LAKE SALVADOR SHORELINE PROTECTION DEMONSTRATION PROJECT (BA-15)

I. INTRODUCTION

I.1. Project Description

The Lake Salvador Shoreline Protection Demonstration Project (BA-15) was proposed on the Third Priority Project List (PPL-3). The project is located in two areas along the northern shore of Lake Salvador (figure 1) in St. Charles and Lafourche Parishes. Phase I of the project is along 5,900 ft (1,800 m) of shoreline along the Lake Salvador Wildlife Management Area (WMA) and is bounded on the west by Baie du Cabanage and on the east by Couba Island (figure 2). Phase II is located along 8,000 about (2,438 m) of shoreline on the southwestern shore of the lake (figure 3) and is bounded on the north by Baie du Chactus and to the south by Bayou Des Allemands (Curole et al. 2002, National Marine Fisheries Service (NMFS) 1997, NMFS 1996). The original project area encompasses 4070 acres of wetlands including 1122 acres of open water and 2948 acres of marsh. According to the Wetland Value Assessment (WVA), this project would protect 180 acres of freshwater marshes, benefit 130 acres of submerged aquatic vegetation and enhance 880 acres of coastal wetlands (NMFS 1996, NMFS 1997).

The location and features of this project changed considerably since the original project proposal in 1993 for the Third Priority Project List. The following is a chronology of the evolution of the location and features of this demonstration project.

1992 Feasibility report for project concept was completed (Howard Needles Tammen and Bergendorf 1992).

1993 The original project was proposed in June 1993 for PPL-3. The project included 4.2 miles of the north shore of Lake Salvador bounded north by Baie du Chactus and to the south by Bayou Des Allemands on the St. Charles-Lafourche Parish lines. The intent of this project was to demonstrate the effectiveness of two separate types of segmented timber breakwaters in highly organic consolidated sediments with poor load-bearing capacity about 300-400 feet offshore and to nourish adjacent shoreline (NMFS 1993).

1995 In April, $1.01 million was awarded for the project design and construction. At this time, four types of structures would be tested.

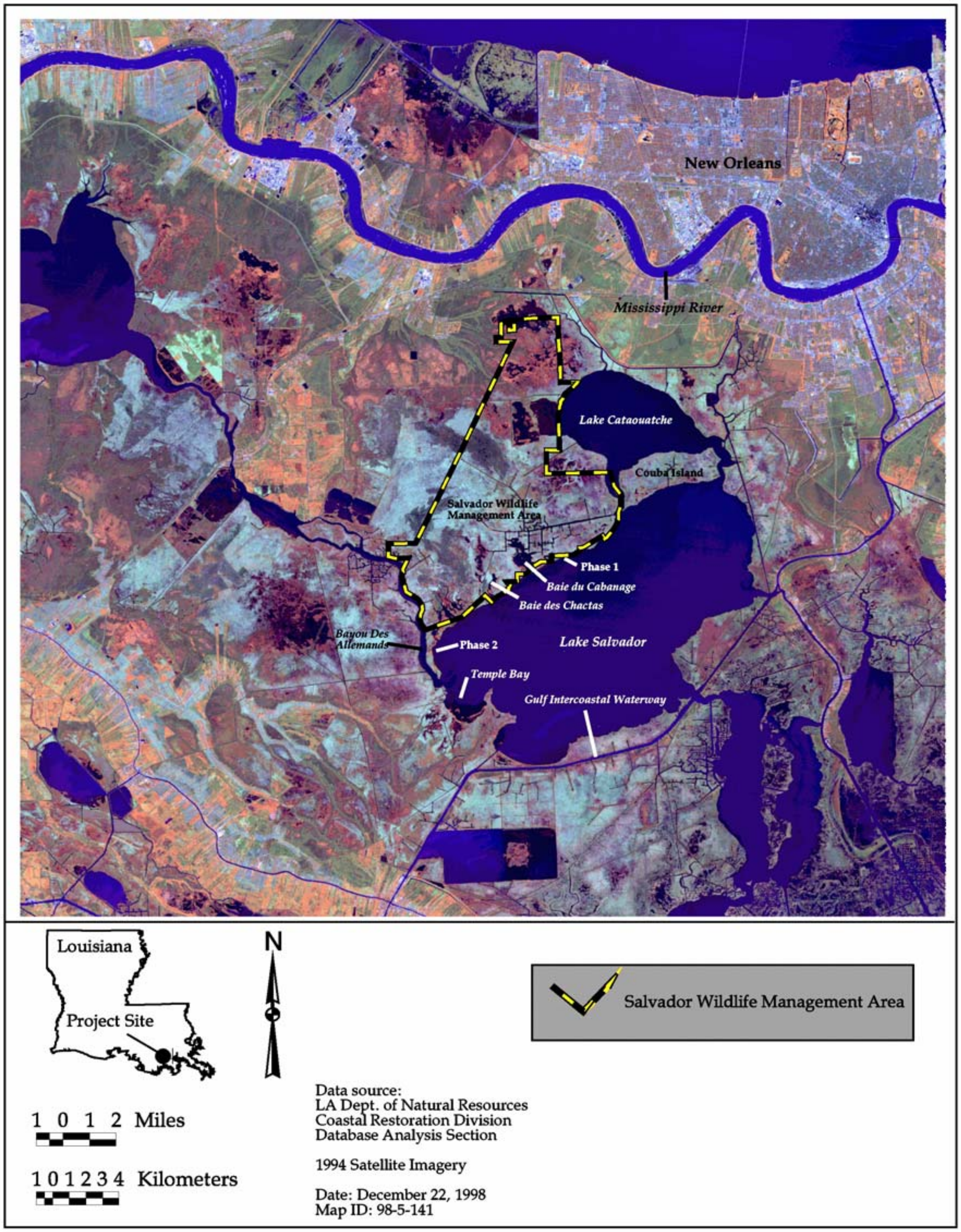

Figure 1. Project location map for BA-15, Lake Salvador Shoreline Protection Demonstration Project.

In October the Louisiana Department of Wildlife and Fisheries requested that the project be relocated along a segment of the shoreline that is part of the Lake Salvador WMA.

In November, the four structure types (Grated Apex, Geotextile Tube, Angled Timber Fence and Vinyl Sheet Pile) were chosen and a small dredge portion would be included in the project if funding permitted.

1996 In April, camp owners in the original project area opposed relocation. In the summer, the demonstration project was moved from its proposed location to the Lake Salvador WMA to avoid questionable liability resulting from the use of untested structures near private property, public concern and objection from St. Charles Parish (correspondence). This new area became Phase I of the project. Phase II was proposed as a solution for the original project location and was approved in September.

Phase I

- In August 1996 the project was approved.
- In September 1996 the Environmental Assessment (EA) was completed.
- On June 30, 1997, project construction began and was completed on October 1, 1997.

Final location: The project area is along 5,900 ft (1,800 m) of shoreline along the north shore of Lake Salvador WMA and is bounded on the west by Baie du Cabanage and on the east by Couba Island. The final location was selected to1) take advantage of one land owner (State of Louisiana), 2) to avoid liabilities or risks to private property if the project fails to reduce shoreline erosion, causes increased erosion, or if structures break apart and damage occurs on adjacent property and 3) provide a somewhat uniform, unbroken shoreline long enough to accommodate four types of wave dampening structures with a nearby control area (Curole et al. 2002, Lee et al. 2000).

Project Features: Installation of four different breakwaters listed below for shoreline protection and to nourish the shoreline with dredge material (Curole et al. 2002, Lee et al. 2000, Permit request 8/96).

1) Five 100 ft (30.8 m) sections of Grated Apex breakwater structures with 30 ft (9.1 m) spacing between each section.
2) Three 250 ft (106.7 m) Geotextile Tube breakwaters with 30 ft (9.1 m) spacing between each tube.
3) Three 167 ft (50.9 m)sections of Angled Timber Fence with 30 ft (9.1 m) spacing between each fence.
4) Six 100 ft (30.8 m) sections Vinyl Sheet Pile (three reinforced and three not reinforced) with 30 ft (9.1 m) spacing between each section.

Phase II

- In June 1997 the EA was completed.
- In April 1998 Phase II was approved.
- On June 16, 1998, Phase II construction was completed.

Location: The project area is located on the southwestern shore of Lake Salvador bounded on the north by Baie du Chactus and to the south by Bayou Des Allemands to test the effectiveness of a rock berm in highly organic, unconsolidated sediments with poor loading bearing capacities (Curole et al. 2002, Lee et al. 2000, NMFS 1997).

Project Features: Project included about 8,000 ft (2,438 m) Rip Rap breakwaters with dredged material islands created behind the structure.

I.2. Project Personnel

Project Phase	Name	Position	Agency
Planning	Peggy Jones	Fisheries Biologist	NMFS
	Rickey Ruebsamen	Fisheries Biologist Branch Chief	NMFS
	Rick Hartman	Fisheries Biologist	NMFS
	Steve Gammill	Fisheries Biologist	DNR/CRD
Engineering	George Boddie	Engineer	DNR/CRD
	Brian Kendrick	Engineer	DNR/CRD
	Hilary Thibodeaux	Engineer	DNR/CRD
Implementation	Kenneth Bahlinger	Project Manager	DNR/CRD
	Jim Meigs	Project Manager	NMFS
	Erik Zobrist	Project Manager	NMFS
Monitoring	Darin Lee	Monitoring Manager	DNR/CRD
	Greg Steyer	Monitoring	DNR/CRD
	Glen Curole	Monitoring	DNR/CRD
	Andy Nyman	Academic advisor	USL/LSU
	Greg Stone	Academic advisor	LSU
	Nebendu Pal	Academic advisor	USL

II. PLANNING

II.1. Causes of Loss

What was assumed to be the major cause of land loss in the project area?
Shoreline erosion due to wind generated waves was assumed to be the major cause of land loss in this area. Tidal erosion is deemed as not a cause of loss (Stone 1996). The Lake Salvador shoreline is susceptible to erosion because of

the long fetch across the lake, the vulnerable shoreline configuration and the highly unconsolidated sediment base. These factors are responsible for the high shoreline erosion rate in the Lake Salvador area of approximately 13 ft/yr (4 m/yr) (NMFS 1997, Louisiana Department of Natural Resources (LDNR) 1996). Shoreline erosion along Lake Salvador has resulted in breaching of the lake rim at several locations. These breaches have allowed tidal and wave energy to erode the highly organic marsh surface, resulting in large, shallow pond formation in the interior marsh (LDNR 1996).

Table 1. Historical marsh loss trends for the project area for U.S. Corps of Engineers (COE) land loss data.

1932-1958 (%/yr)	**1958-1974** (%/yr	**1974-1983** (%/yr)	**1983-1990** (%/yr)
0.177	1.284	0.956	0.282

What was assumed to be the additional causes of land loss in the projected area?
Highly organic and unconsolidated soils (USDA 1983) are considered an additional cause of loss in the area.

II.2. Background

Shoreline protection methods have been very limited along rapidly eroding shorelines with highly organic, unconsolidated sediments which have poor load-bearing capacity. The need to test different types of breakwaters along shorelines with these conditions was proposed.

II.3. Project Goals and Objectives

How were the goals and objectives for the project determined?
There was no documentation of rationale for determining goals and objectives. It is assumed that they were developed based upon the need to test innovative techniques, types of loss, loss rates and the causes of loss in the area. It is assumed that the goals in the monitoring plan were developed by the monitoring work group and technical advisory group.

Phase I
Project Goals and Objectives:
1. Demonstrate the effectiveness of four types of segmented breakwaters in highly organic, unconsolidated sediments with poor load-bearing capacity (NMFS 1993).
2. Reduce wave height and marsh edge erosion along the shoreline.
3. Maintain or recreate the historical shoreline along a section of Lake Salvador and reestablish historical hydrology of the interior marsh to reduce tidal scour and associated land loss (NMFS 1993). Note that this objective was dropped during the design stage presumably to reduce cost.

Phase II
Project Goals and Objectives:
4. Provide shoreline protection in areas having highly organic, unconsolidated sediments.
5. Reduce the rate of marsh edge erosion along the project shoreline.
6. Compare this method with other methods in Phase I (Curole et al. 2002, Lee et al 2000).

Are the goals and objectives clearly stated and unambiguous?
Yes, however these goals and objectives would be clearer if specific target rates (percent reduction) for reducing wave height and shoreline erosion were established prior to construction.

Are the goals and objectives attainable?
Phase I
This is a demonstration project to compare various structures types. Comparison of the various structures can be attained if structures are designed, constructed and placed to make reliable comparisons. It is possible that shoreline protection and reduction of loss rates can be attained depending upon the effectiveness and durability of structures tested.

Phase II
It is possible to attain the stated goals by using Rip Rap and creating marsh islands however, Phase I and Phase II structures cannot be easily and statistically compared because the structures were not constructed at the same time and were therefore exposed to different environmental conditions. In addition, the marsh islands that were placed on the land side of the Rip Rap provided additional protection to the shoreline.

Do the goals and objectives reflect the causes of land loss in the project area?
Yes, the cause of loss is wave induced erosion and the objective was to decrease wave energy by use of four types of structures.

III. ENGINEERING

III.1. Design Feature(s)

What construction features were used to address the major cause of land loss in the project area?
Phase I of this demonstration project was designed by C-K and Associates of Baton Rouge. The features (table 2) of the Phase I portion of the project included the Grated Apex, Angled Timber Fence, Geotextile Tubes stabilized with cement and reinforcement fibers, and two configurations of Vinyl Sheet Pile (with and without 40 ft (12.2 m) vertical piles and walers) (Curole et al. 2002, Lee et al. 2000, NMFS 1997, NMFS 1996, 1993).

The Phase II rock structure was designed by the LDNR/CRD Engineering Section. The Phase II portion consisted of 8,000 ft (2,621 m) of conventional rock foreshore structure with dredge material islands landside of the structure. The Phase II portion consisted of a conventional rock foreshore structure which has been shown to reduce wave energy thus reduces shoreline erosion (NMFS 1997). This phase directly created approximately 5 acres of earthen berm (islands) directly behind the structure by utilizing a portion of the dredge material from the flotation channel. This berm was vegetated with *Salix nigra* (Black willow) shortly after completion of the structure.

Table 2. Project design features for BA-15, Lake Salvador Shoreline Protection Demonstration Project.

Structure Type	Length of Structure/ Spacing	$/ft	Total Length of Protection
Phase I			
Geotextile Tube	3-250-ft tubes, 30-ft gaps	$340	810-ft
Grated Apex	6-100-ft structures, 30-ft gaps	$390	620-ft
Angled Fence	3-167-ft structures, 30-ft gaps	$252	561-ft
Vinyl Sheet Pile (Two configurations)	5-100-ft structures, 30-ft gaps	$200	620-ft
Phase II			
Conventional Rock	8,000-ft continuous	$150	8000-ft

What construction features were used to address the additional causes of land loss in the project area?
No other construction features were used on this project to address additional causes of land loss.

In the general vicinity of the project, several different methods of shore protection have been used since this project was completed. Rock shore protection has been previously used successfully on the eastern side of the lake adjacent to Bayou Segnette and approximately 4-miles north of the project area along the western edge of Lake Cataouatche. This structure was inspected by DNR and NRCS in 1998 and appeared to be missing approximately 30% of the tires. Another USACE project on the eastern shoreline of Lake Salvador adjacent to Bayou Segnette consisted of a “Geocrib” The project consisted of heavy wire fencing with a geotube-type structure in the middle. This project was unsuccessful, however the 300-ft (91.4 m) rock sections the USACE used to tie the structure to the shoreline have performed well.

More recently, NRCS has completed a demonstration phase on the Land Bridge project which is located approximately 18 miles (33.3 km) southeast of the BA-15 project. Soil conditions in the Land Bridge Project area are more challenging than the BA-15 project. The techniques tested in the Land Bridge project included a foreshore rock dike w/lightweight core material and a concrete panel structure. Both of these structures may hold greater potential for applications than any of the structures installed in the Phase I portion of BA-15. Others believe that none of the structures in the BA-15 Phase I project warrant further consideration for application in this type of environment and that the lessons learned from the BA-15 Phase I project helped improved the features of the Land Bridge Demonstration Project and hold greater promise for future applications (Broussard and Boddie 2002, pers. comm.).

What kind of data was gathered to engineer the features?
Survey information collected included bathymetric contours, tidal range, wave height and length, and typical wave orientation between the structure and the shoreline. To aid in the design of the project, soil borings were taken in the project area to determine the suitability of in-situ material for the Geotextile tubes. Soil classification, strength and consolidation tests were used to calculate pile capacities and embedment depths, lateral load capacities and estimated settlements (settlements were primarily performed for the geotube structure). Strength tests were run on sand samples added with various percentages of cement to determine the optimum dosage (Kendrick pers. comm. 2002).

Survey data and historical records were obtained to determine appropriate heights of the structures. Wave runup calculations were performed using the COE manual.

What engineering targets were the features trying to achieve?
The engineering targets were to evaluate the effectiveness of various structural breakwaters in areas having highly organic, unconsolidated sediments. The primary goal was to find a structure type, other than the conventional rock structure, that could be used in these type areas.

III.2. Implementation of Design Feature(s)

Were construction features built as designed? If not, which features were altered and why?

Phase I
All of the features were constructed as designed except for the Geotextile Tubes (Boddie pers. Comm. 2002). There was no immediate post construction inspection report for this project. One survey report (GOTECH 1997) was

completed to establish baseline elevations following construction. In that report, there is no indication of poor condition of the structures, structures are shown in photographs and appeared to be intact. Other documentation of structure condition occurs in a field inspection report (LDNR 2000), another report from GOTECH (2000) and in the monitoring reports (Lee et al. 2000 and Curole et al. 2002).

The Geotextile Tubes posed the most challenging to construct. Prior to this project, numerous geotextile vendors had proposed the use of geotubes as low cost shore protection. According to the geotextile experts, the general rule is that there is approximately one foot of tube elevation for every six feet of tube circumference. This formula is based on using good quality sand as the fill material. Unfortunately, Lake Salvador fill was of poor quality and in order to achieve the desired elevation sand was barged in to fill the tubes. Another concern was potential damage either from vandalism and/or a weakening of the geotextile material from long-term exposure to ultra violet light (Boddie pers. Comm. 2002).

To address these concerns, specifications indicated that a slurry method should be used (pug mill batch mixer) however, the contractor used a jet mixer which resulted in a much lower strength of the material filling the geotubes. The tensile fibers were discontinued because the jet mixer method could not properly mix the slurry. The desired result was material with a toothpaste consistency. Unfortunately, the pumping mechanism used to fill the tube required a much lighter slurry to pump. As a result, the structure was not filled with stabilized material and fell apart as the surrounding woven fabric degraded and failed. LDNR suspects that a large percentage of the cement was lost into the lake. Additionally, a portion of the reinforcement fibers floated out of the water return at the top of the tube. The overall process of mixing and pumping the slurry was much slower than either the engineer or the contractor envisioned. Once the process of filling the tubes was started, the operation had to continue until the tube was filled. This is necessary because the pressure exerted by the pump maintains the shape of the tube and if the pressure is released during the filling operation, the material will slump making it virtually impossible to regain the desired elevation (Boddie pers. comm 2002).

In September 1998, the Geotextile Tubes began to show signs of structural failure as noted in a filed deployment report by Stone et al. (1998). By January 2000, a field inspection report (LDNR 2000) summarized the condition of all of the structures. The report stated that structural failure had occurred and repairs were recommended. Later that year, GOTECH (2000) further evaluated the structures. According to that report, the structures with pile support held up well in the heavy wave environment. The main problem with the pile supported structures was that the connections (bolts) were worn or loose from wave generated vibrations. Missing bolts were attributed to lack of proper nut locking. The Geotextile Tubes did not perform well, had subsided and the fabric deteriorated. The Vinyl Sheet Pile structures without support piling were in poor condition and could not withstand the wave energy. Of the four demonstrated designs, the Vinyl Sheet Pile was the least expensive but was more expensive than rocks. The reinforced Vinyl Sheet Pile also performed the best of all treatment during three years of monitoring (Curole et al. 2002). The following is a summary of the condition of each structure from LDNR (2000) and GOTECH (2000).

The Grated Apex structures exhibited better structural performance than the Geotextile Tubes and the unreinforced Vinyl Sheet Pile. However, it showed some damage at piling attachments near the bottom and corroded and loose or missing hardware (bolts, washers, nuts) occurred throughout the structure. There were loose or missing lateral timbers and vertical pile walers were cracked or splitting where hardware was drilled and placed. Some lateral timbers were warped, pile caps corroded, protective creosote lost and timber weathered. The structure had minimal vertical settlement. The structure tilted or shifted slightly horizontally (1 ft (0.3 m) or less). Most movement and damage were below the waterline possibly due to the missing bolts or broken wood. Most of the creosote coating was washed away (LDNR 2000, GOTECH 2000, Curole et al. 2002).

The Angled Timber Fencing remained in good condition and appears to be the most stable of the four structures, with some minor deterioration and damage as in the Grated Apex. The structure has exhibited very little movement in either direction. Boards were in good shape but creosote was washed away, bolts were intact and in good condition and some began to loosen. Piles were sturdy and caps were intact (LDNR 2000, GOTECH 2000, Curole et al. 2002).

The Vinyl Sheet Pile Fencing showed drastic differences between the pile supported (reinforced) and the unsupported (not reinforced) sections. The reinforced Vinyl Sheet Pile maintained structural integrity over the three years of the project (GOTECH 2000). The pile supported sections remained in good condition. Vertical piles were straight, all pile caps were intact except one but rust was extensive, bolts appeared solid and sheeting had no visible problems. They showed little or no movement horizontally or vertically. The unreinforced Vinyl Sheet Pile showed structural failure caused by wave energy. The structure became warped, the vinyl was cracked, loosened and/or removed from the waler attachments, walers were weathered, warped, cracked or missing. Hardware was corroded, loose, broken, or missing; the vinyl sheet pile was cracked loose or missing. The structures showed major movement with wave action and were in poor condition, ranging from 30-70% intact (Curole et al. 2002, GOTECH 2000, Stone et al. 1999).

The Geotextile Tubes were in poor condition and were mostly subsided by June 2000 although those that remained were reasonably stable vertically but had unacceptable horizontal movement (sliding). From 20-70% of the structures were not visible above the water line. Where tubes remained, the outer material was torn and interior was exposed. The structural failure appeared to be due to differential settlement rates in each tube which caused the concrete and sand to fracture and wear on the fabric during wave induced motion and problems with Geotextile Tube design and installation where the sand and concrete fill material were not properly mixed (Curole et al. 2002, Kendrick per comm 2002, GOTECH 2000).

Both the Grated Apex and the Angled Timber structures maintained the best structural integrity but had the worst energy reduction performance. It has been suggested that a change in the design may help efficiency in reducing wave energy. Some suggested changes are to eliminate all the horizontal slats from being aligned and/or modify the angle and spacing of the slats themselves. However, these functional changes could cause greater stress on the structure as they absorb more wave energy therefore, structural design should be modified accordingly.

After reviewing the construction plans and comments by LDWF and observing the resulting accelerated structural failures NRCS has indicated that it is obvious that some of the components of the Phase I portion of the project were under designed for the conditions that they were subjected to and that it may be unfair to conclusively state that Geotextile Tubes and the Vinyl Sheet Pile structures are not effective in reducing wave energy and shoreline erosion when they actually failed structurally before given a chance to perform. NRCS faced the same dilemma with PVC sheetpiling. Once the design faults were corrected, the PVC structure is now performing successfully. The question remains whether structural or functional failure had more of an impact on ineffectiveness of the structures than did structure placement or the type of structure themselves (Broussard pers comm. 2002).

It should be noted that before assessment of the *performance* of the structures to curb shoreline erosion could adequately occur, some of the structures failed because the structural design was not adequate to withstand the environmental conditions of the project area. Therefore, due to structural failure of the Geotextile Tubes and unsupported Vinyl Sheet Pile and structure placement, the performance of the structures could not be adequately assessed. Furthermore, no post construction report was submitted and no follow up inspections occurred. Without this information it is difficult to determine when structural failure occurred. It is clear that some of the structures failed before the 5-year demonstration period was completed.

Phase II

Recent monitoring data indicates that the Phase II rock structure appears to have settled little when compared to settlement plate elevations adjusted to the DNR network (Lee 2002). The average settlement from the survey measurements was 0.29 ft from 1998 to 2002 (table 3). This would indicate a settling rate of only

Table 3. Elevation change of settlement plates at Lake Salvador Shoreline Protection Demonstration (BA-15) Project Phase II from 1998 to 2002.

Plate #	Elevation (NAVD88)		Change	
	As-built	*Post Construction 2002*		
	ft (m)	*ft (m)*	*ft*	*(m)*
1	6.00 (1.83)	4.98 (1.52)	-1.02	(-0.31)
2	5.70 (1.74)	4.99 (1.52)	-0.71	(-0.22)
3	5.70 (1.74)	5.96 (1.82)	0.26	(0.26)
4	5.80 (1.77)	4.83 (1.47)	-0.97	(-0.30)
5	5.70 (1.74)	5.57 (1.70)	-0.13	(-0.04)
6	5.50 (1.68)	7.19 (2.19)	1.69	(0.52)
7	6.00 (1.83)	4.83 (1.47)	-1.17	(-0.36)
Avg. Settlement			**-0.29**	**(-0.09)**

0.07 ft per yr. However, the average height of the center of the rock structure is only 2.51 ft NAVD88 and the design called for a crest elevation of +4.0 ft. This could indicate that the structure was not built to the proper elevation.

III.3. Operation and Maintenance

Were structures operated as planned? If not, why not?
There were no operational features on the project because this was intended to be a demonstration project. However, a recommendation for repairs on Phase I structures was made by DNR and NMFS following an annual inspection trip at the site on January 20, 2000 but no repairs were performed (LDNR 2000).

Are the structures still functioning as designed? If not, why not?
The Geotextile Tubes and unreinforced Vinyl Sheet Pile structures have had various degrees of structural failure (see section III.2) and are not fully functioning as designed. Plans are currently being developed to remove all of the Phase I structures in the fall of 2002. It will cost approximately $125,000 to remove the Phase I structures.

The Phase II rock structure and marsh islands are working very well, structures are intact and loss has been arrested. Plans are currently being developed to expand this project for an additional 2-miles along the northwestern shoreline of the lake.

Was maintenance performed?
This was a demonstration project and no maintenance has been planned.

IV. PHYSICAL RESPONSE

IV.1. Project Goals

Do monitoring goals and objectives match the project goals and objectives?
Monitoring Plan Goals and Objectives:
Objective:
Compare the effectiveness and ability to reduce erosion from tidal and wave energy of four different wave dampening devices and one shoreline device during a five-year evaluation period.

Phase I Goals
1. Reduce wave height and energy landward of the wave dampening devices.
2. Reduce the rate of marsh edge erosion along the project shoreline.

Phase II Goals
1. Reduce the rate of marsh edge erosion along the project shoreline.

The monitoring goals and objectives match the project goals and objectives, average significant wave height and winds were measured in Phase I and shoreline position in Phases I and II. The shoreline markers technically failed and the DGPS surveys were used for shoreline erosion.

IV.2. Comparison to adjacent and/or healthy marshes

IV.2.1. Elevation

What is the range of elevations that support healthy marshes in the different marsh types?
No topographic surveys were conducted on the marshes or the dredged material islands for this project.

Does the project elevation fall within the range for its marsh type?
While no marsh elevation surveys were undertaken, it is clear that the dredged material islands and the natural marshes are at different elevations and because they support different wetland communities Salix nigra vegetate the islands and fresh marsh vegetation such as Sagittaria lancifolia in the marshes.

According to the WVA of the original Lake Salvador Shoreline Protection Demonstration Project (NMFS 1993), implementation would protect approximately 180 acres of freshwater marshes, benefit 130 acres of submerged aquatic vegetation (SAV) and enhance 880 acres of coastal wetlands. Since the WVA for the revised location has not been conducted, an estimate of benefits at this site is unavailable. However, because the revised site is nearby, and similar in vegetative and soil composition, the benefits are assumed to be approximately the same as when estimated previously (NMFS1996).

Did the project meet its target elevation?
There was no target elevation for marsh set for this project and there is no marsh elevation data. The height of the structures were installed as designed however, subsidence and slipping have occurred.

What is the subsidence rate and how long will the project remain in the correct elevation range?
Subsidence in the general area ranges from 1.1-2.0 ft/century (33- 60 cm/century)(LDNR 1999). There is no marsh subsidence data specific to this project. Note that Phase I geotextile tube structures rapidly subsided after construction primarily due to the limited substrate load-bearing capacity.

IV.2.2. Hydrology

What is the hydrology that supports healthy marshes in the different marsh types?
N/A

Does the project have the correct hydrology for its marsh type?
N/A

What were the hydrology targets for the project and were they met?
N/A

IV.2.3. Salinity

What is the salinity regime that supports healthy marshes in the different marsh types?
N/A

Does the project have the correct salinity for its marsh type?
N/A

What were the salinity targets for the project and were they met?
N/A

IV.2.4. Soils

What is the soil type that supports healthy marshes in the different marsh types?
A field investigation in August 1995 indicated soft, unconsolidated sediments near the shoreline of the project area. Geotechnical investigations in 1993 off Couba Island and between Bayou des Allemands and Bois Chactas Shell Banks by Eustis Engineering in 1993 showed soft and very soft clays and silts (NMFS 1996). The soils are mainly Kenner muck and in some areas Allemands, Barbary and Larose soils. These soils are very dark grey slightly acid fluid muck, about 21 inches thick. They are organic, very poor drained soils which are ponded or flooded most of the time (Howard, Needles, Tammen and Bergendorf 1992). This type of monitoring data was not collected for this project.

The organic content of Lake Salvador was 83% of dry mass (Swarzenski, 1991).

Does the project have the correct soil for its marsh type?
N/A

IV.2.5. Shoreline Erosion

How have shoreline erosion rates changed in the project area compared to nearby reference areas?
Shoreline erosion behind the structures in Phase I was variable during the project period and ranged between 2.32-8.69 ft/yr (0.71-2.65 m/yr) as shown in table 4. The preconstruction rate for the total project area was 4.4 ft/yr (1.34 m/yr) and three years post construction increased to 5.08 ft/yr (1.55 m/yr) (Curole et al. 2002). The preconstruction loss rate in the reference area was 6.83 ft/yr (2.08 m/yr) and increased to 9.51 ft/yr (2.9 m/yr) post construction (Curole et al. 2002). The reference area had higher erosion rates than the treatment area for both preconstruction and three years after construction. The Geotextile Tubes and the Grated Apex structures showed on average, the lowest erosion rates during the three year period at 2.33 and 4.72 ft/yr (0.7 and 1.4 m/yr) respectively (table 4, figure 24 from Curole et al. 2002 in Appendix A) followed by Vinyl Sheet Pile and the Angled Fence with 6.46 and 8.69 ft/yr (1.97 and 2.65 m/yr) respectively (Curole et al. 2002). Differences in the performance of the structures in this project are not necessarily due to structure type but may be related to the interaction between the structures. The values recorded for each structure are not completely due the influence of that structure because the structures were too close each other which resulted in an interaction effect. To eliminate this problem, the design could be improved by placing the different structures further apart and out of range of influence on one another.

The Geotextile Tubes were the only structures that showed a shoreline progradation rate which was 1.74 ft/yr (0.53 m/yr). However, progradation occurred only in the first year and by the second year the Geotextile Tubes began to fail structurally and shoreline erosion was recorded. It should be noted that Geotextile Tubes have been successful at reducing shoreline erosion in other areas such as Chesapeake Bay where no movement or damage to the structures occurred (Gill et al. 1995 as cited in Curole et al. 2002). These structures may still have potential in Louisiana with changes in fill material, installation methods, placement in relation to the shoreline and placement in firmer sediment conditions (Curole et al. 2002).

Table 4. Structure cost versus effects on wave heights and shoreline erosion rates at the Lake Salvador Shoreline Protection (BA-15) Demonstration project. Modified from Curole et al. 2002.

TREATMENT	Approximate Structure Cost[a] ($/ft)	Approximate Wave Height Reduction[b] (%)	Post Construction Shoreline Change Rate[c] ft/yr-1 (m/yr-1)
Phase I reference[d]	-	-	-9.51 (2.90)
Grated Apex	390	30 - 80	- 4.72 (1.44)
Geotextile Tube	340	>90	-2.32 (0.71)
Angled Timber Fence	252	20 - 80	-8.69 (2.65)
Vinyl Sheet Pile	200	>90	-6.46 (1.97)
Phase II reference	-	-	-6.95 (2.12)
Rip-Rap Rock	150	Not measured[e]	2.85 (0.87)

[a] These costs are based upon 1994 dollars and a 5-year project life for small areas. It should be noted that cost of rock has increased significantly since 9/11/02 to accommodate for increases in port security.
[b] The approximate wave height reductions are from Stone et al. (1999).
[c] These shoreline rates are not distinctly related to structure type.
[d] Phase I preconstruction erosion rate was 13.0 ft/yr (4.9 m/yr) (HNTB 1992) and 7.74 ft/yr (2.36 m/yr)(May and Britsch 1987).
[e] Comparisons among Phase I and Phase II structures was not an objective of this project.

IV.2.6. Other

Describe any other physical characteristics of the project that have bearing on the projects' success.
Monitoring data for three years in the Phase I area shows that wave height was generally reduced behind all structures depending upon wind direction. The wave height data is specific for each structure type as the instruments were placed directly behind the structures. Therefore, the data collected reflects the effect of each structure on wave height accurately. The Geotextile Tubes and the Vinyl Sheet Pile were consistently effective in reducing wave height when wind was from the south. Wave reduction ranged from 23-80% for the Grated Apex, >90% for the Geotextile Tubes, 20-80% for the Angled Timber and >90% for the Vinyl Sheet Pile (table 4, figures 16 and 18 from Curole et al. 2002 in Appendix A). The effect on wave energy for the Grated Apex and the Timber Fencing appeared to be dependent on average water level, wave height, and direction of wave propagation.

The Angled Timber Fence and the Grated Apex exhibited variable effects on wave energy. These structures also exhibited up to 20% increases in average wave height on several occasions as did the Geotextile Tubes. Wind direction, velocity, mean water level and wave height may have contributed to the performance of these structures (Curole et al. 2002). No wave height data was collected for Phase II.

Porosity of the structures and water level may explain some of the differences in the performance of the structures to reduce wave height. The porous structures (Angled Timber Fence and Grated Apex) were less effective than the non porous (Geotextile Tubes and Vinyl Sheet Pile) structure type. The structures also appeared to perform better at reducing wave height during lower water levels.

It remains uncertain whether the Phase II structure or the installation had the greatest effect on bottom scour. However, recent data show that the bottom elevations along the lake side of the rock structure have decreased (Lee 2002, Appendix). Without as-built bathymetry surveys to document the impacts from structure installation it is impossible to differentiate between the installation and wave scour actions. However, the fact that either or both had an effect of lowering the bottom elevations and removing approximately 203,989 cubic yards of sediment from the area should raise some concerns for the long-term stability of the structure foundation (table 5). Future projects should look at these effects in a more scientific manner and try to determine the greatest effect as well as the possibility of nonflotation channel or backside flotation channel during installation.

Table 5. Volume change from pre- to post construction in the offshore area for each sample period at Lake Salvador Shoreline Protection Demonstration Project (BA-15) Phase II.

Loss		**Gain**		**Net Volume Change**	
Area	Volume	Area	Volume	Area	Volume
48 ac	203,978 yd^3	0 ac	1 yd^3	48 ac	-203,989 yd^3
-195,052 m2	-155,952 m^3	36 m2	1 m^3	-195,088 m^2	-155,961 m^3

IV.3. Suggestions for physical response monitoring

Are there other variables that could be monitored to substantially increase the ability to understand the results of the project?

1) Habitat mapping could be employed to track shoreline employment and dredged material island creation over time.
2) Sediment and bathymetric surveys behind and in front of the structures could be employed to estimate accretion and the influence of bottom scour.

V. BIOLOGICAL RESPONSE

V.1. Project Goals

Project and monitoring goals and objectives have been previously stated in sections II.3 and IV.1.

V.2. Comparison to adjacent and/or healthy marshes

V.2.1. Vegetation

What is the range in species composition and cover for healthy marshes in each type?
No vegetation data was collected for this project. However, the general area is freshwater emergent vegetation and floating marsh. A CWPPRA field trip in 1993 noted 25% *Sagittaria lancifolia* (Bulltongue), 40% *Typha latifolia* (Cattail), 10% *Colocasia esculenta* (Elephant ear) and 5% *Scirpus californicus* (Bullwhip) and by 1995 vegetation was primarily *Sagittaria lancifolia*.

Monitoring field investigations indicated that the dominant species presently along the Phase I project and reference areas are *Sagittaria lancifolia*, *Scirpus californicus*, *Salix nigra* and *Phragmites australis* (formerly *P. communis*, Common reed, Roseau cane).

The Phase II reference area is colonized by several different species of aquatic vegetation. The dominant species in this area are *Sagittaria lancifolia*, *Colocasia esculenta*, *Scirpus californicus* and *Alternanthera philoxeroides* (Alligator weed). The dominant vegetative species encountered along the first quarter of the Phase II project area are *Sagittaria lancifolia*, *Colocasia esculenta* and *Scirpus* californicus. In addition, *Phragmites australis* and *Salix nigra* were also found along the edge of the shoreline. Shoreline vegetation encountered along the second and third quarters of the Phase II project area consists of *Sagittaria lancifolia*, *Alternanthera philoxeroides* and *Scirpus californicus*, *Baccharis halimifolia* (Groundselbush), *Kosteletzkya virginica* (Salt marsh mallow), *Commelina virginica* (Virginia dayflower) and *Solidago sempervirens* (Seaside goldenrod). The dominant forms of aquatic vegetation found along the edge of the shoreline in the last quarter of the Phase II project area are *Panicum hemitomon* (Maidencane) and *Scirpus californicus*.

The dredged material islands created between the Rip-Rap rock structure and the Phase II shoreline has a monotypic vegetation population consisting of thick stands of *Salix nigra.*

Does the project have the correct species composition and cover for its type?
Based on field observations vegetative cover seems to be high in all areas. Species composition seems to be correct for this marsh type in all areas except the dredged material islands, which are only colonized by *Salix nigra*.

What were the vegetation targets for this project and were they met? If not, what is the most likely reason?
No vegetation targets were established for this project. However, the vegetative composition of the dredged material islands are not consistent with the vegetative composition of the surrounding wetlands.

V.2.2. Landscape

What is the range in landscapes that supports healthy marshes in different marsh types?
Land/water and habitat mapping were not monitored for this project. The monitoring plan (LDNR 1998) states that land/water would be conducted once preconstruction (1994) and once post construction. The monitoring plan has not been revised, although the monitoring reports (Curole et al. 2002, Lee et al. 2000) state the following:
"The United State Geological Survey/National Wetlands Center (USGS/NWRC) obtained 1:12,000 scale near vertical color-infrared aerial photography of Phase I on December 18, 1997 (immediate post construction) and of the Phase II project area on December 19, 1994 (preconstruction) and December 19, 1997 (preconstruction). The Phase II site was originally selected as the site for both project phases and a preconstruction photo was taken in 1994. Due to project location changes and time delays, Phase I photography was only obtained in 1997 and Phase II was flown in 1994 and 1997, both of which were preconstruction. These changes are the reason for duplicate preconstruction Phase II photos over a 2-year period and a lack of preconstruction photography for Phase1. Due to budget constraints and questions about the accuracy of aerial photos to access project shoreline erosion rates at the required scale, the monitoring plan was revised to eliminate all future aerial photograph and photo interpretation of the existing photography."

Is the project changing in the direction of the optimal landscape? If not, what is the most likely reason?
Phase I is not changing in the direction of optimal landscape because it is still eroding at a rate close to the long term average. In contrast, the rock structure and the dredge material islands have allowed the Phase II shoreline to maintain itself. The dredged material islands are higher than the surrounding marshes and are colonized by *Salix nigra* which could be considered an altered the landscape but these islands provide additional protection to the shoreline. It can be argued that lakes naturally have a higher edge or a rim, which is often colonized by *Salix nigra* or other woody vegetation. Although rocks may not be as aesthetically pleasing, they also function to curb shoreline erosion and can provide habitat and refuge for small aquatic organisms including small fish. Many small shorebirds and other species also use the habitat.

V.3. Suggestions for biological response monitoring

Are there other variables that could be monitored to substantially increase the ability to understand the results of the project?

1) Vegetation surveys could be conducted to follow relative abundance and species composition in project areas, dredged material areas and the dredge disposal area.
2) Habitat mapping could be employed to classify vegetation communities over time in the project, reference and disposal areas.
3) Soil surveys could be undertaken to compare project, reference and disposal area soils.

VI. ADAPTIVE MANAGEMENT

VI.1. Existing improvements

What has already been done to improve the project?

1) Shoreline marker surveys were replaced with DGPS to determine shoreline change after one sampling period because several markers were lost and not replaced and DGPS was deemed more reliable.
2) SAV sampling was discontinued to reduce costs and because SAVs were not specific objectives of this project.
3) Structural surveys of Phase I structures were incorporated into the project to determine structural movement, position and settlement (GOTECH 2000).
4) The demonstration structures are expected to be removed in 2002.

VI.2. Project effectiveness

Are we able to determine if the project has performed as planned? If not, why?

Phase I.

Yes and no. Wave energy reductions for each structure and under different wind directions were determined. In contrast, monitoring was not able to determine the effect of the structures on the shoreline change rate due to the ineffective structure placement, structural failure, and statistical dependence. Furthermore, structural failure occurred in some of the structures early in the project period and the ability to adequately determine the performance of the structures as intended was limited. Although the effectiveness was not fully assessed, it does not rule out the use of these structures in the future. Furthermore, the data on wave reduction shows that wave energy was reduced and could potentially be further reduced if the structures maintained their integrity and are optimally positioned and oriented relative to the shoreline.

Phase II.

Yes, at this time it appears that Phase II goals and objectives were attained. Shoreline change analysis and field observations have determined that the natural shoreline transgression rate has slowed. Note that this determination is based upon only two years of data.

What should be the success criteria for this project?

1) Phase I should statistically determine method effectiveness (success or failure) at reducing wave energy by 80% and shoreline erosion by 75%.
2) Structures should be fully functional for the life of the project to determine the success.
3) Phase II should reduce shoreline erosion by 100%. Also the structures should last at least five years without maintenance and should not scour the benthic sediments around the structures.

VI.3. Recommended improvements

What can be done to improve the project?

1) Prior to construction, optimal orientation with respect to the shoreline should be determined for placing structures.
2) Prior to construction, optimal distance from shoreline should be determined for placing structures. For example, this project demonstrated that structures need to be placed closer to the shoreline.
3) Preconstruction and site specific data should be incorporated into structure design and placement.
4) If different structure types are employed, these should be placed in statistically independent settings to eliminate interaction of structures.
5) All projects should be designed and constructed to last through the standard CWPPRA project period (20 years).
6) Use flexible armor over any geotubes built in the future to protect the fabric covering from weathering from the sun and waves.
7) Conduct frequent post construction inspections and maintenance for demonstration projects.
8) Post construction reports and inspections on integrity and functioning of structures can have bearing on physical and biological response and should be evaluated.
9) Remediate structural failure immediately.
10) Project managers and sponsors need representation on site often during construction.
11) Operations and maintenance is needed for this project type to provide for functional inspection and minor remediation of structures.
12) Demonstration projects should include contingencies for removal of structures.

VI.4. Lessons learned

The debate remains whether this project was a success or a failure. Some of the structures did not remain structurally intact for the 5-year period of the project indicating that structural failure was due to faulty design or under design for the environmental conditions of the project area. The goal of the project was to determine the effectiveness of various structures. One reason the effectiveness of the structures could not be fully assessed was because of structural failure. In addition, the layout design of the structures was not conducive to accurate statistical analysis to assess the structure's effectiveness. Although some of the structures failed, it does not mean that the structures that were tested will not be effective shoreline protection methods if adequately designed and constructed to withstand the environmental conditions in which they are placed. The wave data shows that some of the structures had positive effects. The following are a list of lessons learned:

1) Demonstration projects should be designed and built for the anticipated life of a standard CWPPRA project (20 years) in order to adequately access/predict performance. This project was under designed to meet project goals.
2) Demonstration projects should have several structural integrity inspections within short time periods following construction. Current monitoring plans typically focus on "response" and do not include engineering inspections.
3) Consider fewer treatments and more replication for this type of demonstration project.
4) The short time period of the study is problematic and may not be representative of the variable environmental conditions for the life of a project, therefore results are inconclusive.
5) Structure placement can cause a structure(s) to be ineffective and statistically dependent. Therefore, structure placement is as important as the type of structure selected to reduce erosion rates along the shorelines.
6) Bolts on structures need to be secured at construction.
7) Post construction inspections and maintenance are extremely important and could have potentially prevented structural failure.
8) A post construction report on integrity and functioning of structures can have bearing on physical and biological response.
9) Regular inspections of structures should occur to prevent or arrest structural failure.
10) Structural failure should be remediated quickly.
11) Grated Apex and Angled Timber Fence structures are not as effective in reducing wave energy as the Geotextile Tubes and Vinyl Sheet Pile structures.
12) Geotextile Tubes and unreinforced Vinyl Sheet Pile structures were not as durable (as built) in this project as those tested in open water areas with low amplitude, high frequency waves
13) The reinforced vinyl worked well considering the wave fetch. However, they are more suitable in a low wave fetch environment. They should be built with supporting structure.
14) Project design should account for 3-D dynamic movement (horizontal and vertical forces) of structures.
15) Geotextile tubes can be protected with flexible armor to prevent disintegration of the structures fabric liner.
16) Islands created landward of the structures in Phase II could have had an effect on shoreline erosion rates and cannot be compared to Phase I. However,

designing a structure with this additional land building component shoreward of the structure may serve as a reinforcement structure.
17) Rock was most durable, least expensive but is foundation dependent.
18) Fill material for geotextile tubes should not be rigid under conditions where differential settlement could occur.

VII. SUPPORTING DOCUMENTATION

VII.1. Published References

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Broussard, L. 2002 (May) pers. comm. Natural Resources Conservation Service.

C-K Associates, Inc. 1996 (May). Special Provisions and Technical Specifications: Lake Salvador Shoreline Protection Project (BA-15) St. Charles Parish, Louisiana.
35 pp in four sections.

Curole, G. P., D. M. Lee, and N. S. Clark. 2002. Lake Salvador Shoreline Protection Demonstration BA-15: Comprehensive Report No. 1 for the period of October 1, 1997 to May 1 2001. Louisiana Department of Natural Resources Monitoring Series No. BA-15-MSPR-0202-1. 38 p plus appendices.

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Howard, Needles, Tammen and Bergendorf (HNTB). 1992 (May). Feasibility Report for Proposed Coastal Project: BA-15 Lake Salvador Shore Protection. Prepared for the Coastal Restoration Division, Louisiana Department of Natural Resources. DNR Contract No. 25030-91-32. 15 pp.

Kendrick, B. 2002 (May) pers comm. Engineer. Morris Hebert Inc. (formerly of LDNR).

Lee, D. M. 2002 (July) pers comm. Biologist. Coastal Restoration Division, Louisiana Department of Natural Resources.

Lee, D.M., G.P. Curole, D.S. Smith, N. Clark and H. Gaudier. 2000 (March). Lake Salvador Shoreline Protection Demonstration BA-15. Progress Report No. 1 for period of October 1, 1997- October 1, 1999. Louisiana Department of Natural Resources Monitoring Series No. BA-15-MSPR-0300-1. 35 p plus appendices.

Louisiana Department of Natural Resources, Coastal Restoration Division. 2000. Inspection Report. January 20, 2000. Hilary Thibodeaux, (DNR) Brian Kendrick (DNR) Rachel Sweeney(NMFS) and Gregory Miller (NMFS) 12 pp.

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Louisiana Department of Natural Resources. 1998 (revised July 23). Monitoring Plan. Project No. BA-15, Lake Salvador Shoreline Protection Demonstration Project. Coastal Restoration Division, Louisiana Department of Natural Resources. 18 pp.

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Louisiana Department of Natural Resources, Coastal Restoration Division, 1996 (September). Monitoring Plan: Project No. BA-15 Lake Salvador Shoreline Protection Demonstration Project. 19+ pp.

May, J. R. and L. D. Britsch. 1987. Geological investigation of the Mississippi River Deltaic plain: Land Loss and Land accretion. Department of the Army, Corps of Engineers, Waterways Experiment Station. Vicksburg, MS, July 1987.

National Marine Fisheries Service. 1997 (June). Environmental Assessment of Lake Salvador Shoreline Protection Demonstration Project BA-15, Phase II. St. Charles Parish, Louisiana. Prepared by St. Charles Parish Coastal Zone Management. 20 pp plus appendices. Final EA.

National Marine Fisheries Service. 1996 (September). Environmental Assessment of Lake Salvador Shoreline Protection Demonstration Project BA-15. St. Charles Parish, Louisiana.

Prepared by GOTECH Inc. and C-K Associates. Baton Rouge, LA. Task Order No. 56-DKNF-5-10006.21pp plus appendices. Final EA.

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Stone, G. W., P. Wang and X. Zhang. 1999. Wave height measurements at the Lake Salvador shoreline protection demonstration project (BS-15): Report to LDNR, September 1999 field deployment. Coastal Studies Institute, LSU, Baton Rouge, LA.

U.S. Department of Agriculture, Soil Conservation Service. 1983. Soil Survey of St. Charles Parish, Louisiana. Alexandria, LA. 228 pp.

VII.2. Unpublished Sources

Agency	Year (Month)	Agency contact	Document type	Short description	# Pages
USACE	2/28/96	Al Alonso	Meeting report	Decisions made in TAG meeting concerning project	21
NMFS	7/17/96	Rickey Ruebsamen	Letter	Letter of support for Phase II from Chris Tregre, St. Charles parish president	

Agency	Year (Month)	Agency contact	Document type	Short description	# Pages
LDNR	35295	Kenneth Bahlinger	CUP request	Request for Phase I construction under CRMA	7
LDNR	35292	Kenneth Bahlinger	Letter/ proposal	Letter from Earl Materne on proposal for Phase II and cost	4
LDNR	9/13/96	Kenneth Bahlinger	Letter	Letter of support for Phase II from Joan Becnel, St Charles Parish Council	1
LDNR	9/30/96	-	Approval	Task Force approval for Phase II, includes summary, maps, construction diagrams and other letters	11
LDNR	1/27/97	Kenneth Bahlinger	Addendum	Fax to Tim Osborne (NMFS) on Technical Specifications	9
NMFS	2/3/98	Tim Osborne	Memo	From Bruce Dyson (GOTECH) survey report	10
LDNR	2/1/99	Darin Lee	Memo	Final Project and reference area boundaries	3
NMFS	1/20/00	-	Unsigned Notes	Field trip notes	2

VIII. PROJECT REVIEW TEAM

Dianne M. Lindstedt, LSU for NMFS
Glen Curole, DNR/CRD
Darin Lee, DNR/CRD
George Boddie, DNR/CRD
Loland Broussard, NRCS
Joy Merino, NMFS
Cindy Steyer, NRCS
Larry Rouse, LSU
Wes McQuiddy, EPA
Jason Binet, USACE

APPENDIX A.

Figures from Curole et al. 2002

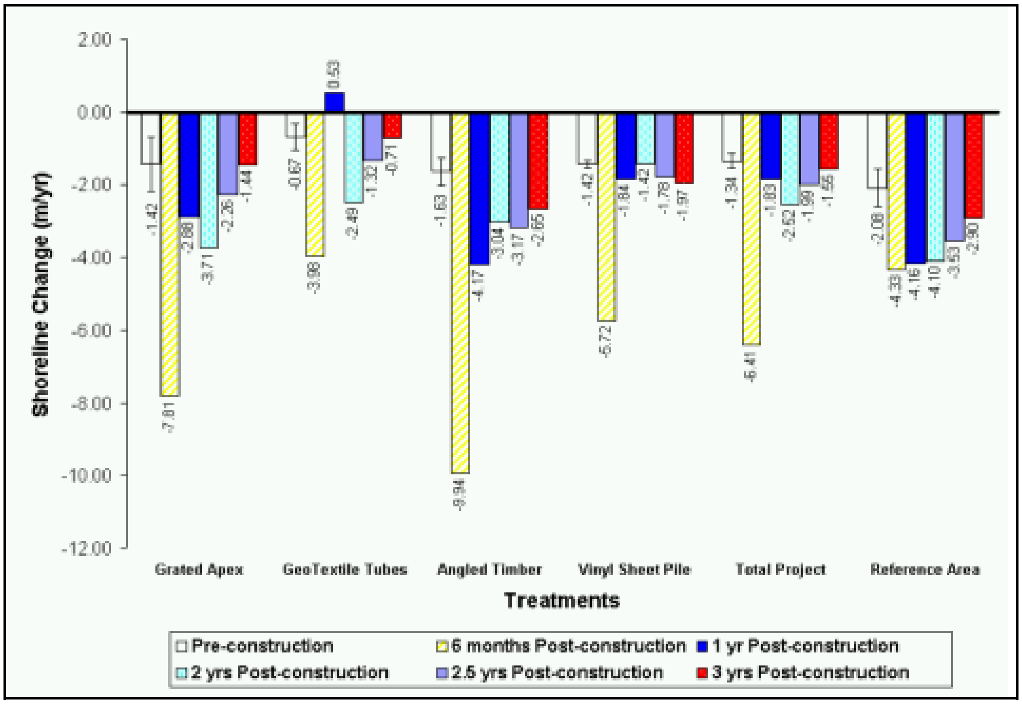


Figure 14. **Shoreline change rates from DGPS data for all treatments at Phase 1 of the Lake Salvador Shoreline Protection (BA-15) Demonstration project from January 1996 to August 2000.**

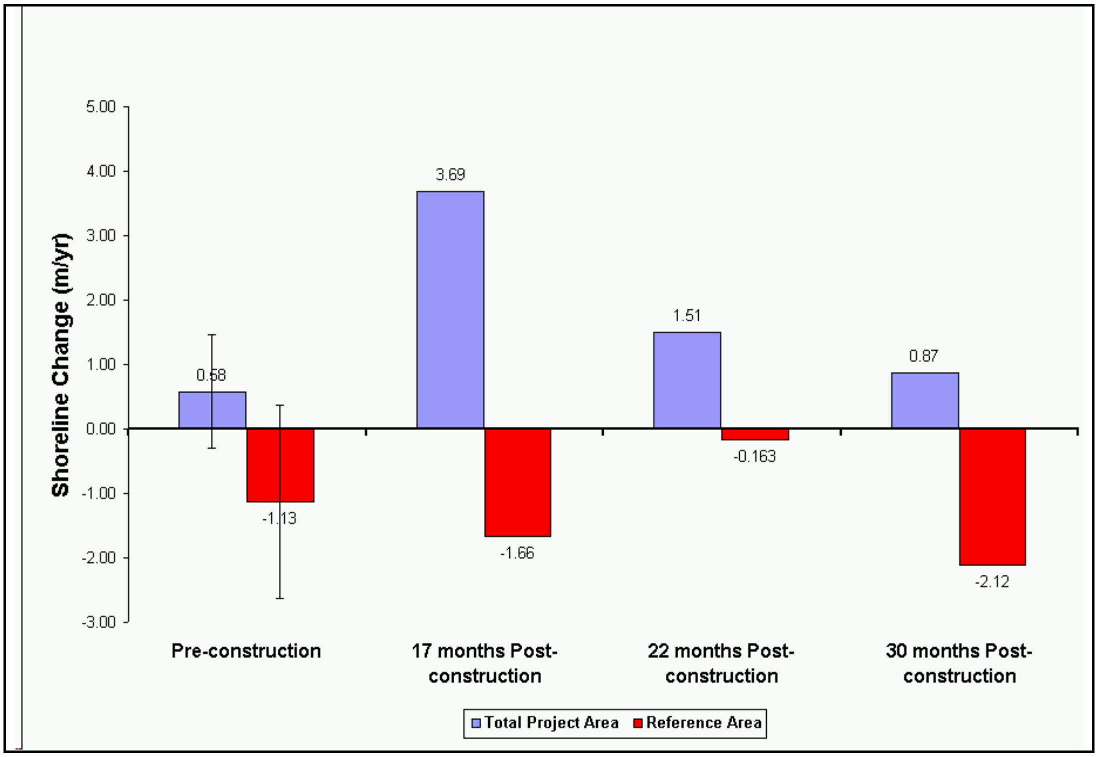


Figure 20. Shoreline change rates from DGPS data for Phase 2 of the Lake Salvador Shoreline Protection (BA-15) Demonstration project.

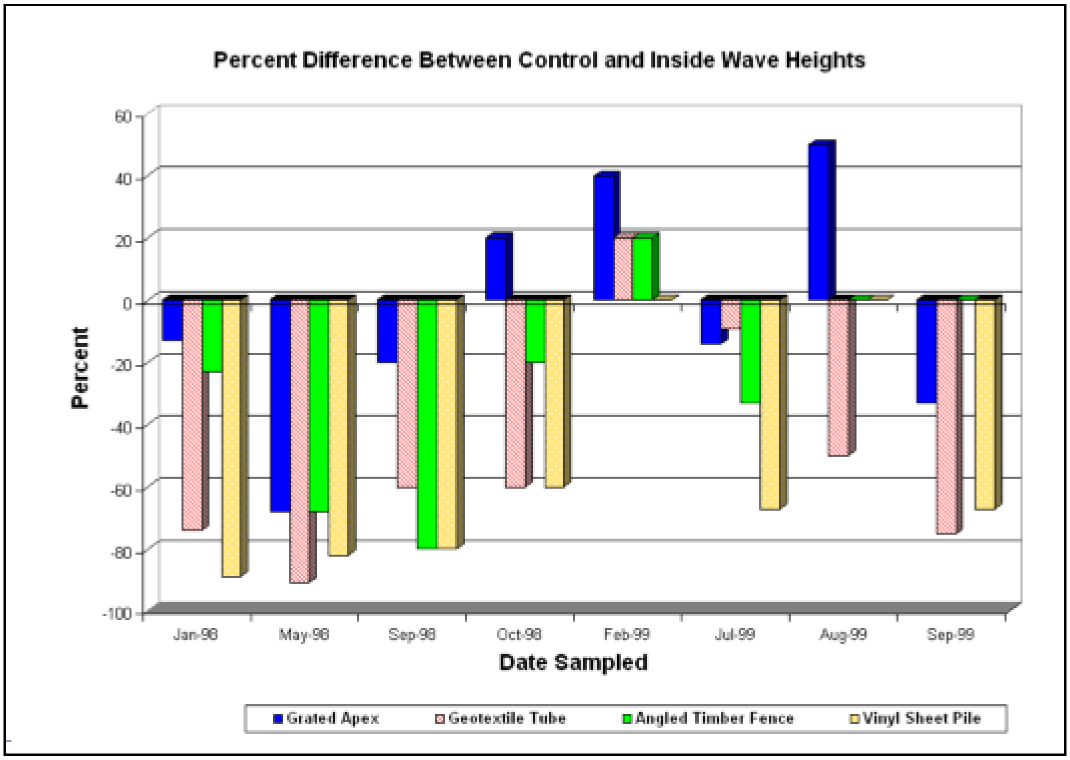


Figure 16. Average significant wave height reductions for all treatments during all sampling periods at Phase 1 of the Lake Salvador Shoreline Protection (BA-15) Demonstration project (from Stone et al. 1998a, 1998b, 1998c, 1998d, 1999a, 1999b,1999c, 1999d, 1999e).

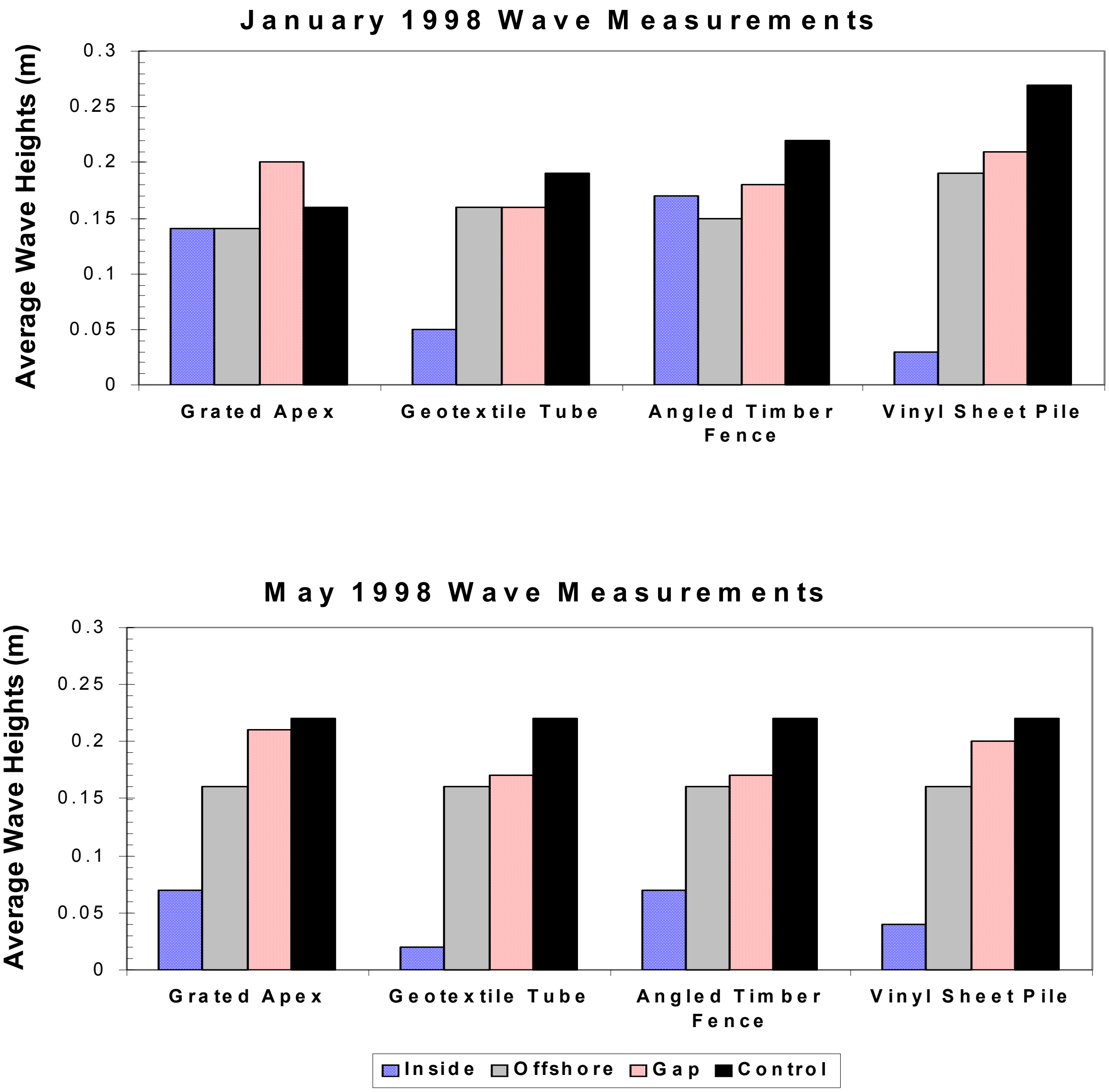
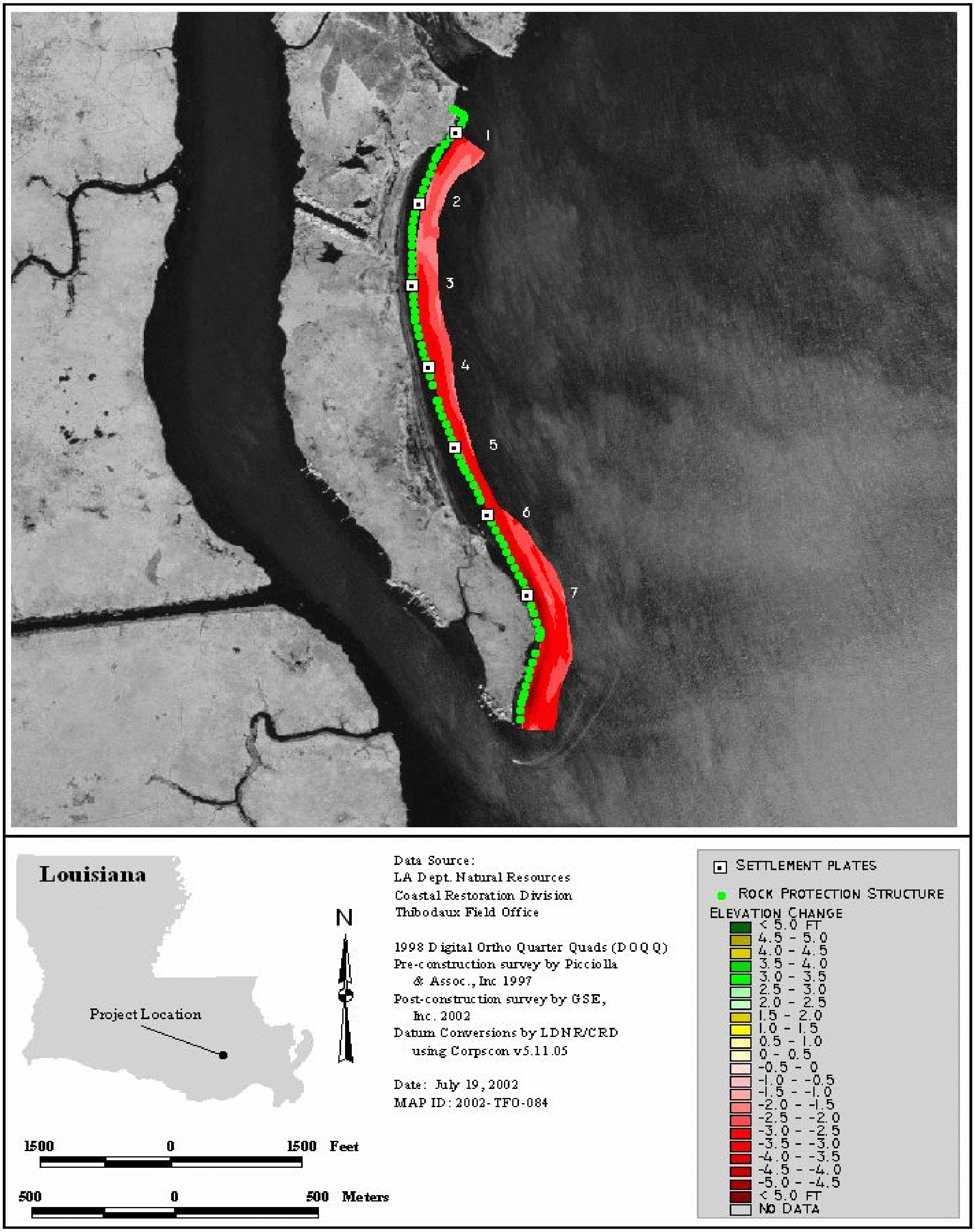


Figure 18. Average significant wave heights at each treatment on January 21, 1998 to May 6, 1998 at Phase 1 of the Lake Salvador Shoreline Protection (BA-15) Demonstration project (from Stone et al. 1998a, 1998b.)


1
2
3
4
5
6
7
Louisiana
Project Location
N
1500 0 1500 Feet
500 0 500 Meters
Data Source:
LA Dept. Natural Resources
Coastal Restoration Division
Thibodaux Field Office
1998 Digital Ortho Quarter Quads (DOQQ)
Pre-construction survey by Picciolla
& Assoc., Inc 1997
Post-construction survey by GSE,
Inc. 2002
Datum Conversions by LDNR/CRD
using Corpscon v5.11.05
Date: July 19, 2002
MAP ID: 2002-TFO-084
SETTLEMENT PLATES
ROCK PROTECTION STRUCTURE
ELEVATION CHANGE
< 5.0 FT
4.5 - 5.0
4.0 - 4.5
3.5 - 4.0
3.0 - 3.5
2.5 - 3.0
2.0 - 2.5
1.5 - 2.0
1.0 - 1.5
0.5 - 1.0
0 - 0.5
-0.5 - 0
-1.0 - -0.5
-1.5 - -1.0
-2.0 - -1.5
-2.5 - -2.0
-3.0 - -2.5
-3.5 - -3.0
-4.0 - -3.5
-4.5 - -4.0
-5.0 - -4.5
< 5.0 FT
NO DATA

APPENDIX B: INFORMATION CHECK SHEET

Project Name and Number: BA-15 Lake Salvador - Shoreline
Date: March 11, 2002

INFORMATION TYPE	YES	NO	N/A	SOURCE
Fact Sheet	X			PPL 3, Web, Joy Merino/Erik Zobrist (NMFS)
Project Description	X			Joy Merino/Erik Zobrist (NMFS)
Project Information Sheet	X			Joy Merino/Erik Zobrist (NMFS)
Wetland Value Assessment		X	X	No WVA for demo projects
Environmental Assessment	X			Joy Merino/Erik Zobrist (NMFS)
Project Boundary (changed from original)	X			Joy Merino/Erik Zobrist (NMFS)
Planning Data	X			HNTB report, Hilary Thibodaux (DNR)
Permits	X			Hilary T. DNR (multiple permits)
Landrights	X			Hilary T. DNR
Cultural Resources	X			In EA, Joy Merino (NMFS)
Preliminary Engineering Design	X			CK did phase 1, DNR did phase 2 (DNR)
Geotechnical	X			Eustis Report (DNR)
Engineering Design	X			DNR
As-built Drawings	½			Phase 2 Mitch Andrus (DNR)
Modeling Output		X		
Construction Completion Report		X		
Engineering Data	X			Postconstr. Survey of phase 1, Gotech report Joy Merino (NMFS)
Monitoring Plan	X			DNR, web www.saveLAwetlands.org
Monitoring Reports	X			DNR, web www.saveLAwetlands.org
Supporting Literature	X			Possibly some info on structure type, Joy Merino (NMFS)
Monitoring Data		X		
Operations Plan				
Operations Data		X		
Maintenance Plan: O&M Plan	X			DNR and NMFS
Maintenance Data		X		
O&M Reports: Annual inspection rpts	X			2 are available, Hilary Thibodaux (DNR)
Other				
Data Needs:				
Bottom Scour – bathymetry				
Settlement of rock, there have been no surveys of settlement plates				
Accretion behind the rock				