



Coastal Protection and  
Restoration Authority of Louisiana

**State of Louisiana  
Office of Coastal Protection and  
Restoration**

**2009 Annual Inspection Report**

for

**BRADY CANAL HYDROLOGIC  
RESTORATION PROJECT (TE-28)**

State Project Number TE-28  
Priority Project List 3

June 30, 2009  
Terrebonne Parish

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## **I. Introduction**

The Brady Canal Hydrologic Restoration Project consists of 7,653 acres located in the Terrebonne Basin, within the Bayou Penchant - Lake Penchant watershed in Terrebonne Parish, Louisiana. The project is bounded by the Bayou Penchant, Brady Canal, and Little Carencro Bayou to the north, Bayou Decade and Turtle Bayou to the south, Superior canal to the east, and Little Carencro Bayou and Voss Canal to the west (Appendix A – Project Features Map).

The Brady Canal Project is a hydrologic restoration project consisting of the installation and maintenance of a fixed crest weir with barge bay, a rock plug, several variable crest weir structures, earthen embankments and overflow banks, rock dikes, rock armored earthen embankments and rock armored channel liners. These structures were designed to reduce the adverse tidal affects and saltwater intrusion in the project area and to promote freshwater introduction to better utilize available freshwater and sediment retention as well as encourage re-establishment of emergent and sub-aquatic vegetation in eroded areas (Folse, August 2003)

The Brady Canal Hydrologic Restoration Project (TE-28) is co-sponsored by the Natural Resource Conservation Service (NRCS) and the Louisiana Office of Coastal Protection and Restoration (OCPR). The 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 and approved on the third Priority Project List.

As a result of wide-spread ecological and structural damage caused by Hurricanes Gustav and Ike, the CWPPRA Task Force authorized emergency funding, through the OCPR , to conduct post-storm damage assessment inspections of all constructed CWPPRA projects which were believed to have sustained damages from Hurricane Ike. The purpose of the damage assessment is to determine the extent of damages to existing project features, if any; provide a full accounting of the necessary corrective actions along with estimated project costs, and to initiate contact with the Federal Emergency Management Agency (FEMA) for potential storm related claims. The annual inspection of the Brady Canal Hydrologic Restoration (TE-28) project usually occurs in the first quarter (March/April) of each year. However, due to the damage caused by Hurricanes Gustav and Ike, a damage assessment was performed immediately following the storms in September 2008. With concurrence from the federal sponsor, NRCS, the OCPR has decided not to conduct the field investigation portion of the annual inspection in the first quarter of 2009, but rather use the field information gathered on the damage assessment field trip in September 2008 to produce the 2009 Annual Inspection Report.

## **II. Inspection Purpose and Procedures**

The purpose of the annual inspection of the Brady Canal Hydrologic Restoration Project (TE-28) is to evaluate the constructed project features, identify any deficiencies, and prepare a report detailing the condition of the project features including recommendations for corrective actions, if needed. Should it be determined that corrective actions are needed, OCPR shall provide in the report, a detailed cost estimate for engineering, design, bidding, construction oversight and supervision, inspection, project contingencies, and an assessment of the urgency of such repairs (LDNR\_CRD; Pyburn and Odom, 2002 OM&R Plan). The annual inspection report also contains a summary of the completed maintenance projects and an estimated projected budget for the upcoming three (3) years for operations, maintenance and rehabilitation. The three (3) year projected operations and maintenance budget is shown in Appendix C. A summary of completed operation and maintenance projects are outlined in Section IV of this report.

As noted in introduction of the report, the field investigation portion of the 2009 Annual Inspection was not performed, but rather the information gathered from the damage assessment of the Brady Canal project in September 2008 will be presented in this report. The damage assessment for the Brady Canal project was held on September 30, 2008. In attendance were representatives from the OCPR (Brian Babin, Shane Triche and Laurie Rodrigue), Natural Resources Conservation Service (Loland Broussard) and the landowners. Representing the landowners were Mr. Francis Fields with Apache Minerals and Mr. Frank Ellender with ConocoPhillips. The damage assessment began at approximately 8:45 a.m. on the east side of the project near Turtle Bayou and ended at 11:45 a.m. on the west end of the project at the Apache Minerals Camp near the intersection of Bayou Penchant and Brady Canal.

The field investigation included a complete visual inspection of all constructed project features and earthen embankments making up the boundary of the project area. Temporary benchmarks located on three (3) water control structures in Jug Lake were utilized to determine approximate water elevations at the time of the inspection. A hand held fathometer and GPS unit was used to measure water depths and mark low areas along rock dikes and earthen embankments. Photographs of project features taken during the damage assessment field trip are shown in Appendix B.

## **III. Project Description and History**

The Brady Canal Hydrologic Restoration project is bisected by the Mauvais Bois Ridge, resulting in different hydrologic regimes to the north and south of the ridge. The northern section of the project area receives freshwater and sediments which are provided by over-bank flow from Bayou Penchant, Little Carencro Bayou, and Brady Canal (USDA/NRCS 1995). The Mauvais Bois Ridge forms a barrier through the project area reducing the outflow of freshwater to the southern portion of the project area. Freshwater

and sediment retention in the southern portion of the project area has diminished due to unimpeded through-flow and tidal exchange combined with a lack of freshwater introduction from the north (USDA/NRCS 1995). In addition, oilfield access canals extending from within the project area to the Bayou Decade levee ridge have also increased tidal exchange and provided direct routes for saltwater intrusion and reduced freshwater and sediment retention (USDA/NRCS 1995).

Major changes to the hydrology of the Penchant Basin, both natural and human induced, have resulted in a complex hydrologic setting (USDA/NRCS 1995). Under natural hydrologic conditions, the Penchant Basin is confined by natural levee ridges and is open to the west and southwest where it connects with the Lower Atchafalaya River, Atchafalaya Bay, and Fourleague Bay. Historically, this hydrologic setting produced an estuarine system created by freshwater introduction in the upper basin and tidal exchange with the bays. Over time, hydrologic conditions in the Penchant Basin were altered by the construction of numerous canals, levees, local water management structures, and major public works projects. Some of the major projects that have contributed to the change in the hydrologic conditions of the basin are the Atchafalaya Basin Floodway, the Avoca Island Levee project along the Lower Atchafalaya River, the Gulf Intracoastal Waterway (GIWW), the Bayou Chene, Boeuf, and Black Projects, the rock weir at Wax Lake, and the Houma Navigation Canal (USDA/NRCS 1995).

The objective of the Brady Canal Hydrologic Restoration Project is to maintain and enhance existing marshes in the project area by reducing the rate of tidal exchange and improving the retention of introduced freshwater and sediment (Folse T., 1998). Specific goals of the project are to (1) decrease the rate of marsh loss, (2) maintain or increase the abundance of plant species typical of a freshwater and intermediate marsh, (3) decrease variability in water level within the project area, (4) decrease variability in salinities in the southern portion of the project, (5) increase vertical accretion within the project area and (6) increase the frequency of occurrence of SAV within the project area. (Folse T., 1998)

The Brady Canal Hydrologic Restoration Project (TE-28) was completed in July 2000 and involved the installation of the following project features:

- Site 6 – fixed crest weir with barge bay
- Site 7 – rock plug
- Site 10 – stabilization rock armored channel liner
- Site 14 – fixed crest weir with variable crest section
- Site 20 – stabilization rock armored channel liner
- Site 21 – fixed crest weir with three (3) variable crest sections
- Site 23 – fixed crest weir with two (2) variable crest sections
- Site 24 – fixed crest weir
- 4,405 linear ft. – rock armored earth embankment
- 3,660 linear ft. – rock dike
- 8,531 linear ft. – Earthen embankment
- Maintenance of existing over-flow banks (21,600 ft.)

#### **IV. Summary of Past Operation and Maintenance Projects**

General Maintenance: Below is a summary of maintenance projects and operation tasks performed since the completion of the Brady Canal Hydrologic Restoration (TE-28) project.

Under Article II of the Brady Canal Cost Share Agreement, the landowners, ConocoPhillips, formerly Burlington Resources and Apache Minerals Corporation were granted in-kind service credits to repair existing earthen embankments within the project area. Below is a description of work and cost associated with the maintenance performed by the landowners:

##### In Kind Service Credits

7/30/2007 – Apache Corporation contracted Dupre Brothers Construction, Inc. of Houma, La. to repair several breaches along the east bank of Jug Lake and reinforce earthen embankment tie-ins adjacent to variable crest weir structures #21, #23, and #24. The repairs were completed on 7/30/2008 at a total cost of \$9,103.12

9/20/2006 - Apache Corporation contracted Frisco Construction Co. Inc. of Houma, La. to repair breaches and refurbish low areas of the spoil banks along the east bank of Jug Lake and embankment tie-ins adjacent to structures #21, #23 and #24. The repairs were completed on 9/20/2006 at a total cost of \$9,265.

10/31/2003 - Apache Corporation contracted Berry Bros. General Contractors to completed 5,050 linear feet of levee refurbishment along the west bank of Jug Lake. The cost for the levee refurbishment including construction oversight was \$34,284.87. Following the levee refurbishment, Shaw Coastal performed an as-built survey of the repairs at a cost of \$5,100.60. The total project cost for this maintenance event was \$39,385.47.

8/15/2003 – ConocoPhillips, formerly Burlington Resources, completed the repair of two (2) large breaches along Little Carencro Bayou following Hurricane Lili. The maintenance project was completed on 8/15/2003 at a total cost of \$31,642.57, including construction oversight and administration.

10/21/2002 - Apache Corporation contracted Frisco Construction Co. to repair and restore the existing levee embankment along Turtle Bayou, Superior Canal, and along the west bank of Jug Lake. This work was completed at a total cost of \$5,310,.

Brady Canal Breach Repair Project (2003) – This maintenance project was completed on August 13, 2003 by the Louisiana Department of Natural Resources (LDNR) and included the installation of approximately 9,667 tons of riprap along the north bank of Bayou Decade, 2,325 linear feet of levee refurbishment and earthen breach repair along Turtle Bayou and Superior Canal, and replacement of a timber pile on the navigational aid structure at Weir 6. The cost associated with the engineering, design and construction of the 2003 Brady Canal Breach Repair Project is as follows:

Construction:	\$471,329.65
Engineering & Design:	\$ 54,473.00
Bidding:	\$ 4,100.00
Construction Administration:	\$ 8,020.00
Construction Oversight:	\$ 49,635.00
As-built Survey and Drawings:	<u>\$ 12,873.00</u>
 Project Total:	 \$600,430.65

Structure Operations: In accordance with the operation schedule outlined in the Operation and Maintenance Plan, Structures #14, #21, and #23 have been operated twice annually beginning in April 2002. Below is a summary of costs incurred for structure operations:

03/02	Pyburn & Odom	\$9,772.50
09/02	CEEC	\$4,674.00
03/03	CEEC	\$4,022.58
09/03	CEEC	\$3,612.93
03/04	Shaw Coastal	\$4,676.18
09/04	Shaw Coastal	\$5,365.25
03/05	T. Baker Smith	\$8,804.83
09/05	T. Baker Smith	\$8,886.60
03/06	T. Baker Smith	\$7,668.59
09/06	T. Baker Smith	\$9,970.37
03/07	T. Baker Smith	\$8,602.12
09/07	T. Baker Smith	\$9,203.61
03/08	T. Baker Smith	\$7,595.99
10/08	Apache Minerals	\$6,000.00
03/09	Apache Minerals	\$6,000.00

Prior to the scheduled operations in September 2008, the OCPR entered into a sole-source agreement with Apache Minerals for the landowner to assume responsibility of operating all water control structures associated with the Brady Canal (TE-28) project. The cost proposal submitted by Apache to complete this work in accordance with terms of the agreement is \$12,000, annually. Apache began structure operations in October 2008.

Navigational Aids Maintenance: During the operation and maintenance phase of the Brady Canal Hydrologic Restoration (TE-28) Project, the navigational aids at Structure 6 along Bayou Decade have been repaired several times. Below are the dates and costs associated with the repair and maintenance of these navigation lights:

2/2007 – LDNR received bids for a state-wide maintenance contract for inspection, diagnostic testing and maintenance of twenty-seven (27) navigational aid systems at ten (10) separate locations throughout the state. Four (4) of the twenty-seven (27) navigational aid structures are located at Structure 6 within the Brady Canal project area. The total cost of the state-wide maintenance contract is approximately \$83,000 annually, with an option to extend the contract for an additional two (2) years. Inspections of the navigational aids at Structure 6 began in February 2007 under the current maintenance contract.

11/2003 – Ernest P. Breaux Electrical Inc. replaced 20 lamps, 4 – batteries, 1 – lamp changer, 1 – photo cell at structure 6. The cost for parts and labor to service these navigational aids was \$4,132.30.

8/2002 - Automatic Power, Inc. of Larose, La. performed trouble shooting services to determine a schedule of parts requiring replacement – Cost: \$465

8/2002 – B&B Electromatic of Norwood, La. repaired the navigation lights at structure 6 including parts and labor for a total cost of \$2,039.

## **V. Inspection Results**

### **Structure 6 – Fixed crest weir with barge bay**

Structure 6 appeared to be in fair condition with severe damage to the steel guard rail attached to the sheetpile wall on the west side of the barge bay entrance and moderate damage to the timber navigational aid pile supports on the southwest side (Bayou Decade) of the structure. The steel guard rail mounted on top of the channel cap of the steel bulkhead was damaged by an oil field service barge while accessing the barge bay opening. Since the September 2008 damage assessment, the oil field service contractor has replaced the timber bumper guards and straightened the guard rail on the west side of the barge bay. Other deficiencies included moderate damage to the two (2) timber batter piles supporting the navigation aid systems on the south side of the structure. The batter piles were off center and split down the middle, and the steel cable wraps around the pile cluster were very loose. Although there is visual damage to both timber pile clusters, it is not anticipated that structural failure is imminent. However, to avoid having to incur additional costs associated with mobilizing equipment in the future to replace the two (2) structures, it is recommended that the timber dolphin system be included in the next maintenance project for the Brady Canal project. It doesn't appear that there is breaching



of the earthen embankment on either side of the structure. Although there are no breaches in this embankment at this time, it is recommended that the spoil bank adjacent to the structure be refurbished with dredged material from Bayou Decade during the next maintenance project. All navigation lights and signage appear to be in working condition. Automatic Power, Inc. of Larose has been maintaining the navigation lights under a maintenance contract with OCPR since February 2007. (Appendix B, Photos 1-6).

### **Structure 7 – Rock Plug**

Structure 7 appeared to be in very good condition. There were no indications of erosion around the ends of the structure or rock displacement along the length of the plug. The warning signs and supports were also in very good condition. (Appendix B, Photo 7)

### **Structure 10 – Stabilization rock armored channel liner**

The rock armored channel along Voss Canal appeared to be in good condition with no apparent structural settlement or rock displacement. With most of the structure underwater, it is difficult to determine if the rock structure below the water line has settled. Therefore, it is recommended that a survey profile be performed to assess the condition of the entire rock channel liner structure. The only visible damage to Structure 10 was the three (3) warning signs marking the channel on the interior marsh side of the structure. The warning signs were leaning over to one side. At this time, we do not know if the timber support piles were cracked or sheered below the water line, or if the embedded portion of the pile tips shifted under the intense winds produced by Hurricanes Gustav and Ike. Regardless of the cause, it is recommended that the damaged timber supports be removed and replaced with new timbers and the signs reinstalled. (Appendix B, Photos 8-12).

### **Structure 14 – fixed crest weir w/ variable crest section**

The variable crest weir structure located along the east bank of Bayou Carencro appeared to be in very good condition with only minor erosion noted on both sides near the earthen embankment tie-ins. The signs, timber supports and structural components of Structure 14 were in good condition with no noticeable structural damage or corrosion. All signs and supports were also in good condition (Appendix B, 13-15).

### **Structure 20 – Stabilization rock armored channel liner**

Rock rip-rap channel liner located along the west bank of Jug Lake appeared to be in good condition with no obvious rock settlement or displacement. The warning signs and timber pile supports were also in good condition. As in the case of Structure 10, it is recommended that a survey profile of the rock armored channel be performed to determine if the structure settlement below the water line is of concern, and if maintenance is required. (Appendix B, Photos 16-17).

### **Structure 21 – fixed crest weir w/ three (3) variable crest sections**

The variable crest weir structure appeared to be in fair condition with no indication of structural damage or corrosion of the structural components. The earthen embankment tie-ins on both sides of the Structure No. 21 have experienced significant erosion, most notable on the north side. The earthen embankments tie-ins were last refurbished by Apache Minerals in July 2007 under their in-kind service agreement with the OCPR. As documented in previous annual inspection reports, the earthen wing walls have required maintenance several times in previous years to avoid breaching around the steel bulkhead. To alleviate the need for continued maintenance of the earthen embankments in the future, it is recommended that the earthen tie-ins be reinforced with stone or rip rap once the embankment is refurbished. A hardened structure in these areas should provide adequate protection from erosion and breaching. (Appendix B, Photos 18-20)

### **Structure 23 – fixed crest weir w/ two (2) variable crest sections**

The variable crest weir structure appeared to be in fair condition with no visible damage or corrosion of the structural components. We did observe a breach on the north side of the structure near the earthen embankment tie-ins, exposing the end of the steel sheetpile bulkhead and allowing tidal exchange through the embankment. The earthen tie-ins on both sides of the structure were refurbished by Apache Minerals in July 2007. As noted on previous inspections, the wing-walls adjacent to Structure 23 have been repaired several times over the past few years due to constant erosion of embankment tie-ins. To avoid the need for continued maintenance of the earthen embankments in the future, it is recommended that a rock armor or rip rap pad be constructed along the tie-ins on both sides of the structure to protect these areas from erosion. All signs and timber supports were in good condition. (Appendix B, Photos 22-24)

### **Structure 24 – fixed crest weir**

The fixed crest weir located along the southeast bank of Jug Lake appeared to be in very good condition with no visual signs of corrosion of the structural components or erosion of the earthen tie-ins. The earthen tie-ins were refurbished by Apache Minerals, Inc. in July 2007 and are holding up well. All signs and timber supports were also in good condition. (Appendix B, Photo 25)

### **Earthen Embankments**

The inspection of earthen embankments consisted of a visual inspection of previously repaired breaches performed under the 2003 Brady Canal Breach Repair Project, levee refurbishment work performed by the landowners along the shoreline of Jug Lake and adjacent to water control structures located along the rim of Jug Lake, as well as an inspection of existing embankments and overflow banks making up the boundary of the Brady Canal Hydrologic Restoration Project. Below are the results of the earthen embankment inspections:

### **Brady Canal Maintenance Project (2003)**

Breach Repair 1 thru 4 – consisted of the construction of a rock dike and breach closures along a low lying ridge on the north bank Bayou Decade from Turtle Bayou to the mouth of Jug Lake. Based on visual observations during the damage assessment following Hurricanes Gustav and Ike, it was apparent that tidal surges and over-wash of the dike during the storms had resulted in moderate displacement of the rock riprap. We have noticed considerable displacement of the rip rap on the dike following the 2005 and 2008 storms causing the constructed section to become irregular and rounded. The displacement of rock material and possible settlement of the structure has also caused a decrease in the crest elevation of the rock dike. Considering the rock displacement that has taken place, the dike remains in fair condition with only isolated locations where settlement was visible. (Appendix B, Photos 26-31)

Breach Repair 5 & 6 –consisted of the refurbishment of a low area along Turtle Bayou from the mouth of Superior Canal 1500’ southward, utilizing dredge material obtained from the bottom of Turtle Bayou. The entire length of the refurbished levee appeared to be in good condition with only minor erosion (cut banks) along the toe of the levee. (Appendix B, Photos not available)

Breach Repair 7 – is located along an existing oilfield canal off of Superior Canal in the northeast section of the project area. Due to the depth of the opening in the earthen embankment, rock rip-rap was used to plug the breach and reinforce the adjacent bank line. The rock riprap breach closure appeared to be in very good condition with no visual signs of settlement or rock displacement. (Appendix B, Photos 32-34)

Breach Repair 8 – included the refurbishment of a 200 linear foot section of bank line along west bank of Superior Canal adjacent to an existing pipeline right-of-way. Dredge material obtained from channel bottom of Superior Canal was utilized to reinforce the existing bank. The earthen embankment in this area was in good condition no visible signs of erosion along the toe or settlement of the embankment. (Appendix B, Photos not available)

Breach Repair 9 – included approximately 250 linear feet of bank refurbishment along the southern end of Superior Canal on the south bank. This bank line was repaired using dredge material from Superior Canal. The earthen embankment in this area was in very good condition with no visible erosion or settlement of the embankment. (Appendix B, Photos not available)

### **Rock Armored Embankments**

Rock armored embankments along the north bank of Bayou de Cade and Voss Canal appear to be in good to fair condition. The rock dike beginning at the intersection of Bayou Decade and Voss Canal to Structure 10 along the east bank of Voss Canal appeared to have settled slightly with moderate displacement since construction. Although low, there were no indications of breaching in the dike or severe rock displacement. OCPR will continue to monitor the condition of rock dike structure on future field investigations. (Appendix B, Photos not available)

### **Existing Earthen Embankments and Overflow Banks**

During the visual inspection of all earthen embankments and overflow banks which make up the boundary of the Brady Canal Hydrologic Restoration Project, a total of eight (8) breach locations were identified along the northwestern boundary of the project area and another two (2) locations where the crest of the earthen embankments were low. Breaches Nos.1, 2, 3 and 4 are located along Carencro Bayou north of Structure 14. Breach No.5 is located along Little Carencro Bayou midway between Carencro Bayou and Brady Canal. Breaches Nos. 6, 7 and 8 are located along Brady Canal between Little Carencro Bayou and Bayou Penchant. The eight (8) breaches ranged between 10' and 40' wide. The location of each breach is shown in the 2009/2010 Work Plan under Appendix D. Other deficiencies included low and degraded sections of the earthen embankment along Voss Canal north of Structure 10. The bank line in this area appears to have receded since the completion of construction. Although the existing embankment is in fair condition and does not warrant maintenance at this time, we are recommending vegetative plantings along the slopes and berm for added protection against erosion.

### **Other Maintenance Issues**

Over the past several years, since Hurricanes Katrina and Rita, the earthen levee surrounding Jug Lake has become very thin and narrow, particularly on the southeast side of the lake. Of all the overflow banks and levee embankments making up the boundary of Brady Canal project, the perimeter of Jug Lake has become an area of most concern. The Jug Lake boundary is approximately 20,000 ft. in length and is situated in a northeasterly to southwesterly direction with very little interior marsh remaining on the inside of the project area adjacent to the levee. For this reason, both sides of the earthen embankment are exposed to high wave energies from the lake and the open water on the inside of the project area. The degradation of this levee would have negative impacts to the project by rendering the three (3) water control structures along the lake boundary inoperable and allow large volumes of high saline waters into the northern portions of the project area which is primarily fresh. Considering the negative impacts associated with the failure of the earthen embankment system surrounding Jug Lake, it is recommended that the entire levee be refurbished to original elevations and sections outlined in the permit. The material to refurbish the levee would be obtained from the lake bottom.

## **VI. Conclusions and Recommendations**

Overall, the project features appeared to be in fair condition with isolated breaching along Carencro Bayou, Little Carencro Bayou and Brady Canal, moderate to severe erosion along the entire rim of Jug Lake and the earthen embankment tie-ins adjacent to Structures 6, 21 and 23, and structural damage to the timber dolphin supporting the navigational aid system at Structure 6. In regards to the breaching of the overflow banks and erosion along the rim of Jug Lake and the embankment tie-ins, it is recommended that these locations be repaired and/or refurbished using dredge material from the adjacent lakes and channels. In addition to refurbishment of the earthen embankments, it is also recommended that the earthen wing-walls adjacent to the three (3) water control structures in Jug Lake be armored with riprap. The estimated project costs associated with these recommendations are outlined in the Three Year Budget Projections and Worksheets in Appendix C. Below are descriptions and method of repairs for the proposed maintenance recommended in the 2009/2010 Workplan shown in Appendix D.

### Breach Repairs:

A total of eight (8) breaches ranging in width of 10' to 40' along the overflow banks on the north and northeast boundary of the project (Carencro Bayou, Little Carencro Bayou and Brady Canal) were identified for repairs. The recommended method of repair shall include dredging in situ material from the adjacent canals to reconstruct the earthen embankment to the original section. The locations of the eight (8) breaches are shown in the 2009/2010 Work Plan under Appendix D. It is also recommended that the crest, slopes and berms of the existing earthen embankment along Voss Canal be re-vegetated during the 2009/2010 maintenance event.

### Jug Lake Refurbishment/ Earthen Embankment Armoring:

As outlined in Section V of this report, it is recommended that approximately 20,000 linear feet of earthen embankment along the perimeter of Jug Lake be refurbished during this maintenance cycle. The method of repair shall include clearing and grubbing trees and brush on the existing embankment and excavating material from the lake bottom to restore the embankment to the original permitted section followed by seeding of the entire crest and slope of the embankment. Once the refurbishment of the earthen embankment of Jug Lake is complete, a 100' wide rock armored blanket shall be installed adjacent to the three (3) water control structures along the crest and slopes of the wing-walls. The locations of the earthen embankment refurbishment and installation of the rock blankets are shown in the 2009/2010 Work Plan under Appendix D.

### Timber Cluster Pile Replacement

The timber cluster pile replacement shall include removal of two (2) existing timber pile structures and replacing them with new treated timber piles, supports and hardware. This work shall also include removal and reinstallation of the navigation aid system.

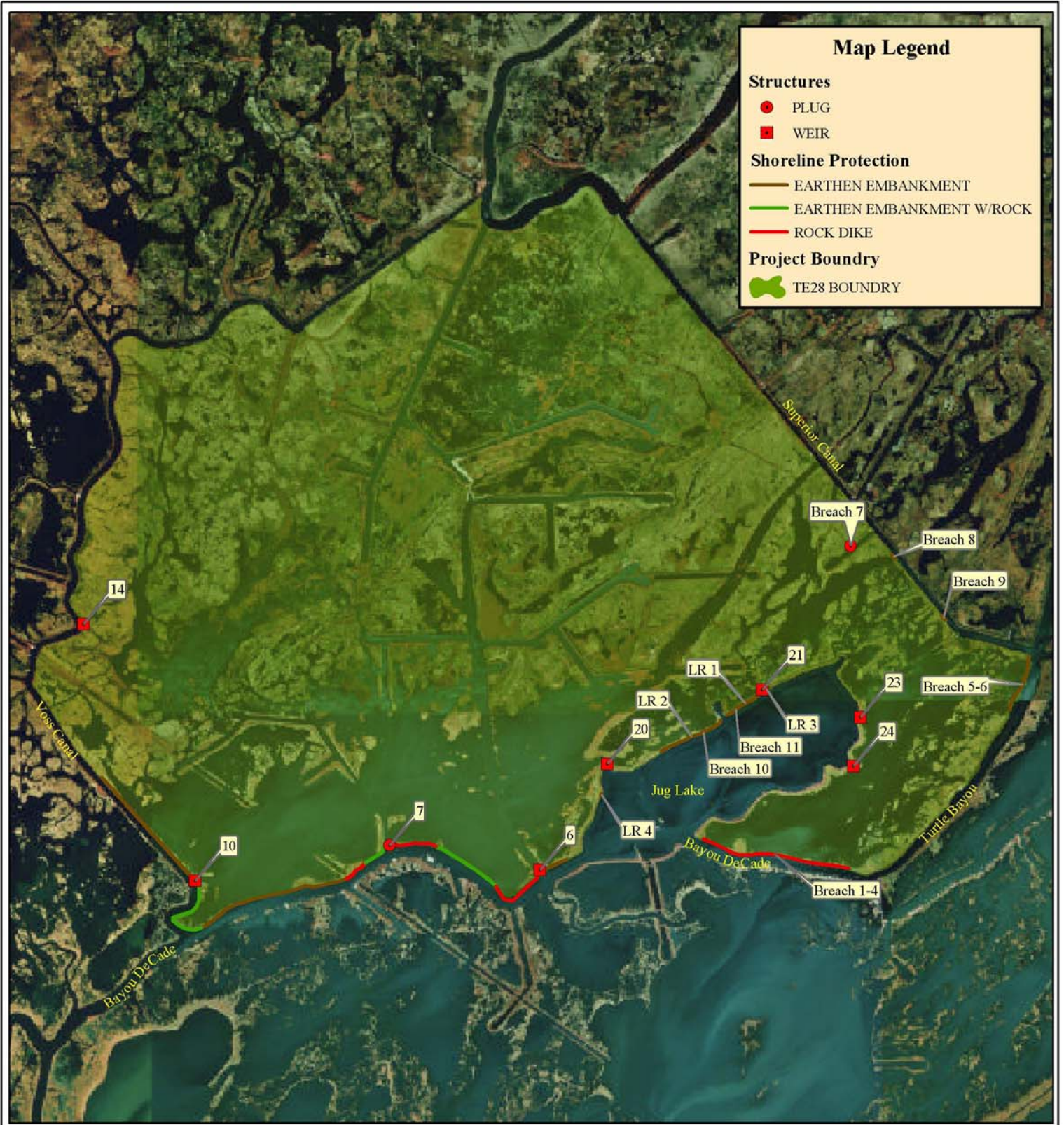
#### References:

Folse, T. August 2003. Monitoring Plan for the Brady Canal Hydrologic Restoration Project (TE-28), Louisiana Department of Natural Resources, Coastal Restoration Division, 16pp.

Louisiana Department of Natural Resources – Coastal Restoration Division and Pyburn and Odom, Inc. 2002. Operation, Maintenance and Rehabilitation Plan for the Brady Canal Hydrologic Restoration Project (TE-28)

United States Department of Agriculture – Natural Resources Conservation Service 1995. Project Plan and Environmental Assessment for the Brady Canal Hydrologic Restoration Project

**Appendix A**  
**Project Features Map**



**Map Legend**

**Structures**

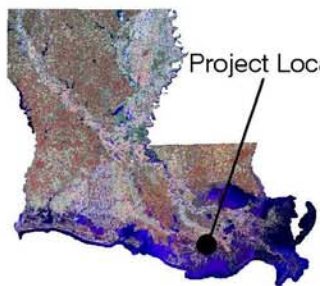
- PLUG
- WEIR

**Shoreline Protection**

- EARTHEN EMBANKMENT
- EARTHEN EMBANKMENT W/ROCK
- ROCK DIKE

**Project Boundry**

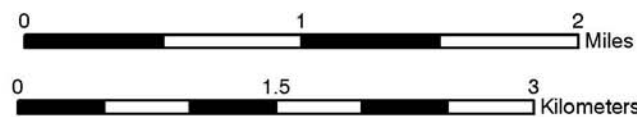
- TE28 BOUNDRY



Project Location

TE28 - Brady Canal Hydrologic Restoration

PROJECT FEATURES MAP



Data Source:  
 LA Dept. Natural Resources  
 Coastal Engineering Division  
 Thibodaux Field Office

1998 DOQQ AERIAL

Date: March 2, 2005

Map ID: 2005-TFO-010



## **Appendix B**

### **Photographs**



Photo No. 1 - View of timber navigation aid structure and steel bulkhead on the east side of the barge bay of Structure No.6 along Bayou Decade.



Photo No. 2 – View of the timber navigational aid structure on the southeast side of Structure No.6. The center pile of this structure was replaced in 2003.



Photo No. 3 – View of the timber navigational structure on the southwest side of Structure No.6.



Photo No. 4 – View of the steel bulkhead and timber bumper guards on the west side of the barge bay of Structure No.6. The timber bumper guards were recently replaced by the oilfield service contractor at the request of the landowner.



Photo No.5 – View of the timber navigational aid support and light on the northeast side of Structure No.6



Photo No.6 – view of the north bank of Bayou Decade west of Structure No.6



Photo No.7 – An overall view of the rock plug (Structure No.7) on the north bank of Bayou Decade



Photo No.8 – view of the south side of the rock channel liner (Structure No.10) along Voss Canal. The warning signs in the background of the photo are leaning over as a result of strong winds from Hurricanes Gustav and Ike.



Photo No. 9 – A closer view of the damaged warning signs at Structure No.10 shown in the previous photo.



Photo No.10 – The interior warning sign on the north side of the rock channel liner (Structure No.10) along Voss Canal.



Photo No.11 – A closer view from the interior marsh area showing the damaged warning signs on the south side of Structure No.10.



Photo No.12 – An overall view of the rock channel liner (Structure No.10) and existing warning signs.



Photo No.13 – view of the steel bulkhead on the south side of the variable crest weir (Structure 14) along Little Carencro Bayou.



Photo No. 14 – View of the steel bulkhead on the north side of the variable crest weir (Structure 14) along Little Carencro Bayou.





Photo No. 15 – View of the variable crested weir section at Structure 14 along Little Carencro Bayou.



Photo No. 16 – View of the northern end of the rock channel liner of Structure No.20.



Photo No. 17- An overall view of the rock channel liner (Structure 20) looking southeast towards Jug Lake.



Photo No. 18 – View of the northern end of the steel bulkhead at Structure No.21. Although there was no breach present, the earthen embankment had eroded back beyond the face of the bulkhead exposing the end of the structure.



Photo No.19 – View of the southern end of the steel bulkhead at Structure No. 21. Observed moderate erosion of the earthen embankment exposing the end of the bulkhead.



Photo No.20 – An overall view of the three (3) bay variable crest weir at Structure No.21.



Photo No. 21 - View of the bulkhead tie-in to the earthen embankment on the south side of Structure No. 23.



Photo No.22 – An overall view of the two (2) bay variable crest weir (Structure No.23) looking north.



Photo No.23 – View of the northern end of the bulkhead of Structure No.23. The earthen embankment had eroded around the end of the bulkhead forming a breach.



Photo No.24 – Another view of the breach around the north end of Structure No.23.



Photo No.25 – view of the northern tie-in to the earthen embankment at Structure No. 24.



Photo No.26 – Existing marsh along the north bank of Bayou Decade connecting the east end of the rock dike constructed in 2003 and the existing bank of Turtle Bayou.



Photo No.27 - Rock dike construction in 2003 along the north bank of Bayou Decade between Turtle Bayou and Jug Lake. There appears to be a fair amount of displacement of rock from Hurricanes Katrina, Rita and Ike.



Photo No. 28 – Heavy concentration of cut grass in front of the rock dike along the north bank of Bayou Decade between Jug Lake and Turtle Bayou. This section of dike is concealed by the grass.



Photo No. 29 – View of rock dike along the north bank of Bayou Decade near Jug Lake.



Photo No.30 – View of the rock dike along Bayou Decade near the mouth of Jug Lake.





Photo No.31 – The very end of the rock dike along Bayou Decade near the mouth of Jug Lake.



Photo No. 32 - View of the rock plug constructed in 2003 (Breach 7) along the north bank of an existing oilfield access canal off of Superior Canal.



Photo No. 33 – View of rock plug (Breach 7) to bank tie-in on the northeast side of the structure.



Photo No.34 - View of rock plug (Breach 7) to bank tie-in on the southwest side of the structure.



Photo No.35 – Area of the shoreline reconstructed in 2003 along the west bank of Turtle Bayou near the mouth of Superior Canal.



Photo No. 36 – Area along Superior Canal where the existing bank line is narrow and low.



Photo No.37 – View of the existing bank along the southeast shoreline of Jug Lake south of Structure No.24. As evident in the photo, the existing bank line sustained extensive damage from Hurricane Ike. There is very little bank line remaining in this area.



Photo No. 38 – Another photo of the degraded bank line along the southeast shoreline of Jug Lake south of Structure No. 24.



Photo No.39 – View of the southeast shoreline of Jug Lake south of Structure No.24. The bank line from Bayou Decade to Structure No.24 was severely degraded during Hurricane Ike.



Photo No. 40 – Another view of the existing shoreline along the southeast bank of Jug Lake.



Photo No. 41 – Section of thin bank line along the north bank of Jug Lake between Structures 23 and 21.



Photo No. 42 – View of shoreline on the west side of Jug Lake between Structures No. 20 and 21.



Photo No. 43 – View of shoreline on the west side of Jug Lake between Structures No. 20 and 21.



Photo No. 44 – View of thin area along the northern bank of Bayou Decade east of Structure No.6 near the mouth of Jug Lake.

## **Appendix C**

### **Three Year Budget Projection and Worksheets**



<b>Brady Canal/ TE-28 / PPL 3</b>			
<b>Three-Year Operations &amp; Maintenance Budgets 07/01/2009 - 06/30/12</b>			
Project Manager	O & M Manager	Federal Sponsor	Prepared By
	<i>Brian Babin</i>	NRCS	<i>Brian Babin</i>
	<b>2009/2010</b>	<b>2010/2011</b>	<b>2011/2012</b>
<b>Maintenance Inspection</b>	\$ 5,736.00	\$ 5,908.00	\$ 6,085.00
<b>Structure Ops/ Nav Aid</b>	\$ 17,000.00	\$ 17,000.00	\$ 17,000.00
<b>OCPR Administration</b>	\$ 23,000.00	\$ 5,500.00	\$ 5,500.00
<b>COE Administration</b>	\$ 1,225.00	\$ 1,240.00	\$ 1,257.00
<b>Maintenance/Rehabilitation</b>			
<b>09/10 Description: Breach Repair, Lake Rim Refurbishment and Timber Cluster Pile Replacement</b>			
<i>E&amp;D</i>	\$85,669.00		
<i>Construction</i>	\$1,136,160.00		
<i>Construction Oversight</i>	\$64,750.00		
<i>Sub Total - Maint. And Rehab.</i>	\$ 1,286,579.00		
<b>10/11 Description: Routine Breach Repairs and Navigational Aid inspection and maintenance</b>			
<i>E&amp;D</i>		\$ -	
<i>Construction</i>		\$ 55,125.00	
<i>Construction Oversight</i>		\$ 3,000.00	
<i>Sub Total - Maint. And Rehab.</i>		\$ 58,125.00	
<b>11/12 Description: Routine Breach Repairs and Navigational Aid Inspection and Maintenance</b>			
<i>E&amp;D</i>			\$ -
<i>Construction</i>			\$ 57,881.00
<i>Construction Oversight</i>			\$ 3,000.00
		<i>Sub Total - Maint. And Rehab.</i>	\$ 60,881.00
	<b>2009/2010</b>	<b>2010/2011</b>	<b>2011/2012</b>
<b>Annual O&amp;M Budgets</b>	\$ 1,333,540.00	\$ 87,773.00	\$ 90,723.00
<b>O &amp; M Budget (3 yr Total)</b>			<b>\$1,512,036.00</b>
<b>Unexpended O &amp; M Funds</b>			<b>\$299,464.33</b>
<b>Remaining O &amp; M Budget (Projected)</b>			<b>\$1,212,572.00</b>
Note: 2009-2012 Unexpended O&M budget includes a deduction of \$94,083 for MIPR O&M funds allocated for NRCS (see attached worksheet for 09-12 accounting)			

**OPERATIONS & MAINTENANCE BUDGET WORKSHEET**

**Project: TE-28 Brady Canal Hydrologic Restoration**

**FY 09/10 –**

OCPR Administration		\$ 23,000*
COE Administration		\$ 1,225
O&M Inspection & Report		\$ 5,736
Operation:		\$ 12,000**
Maintenance:		\$1,291,579
E&D:	\$ 85,669	
Construction:	\$1,136,160***	
Construction Oversight:	\$ 64,750****	
Navigational Aid Maintenance	\$ 5,000	

**Operation and Maintenance Assumptions:**

Refurbishment of the earthen embankments along the perimeter Jug Lake estimated to be approximately 20,000 linear feet in length. The proposed embankment sections shall be constructed to an elevation of +4.0' NAVD with a 10' wide top width and 6:1 side slopes. It is assumed that the existing embankment will make up 40% of the proposed section. Therefore, we are reducing the cross sectional area of the proposed section by 40%.

Area:  $276 \text{ sf.} \times 20,000 / 27 = 204,444 \text{ cy} - 81,777 = 122,666 \text{ cy}$ . Use: 123,000 c.y.

Cap approximately 100 linear feet of the earthen embankment on both ends of Structures 21, 23, & 24. The rock blanket shall be approximately 2' thick and extend the lake floor.

Area:  $166 \text{ sf.} \times 200' / 27 = 1,230 \text{ cy.} \times 1.5 = 1,845 \text{ tons} \times 3 \text{ (structures)} = 5,535 \text{ tons}$

Breach closures at eight (8) locations along Carencro Bayou, Little Carencro Bayou and Brady Canal.

Replacement of timber piling and warning signs at Structure No.10.

**2009/2010 Maintenance Project - Construction Cost:**

Mobilization and Demobilization:	\$ 75,000
Clearing and Grubbing:	\$ 25,000
Earthen Embankments: (123,000 cy. @ \$3.00/cy.)	\$369,000

Armored embankment: (5,535 tons @ \$80/ton)	\$442,800	
Breach Repairs (Carencro Bayou):	\$ 25,000	
Replacement of signs (Structure 10):	<u>\$ 10,000</u>	
	\$946,800	
Contingency: (20%)	\$189,360	
Total Construction Costs:		\$1,136,160

**Engineering and Design Cost:**

Design, Plans and Specifications: (6% of construction)	\$68,169	
Surveying: (5 days @ \$3,000/day)	\$15,000	
Permits:	\$ 2,500	
Construction Inspection: (800 hrs @ \$65/hr)	\$52,000	
Construction Administration: (150 hrs @ \$85/hr)	\$12,750	
OCPR Administration:	<u>\$20,000</u>	
Total E&D and Construction Oversight:	\$170,419	

**Total Overall Estimated Project Costs: \$1,306,579**

**Structure Operations/ Navigational Aid Maintenance**

Structure Operations: 3 – structures are operated twice annually by Apache Minerals for a total of \$12,000\*\*. OCPR Administration: \$3,000\*

Navigational Aid inspection, maintenance and repairs: \$5,000\*\*\*

**FY 10/11 –**

OCPR Administration	\$ 5,500*
COE Administration	\$ 1,240
O&M Inspection & Report	\$ 5,908
Operation:	\$ 12,000**
Maintenance:	\$ 63,125
E&D:	\$ 0
Construction:	\$ 55,125***
Construction Oversight:	\$ 3,000****
Navigation Aid Maintenance	\$ 5,000

**Operation and Maintenance Assumptions:**

Structure Operations: 3 – structures are operated twice annually by landowner for a total \$12,000\*\*, OCPR Administration: \$3,000\*  
Routine Breach Repairs and Levee Refurbishment: 52,500\*\*\* x 5% inflation = \$55,125,  
Construction Oversight: \$3,000\*\*\*\*  
OCPR Admin: \$2,500\*,  
Navigational Aid inspection, maintenance and repairs: \$5,000\*\*\*

It is anticipated that routine earthen breach repairs and navigation lights maintenance will be required during the fiscal year. The cost for breach repairs and levee refurbishment is based on in-kind service credits to the landowner.

**FY 11/12 –**

OCPR Administration	\$ 5,500*
NRCS Administration	\$ 1,257
O&M Inspection & Report	\$ 6,085
Operation:	\$ 12,000**
Maintenance:	\$ 65,881
E&D:	\$ 0
Construction:	\$ 57,881***
Construction Oversight:	\$ 3,000****
Navigational Aid Maintenance	\$ 5,000

**Operation and Maintenance Assumptions:**

Structure Operations: 3 – structures are operated twice annually by landowner for a total \$12,000\*\*, OCPR administration: \$3,000\*  
Routine Breach Repairs and Levee Refurbishment: 55,125\*\*\* x 5% inflation = \$57,881,  
Construction Oversight: \$3,000\*\*\*\*  
OCPR Admin: \$2,500\*,

Navigational Aid inspection, maintenance and repairs: \$5,000\*\*\*

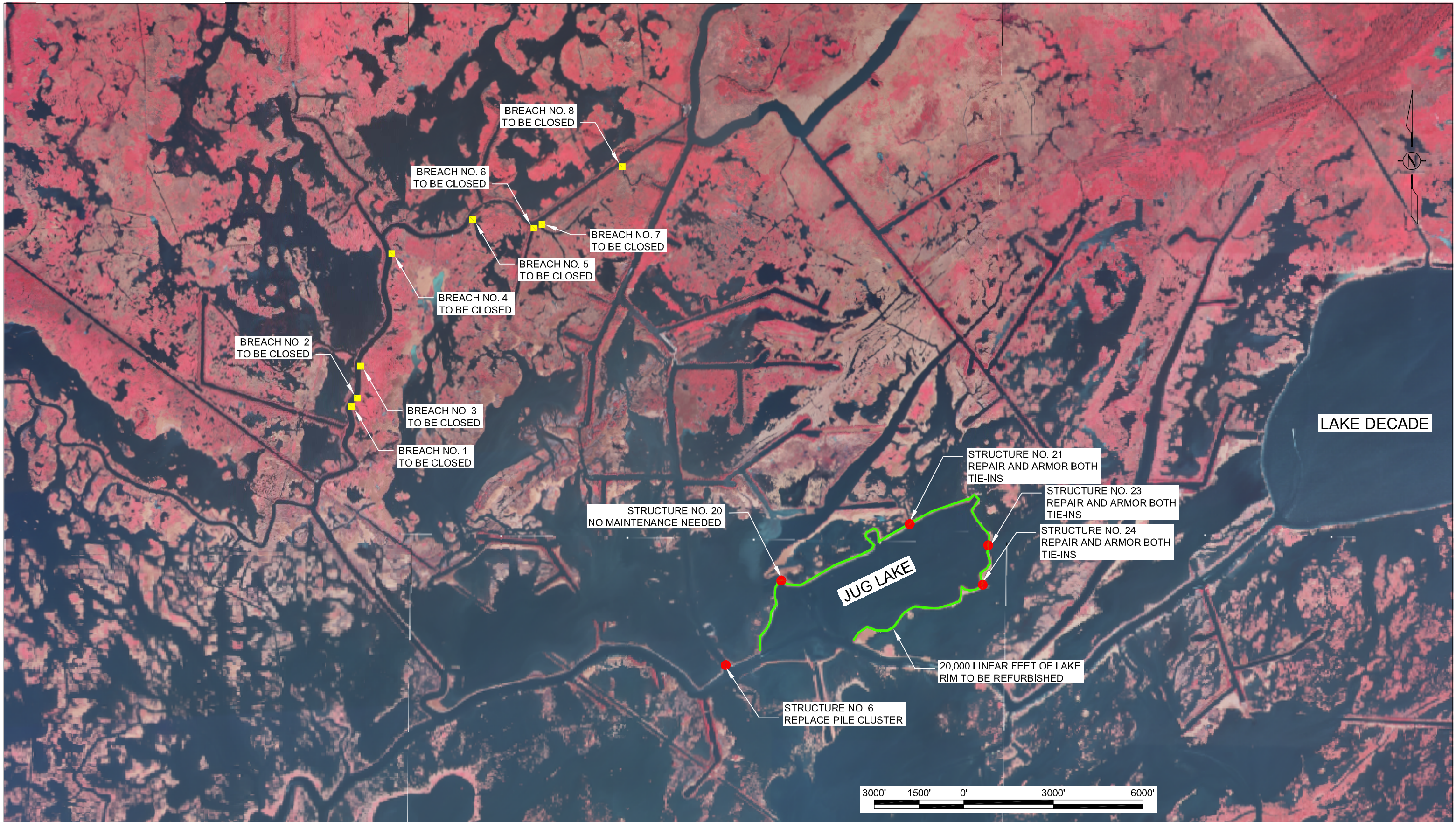
It is anticipated that miscellaneous earthen breaches and navigation lights will have to be repaired during the fiscal year. The cost above is based on in-kind service credits to the landowner for repair of breaches.

2009-2012 Accounting

Total Expenditures (Lana Report through April 09):	\$ 960,376.38
NRCS Expenditures	<u>\$ -14,627.00</u>
State Expenditures	\$ 945,749.38
OCPR Expenditures (April 09 through June 09)	<u>\$ 4,741.29</u>
Total State Expenditures:	\$ 950,490.67
Total Federal Expenditures:	<u>\$ 94,083.00</u>
<b>Total O&amp;M Expenditures:</b>	<b>\$1,044,573.67</b>
<b>Unexpended O&amp;M Funds:</b>	<b>\$ 299,464.33</b>

## **Appendix D**

### **2009/2010 Work Plan**



REV.	DATE	DESCRIPTION	BY

OFFICE OF COASTAL PROTECTION & RESTORATION  
**ENGINEERING BRANCH**  
 450 FLORIDA STREET  
 BATON ROUGE, LOUISIANA 70801

DRAWN BY: SJT      DESIGNED BY: BJB

BRADY CANAL  
 HYDROLOGIC RESTORATION PROJECT

STATE PROJECT NUMBER: TE-28  
 FEDERAL PROJECT NUMBER: PTE-26b

APPROVED BY: DMB

2009/2010  
 WORK PLAN MAP

DATE: JUNE 2009  
 SHEET 1 OF 1