update #27

9-5-2015 – All marsh creation equipment demobilized

9-22-2015 – Execution of Change Order 6. Change order included additional cost of \$211,306.00 for maintenance of the Earthen Ridge and Containment Dike and additional surveying of the East Borrow Area during 60 day suspension of hydraulic dredging, and additional surveying of the East Borrow Area to confirm changes during hydraulic dredging suspension.

10-6-2015 – Execution of Change Order 7. Change order included an additional 21 days of Contract Time to enable the Contractor to place modified final lifts in the marsh creation cells, and an additional 28 days of Contract Time to account for additional dewatering time after placement of the final marsh creation cell lift. A total of 49 days was added to the Contract Time. The change order also includes cost reductions based on final as-built conditions differing from design conditions.

10-21-2015 – Final Acceptance issued by CPRA to the Contractor.

12-23-2016 – Final Project Report Submitted to CPRA.

13. Safety and Accidents

No known recordable accidents occurred during construction.